

# SERICULTURE

Defination :-

- ⇒ Sericulture or silk farming
- ⇒ The cultivation of silk worms to produce silk.
- ⇒ Although there are several commercial species of silkworms.
- ⇒ Bombyx mori is the mostly widely used and intensively silkworm.
- ⇒ Silk was belived to have first been produced in china as the Neolithic period.
- ⇒ Important cottage industry
- ⇒ Cultivation countries such as Brazil, China, France, India, Italy, Japan, Korea, and Russia.
- ⇒ Today china and India are the two main producers with more than 60% of the world's annual production.
- ⇒ The father of sericulture chinese legend, silk was first discovered 2640 BC by Xilingji

## Types of silks

There are four types of natural silk produced in India for commercial purposes

- \* Mulberry silk
- \* Tasar silk
- \* Munga (or) Muga silk
- \* Eri silk

Mulberry silk contributes to more than 80% of the silk produce in the country.

## Types of silk worms

### four types

- \* Mulberry silk worm
- \* Eri silk worm
- \* Munga (or) Muga silk worm
- \* Tasar silk worm

## Classification of Bombyx mori

family: Bombycidae

Phylum: Arthropoda

Class: Insecta

Species: Bombyx mori

order: Lepidoptera

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## Types of silkworms

There are five major types of silkworms

1. Mulberry silkworms
2. Tasar silkworms
3. Eri silkworms
4. Munga (or) muga silkworms
5. Oak tasar silkworms.
6. Anaphe silkworms
7. fagara silkworms
8. Coan silkworms
9. Mussel silkworms
10. Spider silkworms

### 1. Mulberry silkworms.

- ⇒ The bulk of the commercial silk is produced by Mulberry silkworms.
- ⇒ Mulberry silk comes from the silk worm - Bombyx mori.
- ⇒ feeds on the leaves mulberry plant.
- ⇒ The silkworms are completely domesticated and reared indoors.
- ⇒ In India the mulberry silk producing states are Karnataka, A.P., West Bengal, TN, and Jammu and Kashmir.
- ⇒ 92% of the country's total mulberry raw silk production.

## 2. Tasar silk worms:-

- ⇒ Tasar is copperish colour
- ⇒ Coarse silk mainly used for furnishings and interiors.
- ⇒ It is less lustrous than mulberry silk.
- ⇒ Tasar silk is generated of the silk worm Antheraea mylitta.
- ⇒ To eat leaves Asan and Arjuna
- ⇒ In Indian tasar silk is mainly produced in the states of Jarkand, Chattisgarh, Orissa, Maharashtra, West Bengal, Andhra Pradesh

## 3. Eri silk worms:

- ⇒ Also known as Endi or Errandi
- ⇒ Eri is a Multivoltine silk
- ⇒ Open ended cocoons
- ⇒ Eri silk is domesticated silk worms.
- ⇒ Philosamia ricini that feeds mainly on Castor leaves.
- ⇒ Eri silk is a household activity.
- ⇒ Mainly protein rich pupae.
- ⇒ Produced in North and eastern states Assam, Bihar, West Bengal, Orissa.



#### 4. Muga or Muga Silkworms.

⇒ This golden yellow colour silk. is ~~pre~~  
গোলাপী বসন্তের উপস্থাপন

⇒ Semi domesticated Multivoltine silkworm.

⇒ Antheraea assamensis

⇒ These silkworms feed on the aromatic leaves  
of son and soalu plants.

⇒ Muga culture is specific to the state of  
Assam. অসমৰ অৰ্ধ-গৃহস্থী বসন্ত চাৰু

⇒ The muga silk, an high value products.  
like sarees, mekhalas, chaddars. etc.  
শাৰী, মেখলা, চাদৰ

⇒ Silk is a <sup>protein</sup> fibrous protein of animal origin.

⇒ Nearly 400-500 species are known to produce silk but only very few are commercially exploited.

⇒ Silk is classified into Insect silk and non Insect silk.

⇒ New varieties  
K2, N6, M5

⇒ Insect silk is commercially more important

⇒ The majority of silk producing insects belong to the

order: Lepidoptera

1970 - first production of silk  
20-25 kg

super family: Bombycidae

1971 - Indian silk - newspaper

1973 - TN AU

family: Bombycinae (or) Saturniidae

1979 - NSERC - Tokyo

Mr. Goesh - researcher

⇒ Nearly 95% of commercial insect silk comes from the mulberry silkworm Bombyx Mori and is known as "Mulberry silk".

Best silk  
production of India  
- Bivoltine silk

⇒ Commercial silk from all other sources is collectively called Non-mulberry silk ⇒ India - Mysore

1970 - 1980 - World level - 3<sup>rd</sup> place in India

Tamil Nadu - 1.5 M. Done  
₹ 250 crore silk  
2019

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## Silk producing species - their distribution

- ⇒ ① Taser silk worm
- Indian tropical Taser
  - Indian Temperate Taser
  - Chinese Taser
  - Japanese Taser

⇒ This is the most important among the non-mulberry silks accounting for about 90% of it.

⇒ A number of species belonging to the genus Antheraea

⇒ The taser silk cocoons are large,

⇒ thick and pedunculate.  
(*bottom part of cocoon*)

### Indian tropical Taser (ಶಿಗುಣ ಶಿಗುಣಿ)

⇒ This silkworm commonly found in tropical India is called Antheraea Mylitta.

⇒ It is a multivoltine worm <sup>ಶಿಗುಣಿ ಉಂಟು ಒಂದು ವರ್ಷ</sup> having a number of generations in a year.

### Indian Temperate Taser (ಶಿಗುಣ ಶಿಗುಣಿ ಕಾಡು ಶಿಗುಣಿ)

⇒ This is also called Indian Oak Taser.

⇒ The silkworm producing this taser silk is Antheraea proylei.

⇒ It is hybrid between the Chinese Antheraea pernyi

and Indian Antheraea roylei.

⇒ It feeds on the leaves oak trees - Himalayan

⇒ borders

⇒ The worm are grey white in colour.

Chinese Tasar (चिनी तसर)

⇒ Though called Chinese tasar,

⇒ Antheraea pernyi

⇒ It is largest of the silkworms of the world.

⇒ It feeds on Oaks tree.

⇒ Its cocoons are grey brown in colour.

⇒ Silk reeled from it is used for Embroidery threads.

Japanese Tasar (जापनी तसर)

⇒ This occurs mainly in Japan.

⇒ It feeds on Oak

⇒ It belongs to the species Antheraea yamamai

⇒ The silk is greenish tinted and used for cloth and Embroidery work.



## 2) Muga Silk worm

- ⇒ The Muga silk is a golden yellow <sup>summy</sup> lustrous silk produced by Antheraea assamensis.
- ⇒ It is the <sup>genuine</sup> unique monopoly of India.
- ⇒ This species is endemic to India and occurs in Brahmaputra valley <sup>Assam</sup> hills in Assam.
- ⇒ The silkworm feeds on Sorn and Sohlu trees.

## 3) Emi Silkworm

- ⇒ There are two types  $\left\{ \begin{array}{l} \rightarrow \text{Philasamia Cynthia} \\ \rightarrow \text{Ailanthus Silkworm} \end{array} \right.$
- ⇒ It has been introduced in Europe, Africa and Eastern United States.
- ⇒ The cocoons are very weakly pedunculate and open at one end and hence are non-releasable.
- ⇒ The cocoons are white or brick-red in colour.

## 4) Anaphe Silkworm

- ⇒ This silkworm belongs to the genus Anaphe  
Family: Notodontidae  
Order: Lepidoptera

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⇒ Many species, particularly Antheraea venter  
produce the anaphe silk

⇒ They are distributed in the tropical region  
of southern and central Africa.

⇒ The silk is more elastic and stronger than  
Mulberry silk.

⇒ It is used in velvet and plush making.

### 5) Gonometa Silkworm

⇒ Various species of Gonometa are widely  
distributed throughout the African Savanna

⇒ Moths of this insect are called "Eggar Moth"

⇒ They are widely distributed in Botswana - in Africa

⇒ The cocoons are elongated ellipsoidal in shape

⇒ The cocoons produce this lustrous silk.

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## b) Fagara silk worm

- ⇒ This silk worm is distributed in the Indo-Australian <sup>insects/bugs/lobworms</sup> biogeographical realm, China and Sudan.
- ⇒ 13 species of Attacus <sup>atlas</sup> are known to produce this silk.
- ⇒ The giant silk moth, Attacus atlas is Important Commercially.
- ⇒ The cocoons are light brown in colour.

## d) Coan silk worm

- ⇒ This silk worm, also called the Syrian silk worm belongs to the genus pachypasa.
- ⇒ Cultivated in Europe. Introduction of the Chinese silk worm - Bombyx mori.
- ⇒ It also occurs naturally in Mauritania and Morocco.
- ⇒ ~~The cocoons are white in colour.~~
- ⇒ The yield of silk from each cocoon is very little.



⇒ They are not used much in textiles. (12)

## 8) Spiders

⇒ The webs of spider is made of silk and Commercial silk obtained from them is called spider silk.

⇒ It is a non-insect variety of silk

⇒ The silk is not only soft and fine, but also strong and elastic.

⇒ ~~It~~ <sup>3</sup> is typical species of spiders, namely, Nephila madagascariensis, Miranda aurentia and Epeira.

⇒ Since the production of this silk is low, it is not used for textiles.

## 9. Mussel :-

⇒ The byssus thread of the mussel pinna squamosa

are spun into a silk called fish wool in Italy

⇒ order lepidopterans like Moon Moth (Actias selene)



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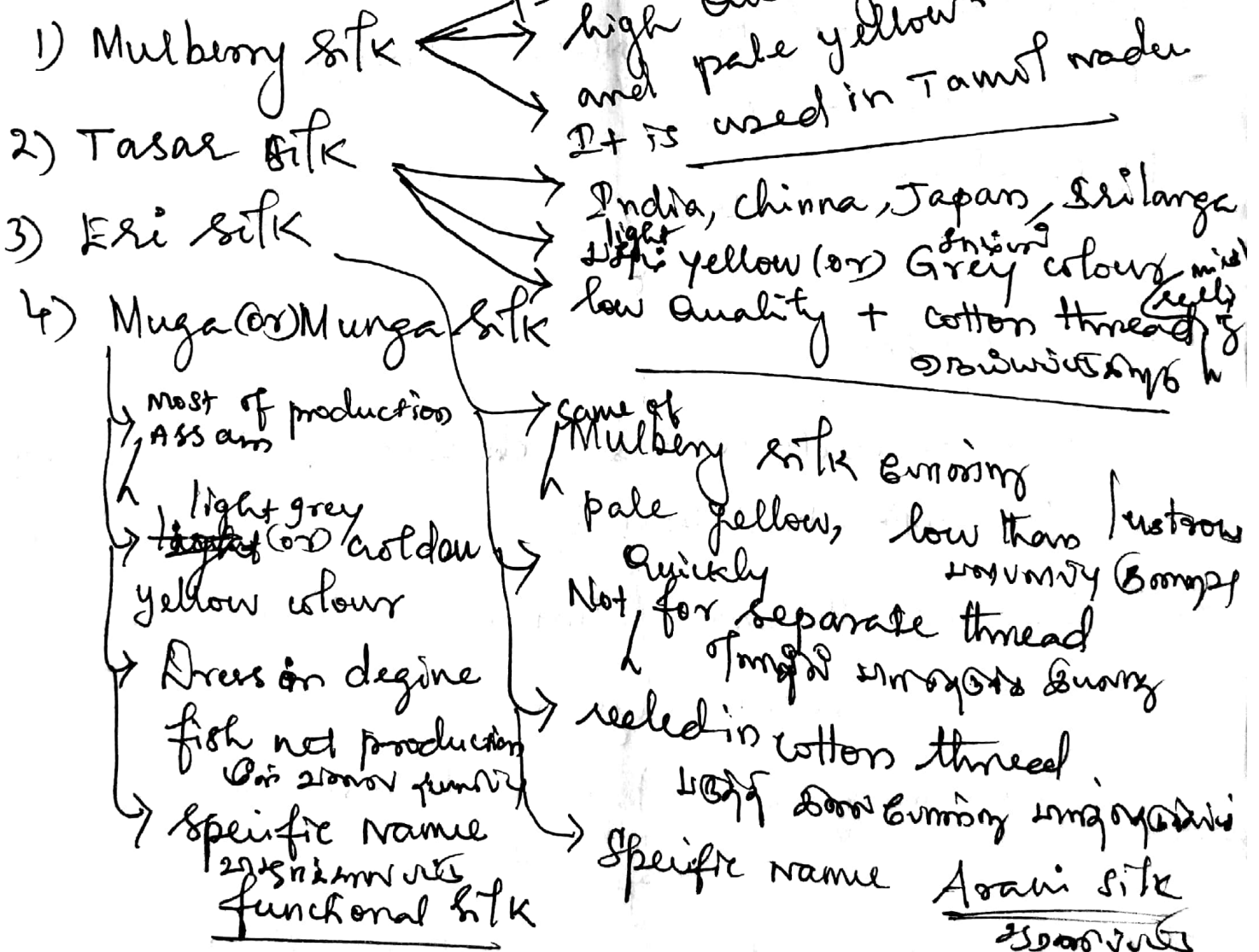
→ The Cashew Caterpillar (*Circula bifrenestrata*)

→ The gregarious mango caterpillar (*Circula* sp.)

Cecropia moth (*Phlocania cecropia*).

→ Commercial Insects.

Types of silks



# Morphology structure of Silkworms (Bombyx mori)

⇒ Mulberry silk worm *Bombyx mori* is a holometabolous insect.

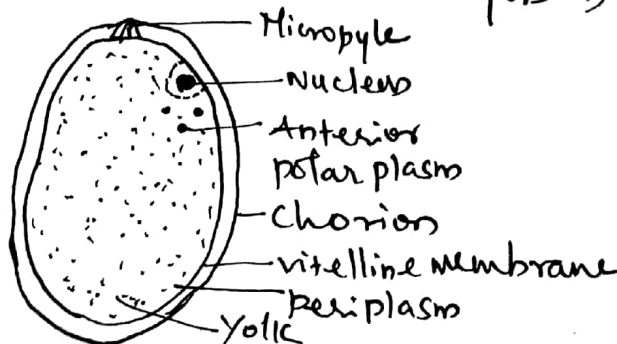
⇒ Morphological structure in life cycle four different stages

Egg → larva → pupa - adult.

## Structure of egg: -

- ⇒ The size, weight, shape and colour of the eggs as well as
  - ⇒ Number eggs per laying
  - ⇒ Different races (~~Bombyx mori~~)
  - ⇒ According to season
  - ⇒ Larval nutrition of the Mother moth
- } Environmental conditions during the egg laying.
- ⇒ Average of Indic cross-breed multivoltine races lays about 400 eggs per laying.
  - ⇒ Egg weight calculate = single egg is about 0.55 - 0.60 mg.  
about 2000 eggs per gram
  - ⇒ colour of egg = Also racial character - yellow, brown, white
  - ⇒ shape of eggs = Ovoid, spherical, ellipsoid and one flat on one side  
= This is called egg timple (black egg)
  - ⇒ The egg protective covering of the egg is called chorion and opening called Micropyle at the anterior end.

⇒ The chorion is two layers i) Endo chorion ii) Exo chorion



- \* serosa
- \* vitelline membrane
- \* fertilization
- \* cleavage
- \* periplasm
- \* polar plasma.

## Structure of larva

- ⇒ The larvae of *Bombyx mori* like other Lepidoptera are Eruciform larvae
- ⇒ The newly hatched larva is about 3 mm long.
- ⇒ Black in colour
- ⇒ As the larva grows, last instar 10 cm long.
- ⇒ The larva is divided into three regions.  
Head, thorax, abdomen.  
(Six segments) (3 segments) (eleven segments)

### Head:-

- ⇒ The head is small. (<sup>Big name is given to all parts of</sup> hypognathous) (Mouth is ventral position)
- ⇒ The fusion of cranium (<sup>last 6</sup> first 6 segments of the body)
- ⇒ The epicranium is large.
- ⇒ Simple eyes are present. located at antennae
- ⇒ The tactile hairs <sup>or primary hairs</sup> are present.
- ⇒ The Mouth parts
  - ↙ Mandibles (strong jaw)
  - ↘ Maxillae (small jaw)
  - ↘ Labium. (lower jaw)

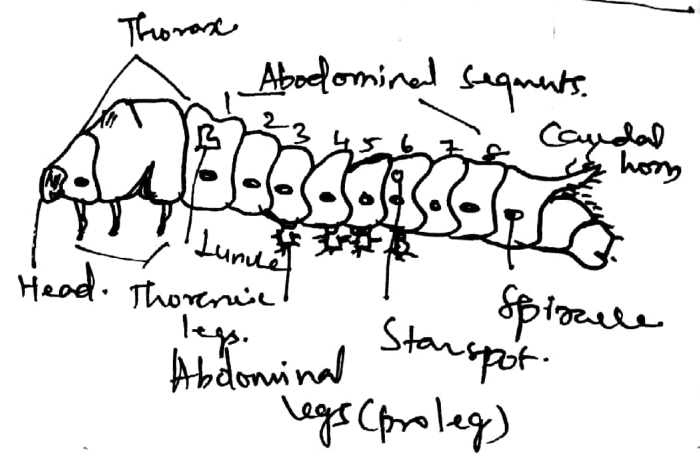
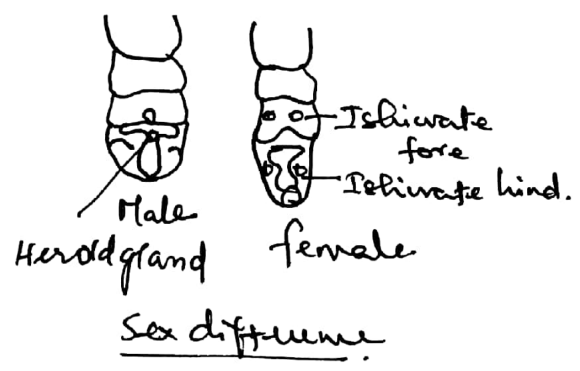
### Thorax:-

- ⇒ The 3 segments are thorax - pro, meso and meta
- ⇒ prothorax respiratory opening
- ⇒ True legs is presented in the body.
- ⇒ The legs are not used for walking
- ⇒ The <sup>↓</sup> holding the <sup>↓</sup> mulberry leaf for feeding



Abdomen :-

- ⇒ The 8 or 9 segments are visible in abdomen.
- ⇒ The eight segments are caudal horn <sup>2x1000 of</sup>
- ⇒ The two sex marking IV and V instar.
- ⇒ The female larva sex marks - Ishiwate fore glands and Ishiwate hind glands.
- ⇒ The ~~female~~ larva single median opening of Aeroid's gland.

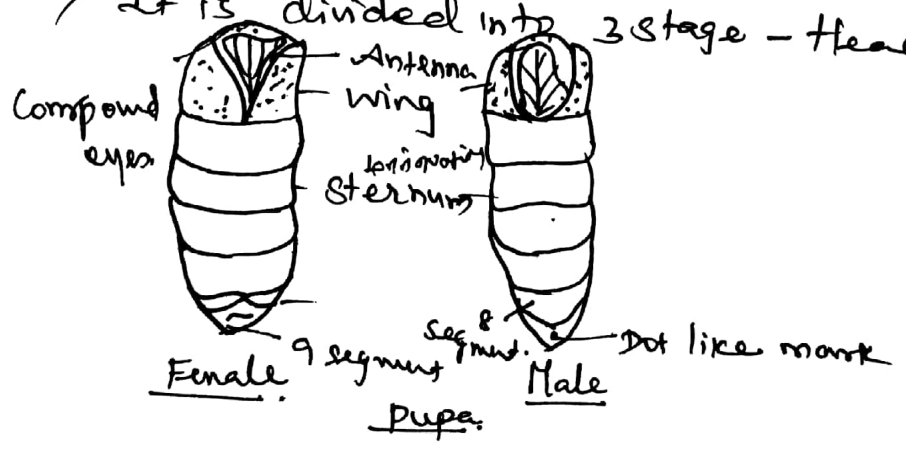


Larva of Bobyca murti.

Structure of pupa :-

- ⇒ The pupa in final instar larva.
- ⇒ pupae can be seen only by cutting open the covers.
- ⇒ pupae are soft. ⇒ compound eyes are present.
- ⇒ pupa is a non-motile and non-feeding stage. <sup>strong wing pads</sup>
- ⇒ larva organs are destroyed. Adult organs is differentiated stage.

⇒ It is divided into 3 stage - head, thorax, abdomen





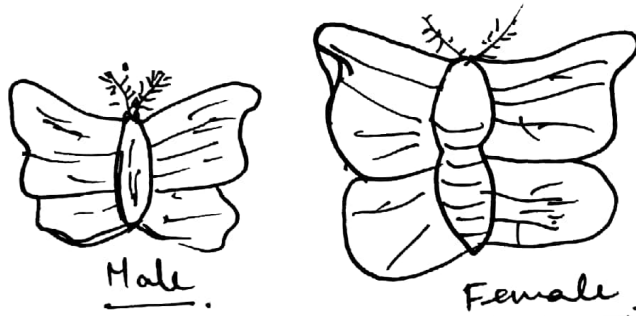
## Structure of Adult :- (17)

- The moth have lose their flight.
- ~~It~~ does not feed during short life (3 to 6 days).
- The size of moth is about 4x2 cm
- The entire body covered wings with <sup>cuticular</sup> epidermal scales.
- The body is divided into head, thorax, Abdomen.

Head → small and hypognathous.  
paired compound eyes.  
Antennae,

thorax → 3 segments, meso and meta thorax segments <sup>located in wings</sup>  
pair of wings  
pair of legs (Jointed  $\bar{v}$  - coxa)

Abdomen → Abdominal covered with scales  
8 segments for male  
7 segments for female } visible on body.



## REARING HOUSE AND EQUIPMENTS

- ⇒ The mulberry silkworm *Bombyx mori* is a delicate and domesticated animal.
- ⇒ which cannot tolerate <sup>HRB/Season</sup> diurnal and seasonal fluctuations.
- ⇒ They are reared in special rearing houses where natural fluctuations in the environmental conditions.
- ⇒ The rearing house has separate rooms for rearing.
- ⇒ The separate storing mulberry leaves.
- ⇒ The incubation for keeping the moultage <sup>concentrations</sup> with the spinning larvae.
- ⇒ The ideal rearing houses are available only in Research laboratories.
- ⇒ Government owned sericultural stations are large few <sup>Scale</sup>.
- ⇒ The very few private rearsers under taking large scale.
- ⇒ Most of the commercial rearsers in India are farmers as a side line activity.
- ⇒ The worms cultivated are separated rooms. But Rearing stands, storing mulberry leaves, rearing tools and moultages are kept outside or their houses.

## Rearing house constructed: <sup>(19)</sup>

- ⇒ Rearing ~~with~~ houses may be brick walled.
- ⇒ Cement plastered permanent structures or mud walled structures.
- ⇒ Rearing houses should not be built on waterlogged areas.
- ⇒ Increased humidity
- ⇒ Disease <sup>ബാധ</sup> prevalence
- ⇒ Constructing the houses in a north-south orientation
- ⇒ Receiving direct afternoon sunlight.
- ⇒ <sup>Direct</sup> Sunlight increases the temperature, reduces the humidity
- ⇒ of mulberry leaves eating soft nature of larvae.

## Roof construction:-

- ⇒ The material used for roofing should be a non-conductor of heat.
- ⇒ <sup>ഗ്രാമീണ</sup> Thatched roofs and <sup>ഗ്രാമീണ</sup> country tiled roofs are ideal for tropical countries.
- ⇒ maximum temperature is lower than those with RCC Roofing  
RCC - Reinforced Cement Concrete.

### Thatched roofs

- ⇒ larval metabolism is normal ✓
- ⇒ larval duration is normal ✓
- ⇒ higher yield of cocoon
- ⇒ on the other hand in rearing houses.

### RCC roofs

- ⇒ maximum temperature reached is higher.
- ⇒ larval metabolism is abnormally increased
- ⇒ larval duration is shorter
- ⇒ cocoon yield is lower.

⇒ When roofing is made of concrete, <sup>zinc</sup> zinc sheets or asbestos sheets.

⇒ For free circulation of air within the room, windows, doors, and ventilators

⇒ must be kept open to provide cross-ventilation.

⇒ The maintained of optimum conditions of humidity and temperature throughout the room.

⇒ If the humidity is too high, there is danger of moulding <sup>(fungus disease)</sup> attack

⇒ leaves are low nourishment of the larvae and poor cotton yield.

⇒ The room install the air heating or air cooling devices.

⇒ Temperature and humidity inside the room are regulated by ~~the~~ hanging wet gunny cloth <sup>8500000</sup> <sup>830000000</sup> on the doors and windows in hot season.

### Requiring Equipments :-

⇒ Bricks, cement, mud, thatched roofs, tiled roofs, RCC roofs, zinc sheets, asbestos sheets, windows, doors, ventilators, air heaters, air cooler devices, gunny cloths, charcoal stove in winter season



# Rearing racks or stands and trays:-

## 1. Rearing stand:-

- ⇒ This stand is used for supporting the rearing trays
- ⇒ Which are placed in vertical rows.
- ⇒ It is made of locally available wood or bamboo
- ⇒ The standard fixed stand has a height of 2.5 m, length of 1.5 m and a width of 0.65 m,
- ⇒ It has 10-12 cross bars at a distance of 0.15 m to accommodate 10-12 tiers of rearing trays.

## 2. Rearing trays:-



- ⇒ A large number of silkworms are accommodated and fed in the rearing trays and these are placed one above the other on the rearing stand.
- ⇒ Circular bamboo trays (13.8 cm dia x 6.5 cm depth) are the most commonly used in India.
- ⇒ Rectangular wooden trays, similar to the ones used for rearing chawki worms are also used.
- ⇒ Some times cardboard boxes or other make-shift arrangement are also used temporarily.
- ⇒ Young silkworms are reared in rectangular trays made of light wood (0.7-0.9 m x 0.9-1.2 m).
- ⇒ In the box rearing method, the trays being placed one above the other directly and not on any stand.
- ⇒ The trays are used mostly after coating them with cowdung paste mixed with formalin to lengthen its life time but such practice has been proved to increase disease incidence.

iii) Ant wells:-

- ⇒ Enamel / Aluminum <sup>sample</sup> bowl or stone / concrete <sup>box</sup> blocks are used as ant wells.
- ⇒ Which are kept filled with water except the central <sup>portion</sup> evaluation on which legs of trays stands are placed.
- ⇒ It prevents ants from crawling up the stand and harming the worms.
- ⇒ 20cm square and 7.5 cm height with a groove of 2.5 cm running all around the top.

iv) paraffin paper:-

- ⇒ To avoid evaporation of moisture and keep humidity on the rearing tray, pad of paraffin coated papers are kept on rearing bed of young silk worm.
- ⇒ polythene sheets, dried banana leaves may also be used instead of paraffin paper.

v) Foam <sup>rubber</sup> strips:-

- ⇒ To maintain the required humidity, sometimes thick foam pads soaked in water are placed all around the bed.
- ⇒ Thick folding of newsprint paper or blotting paper soaked in water can also be used in place of foam strips.

(vi) chop sticks :-



⇒ Forlep-like device, made of two thin bamboo sticks, joined at one end by thread is used to pick worms.

(vii) Feathers :-

⇒ Soft, white feathers are used for brushing newly hatched larvae from the egg card to rearing tray and to spread the young worms during spacing.

Disinfectants (or disinfection)

⇒ This is a preliminary operation carried out <sup>Prior</sup> to the commencement of rearing as a precaution <sup>or measure</sup> against pathogens, which may remain in the room from infecting the worms to be reared.

⇒ The following points are considered the disinfectant method.

- \* The disinfectant must be effective against the pathogens of silkworm disease.
- \* Its application must be simple, easy and should take minimum time.
- \* It must be harmless to man and domestic animals.
- \* It must be cheap and easily available.



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⇒ Disinfection may be carried out by

- \* physical method
- \* chemical method
- \* Radiation method

(Sericulture is a rural activity, radiation method is not feasible)

### Physical methods :-

Physical methods of disinfection are cheap, convenient and easy to carry out.

#### 1. Sun drying :-

- \* This consists of exposing the rearing appliances to direct sunlight for disinfection.
- \* Sunlight is effected by the heat and little amount of ultra violet rays.
- \* This is an effective and cheap method but it cannot be used for disinfecting the rearing room.
- \* It is suitable only for the tropics region.
- \* In the temperate regions, the sunlight very weak.
- \* It cannot be carried out in winter and rainy seasons.

#### 2. Disinfection by steaming

- \* Steam is a good sterilizing agent.



\* It can be successfully used for disinfection the rearing room.

\* But it is rarely used as a disinfecting agent in silk worm rearing for two reasons.

1. Initial cost of installing the boilers and steam pipelines is very high.

2. Hot steam is harmful to the applicance which are mostly made of bamboo or wood.

### 3. Disinfection by Hot Air:-

\* This too is a good sterilizing method in which hot air is turned into the rooms containing the applicances to be sterilized.

\* Once again this method is not used in sericulture practice. (as no real sterilizing agent is used in sericulture)

### 2. Chemical method:-

⇒ chemical methods of disinfection are the most commonly used in sericulture.

⇒ The disinfectant used may be solid, liquid, gas or aerosol.

\* It should have a broad spectrum activity.

\* should be non-toxic to man and animals.

\* The combination of organic matter.

\* Most of the combination proteins diet.

## \* Reacting with the Microbes.

(*Pathogeny... ..*)

Basic chemicals used for disinfection are:-

1. chlorine as chlorine compounds like chloramine and hypo or bichlorites.
2. Iodine as iodophores.
3. phenol as phenol compounds hexachlorophene.
4. Ammonium compounds like cetylpyridinium chloride and Benzyl ammonium chloride.
5. Formaldehyde as formalin.

⇒ However the most popular chemical disinfection methods used by commercial launders are:-

### 1. Disinfection by spraying formalin:-

- ⇒ Formalin is a colourless
- ⇒ Transparent and neutral liquid
- ⇒ Dissolving formaldehyde gas in water
- ⇒ The combination converted to formic acid.
- ⇒ 2% formalin is used for routine disinfection.
- ⇒ 5% formalin is used for pebrine disinfection.
- ⇒ 0.7% to 0.8% formalin spray directly on the worms muscardine infection.

### 2. Disinfection by spraying with chlorkalk:-

- ⇒ chlorkalk is a white powder containing Ca, Cl and water (20%)

⇒ It dissolves almost <sup>(27)</sup> completely in about 20% times of water.

⇒ Hypochloric acid ( $\text{HClO}$ )

⇒ Hydrochloric acid ( $\text{HCl}$ )

⇒ Bleaching powder

⇒ To prepare chlorcalc 55 g + dissolved in 95 ml of water

3. fumigation with formaldehyde gas:-  
(Smoke or vapor)

⇒ Formaldehyde gas is produced } through heated  
⇒ vapour of methyl alcohol }

⇒ 92.5 ml of 35% formalin

⇒ 35 gms of formalin gas

⇒ The door and windows are closed airtight before fumigating.

⇒ Closed for 24 hrs

## Rearing Appliances :- (Sanskrit / English)

- ⇒ Sericulture is a rural based agro industry and accordingly the appliances used are made from cheap and locally available materials.
  - ⇒ Hence, the appliances differ from place to place and also according to the systems of rearing and systems of mulberry harvest.
  - ⇒ With sericulture spreading to many non-traditional states and with the launching of the National Sericulture project.
  - ⇒ Many innovations have been carried out by the researchers of the CSB and also by private researchers in devising novel rearing appliances to suit the conditions in India.
  - ⇒ The most common method of rearing in India is the self rearing method as it facilitates the rearing of the large number of worms in a small place.
  - ⇒ The late age silkworms do not tolerate, high temperature, humidity and poor ventilation.
  - ⇒ Hence the rearing house should have cross ventilation facilities.
  - ⇒ Down the room temperature and for removal of vapour and harmful gases.
- |                       |               |
|-----------------------|---------------|
| * Rearing Stand       | * Chop sticks |
| * Rearing Trays       | * feather     |
| * Antwells            |               |
| * paraffin paper      |               |
| * foam rubber strips. |               |



Appliances used for feeding:-

- \* Leaf basket
- \* Leaf chamber <sup>ചങ്ങല</sup>
- \* Chopping board <sup>കുറുപ്പുമേശ</sup>
- \* Mats <sup>മുതലി</sup>
- \* feeding stand



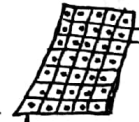
Methods of Bed Cleaning:-

- ① Cleaning with husk - മൂലക്കൊടി ഉപയോഗിച്ച് മൃദലമാക്കുന്നു
  - ② Cleaning with net - മണലിനെ ഉപയോഗിച്ച് മൃദലമാക്കുന്നു
  - ③ Combined net and husk method - മൂലക്കൊടി ഉപയോഗിച്ച് മൃദലമാക്കുന്നതിനും മണലിന്റെ ഉപയോഗം ഉൾപ്പെടെ.
- ④
- ① ⇒ മൂലക്കൊടി ഉപയോഗിച്ച് മൃദലമാക്കുന്നതിനും മണലിന്റെ ഉപയോഗം ഉൾപ്പെടെ.
    - മൂലക്കൊടി ഉപയോഗിക്കുന്നു.
    - \* മൂലക്കൊടി ഉപയോഗിച്ച് മൃദലമാക്കുന്നതിനും മണലിന്റെ ഉപയോഗം ഉൾപ്പെടെ.
    - \* മൂലക്കൊടി ഉപയോഗിച്ച് മൃദലമാക്കുന്നതിനും മണലിന്റെ ഉപയോഗം ഉൾപ്പെടെ.
  - ② ⇒ മണലിനെ ഉപയോഗിച്ച് മൃദലമാക്കുന്നതിനും മൂലക്കൊടി ഉപയോഗം ഉൾപ്പെടെ.
    - \* മൂലക്കൊടി ഉപയോഗിച്ച് മൃദലമാക്കുന്നതിനും മണലിന്റെ ഉപയോഗം ഉൾപ്പെടെ.
    - \* മൂലക്കൊടി ഉപയോഗിച്ച് മൃദലമാക്കുന്നതിനും മണലിന്റെ ഉപയോഗം ഉൾപ്പെടെ.
  - ③ ⇒

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Black Boxing :- (The technique is developing eggs to totally dark condition of silkworms)

- ⇒ If the eggs in the body pigmentation stage are transferred to dark room.
- ⇒ The hatching of the eggs can be inhibited to growth of embryo.
- ⇒ This process is called black boxing of eggs.
- ⇒ The uniform hatching of all the eggs.
- ⇒ Black boxing is done by covering the silkworm eggs in the black paper (or) black cloth.
- ⇒ To avoid the escape of newly hatched larvae from the egg sheet.
- ⇒ The eggs must be wrapped in a tissue paper during the body pigmentation stage.
- ⇒ Farmers should be given a black bag containing pigmented eggs.



Box Rearing :-

- ⇒ Boxes or deep trays - made of wood, plastic, or galvanised iron
- ⇒ 10-15 cm depth
- ⇒ Preparation of the rearing bed is similar to paraffin paper rearing method.
- ⇒ Chopped leaves and brushed larvae
- ⇒ Wet foam strips - around in the bed leaves
- ⇒ For rearing II and III instar larvae a space of 2 to 3 cm.



Net model



plastic trays



⇒ Instead, the boxes may be placed cross wise Ventilation.

⇒ Feeding, bed cleaning, spacing and anti mousc  
-ding measures are done as in the paraffin  
paper method.

Black Boxing of eggs:-

⇒ The hatching of eggs upto 90 to 95 percent  
take places of times. "Black boxing eggs"

⇒ About 48 hours before hatching

- \* embryo reaches "pin head stage"
- \* About 24 hours prior to hatching
- \* If attains the "Blue egg stage" during the period
- \* The egg sheet convenient card board box, wooden box, wrapped black piece of cloth, black sheet paper.

⇒ The date of hatching (normally between 9 to 12 days after egg laying depending on the seasonal temperature conditions)

⇒ The black boxed eggs should be exposed suddenly to bright day light between 8.am and 9.am

⇒ The photo stimulus thus provided will ensure over 90 to 95% hatching in one to two  
hours time

# Chawki Rearing:-

- \* Chawki rearing or Rearing of Young Age Worms
- \* Chawki rearing refers to the rearing of young silkworms.
- \* The newly hatched larva is wet because
- \* Moisture of the egg remains on its skin but dries up gradually and larva begins to move.
- \* The percentage of moisture in its body is less than in the larva which has started consuming the leaves.
- \* Further, the larva at this stage has less resistance to dryness.
- Structure of Rearing room:-
- \* In Chawki rearing on higher temperature (27°C) humidity (80-85%)
- \* bed, leaves, rich moisture, sugar. Salt and protein, fibre content
- \* feeding for <sup>nutritional</sup> succulent/leaves, water content leaves
- \* The water content does not increase in the II and III instar larvae
- \* Sufficient ventilation
- \* Pathogen-free accumulating
- \* The young instar are less resistant to Micro organisms bacteria, fungi, virus.
- \* Growth rate is highest
- \* The newly hatched stage and nearly 15 times increased.



- \* Increase in biomass
- \* food materials highly nutrients.
- \* Good irrigation <sup>for leaves</sup>
- \* Good sunlight for ~~worms~~ leaves
- \* Plenty <sup>of</sup> fertilizers (both organic and chemical)

Bed cleaning :-

- \* sizeable quantity of unconsumed leaves unfit for feeding
- \* Moulted larvae - dead larvae
- \* thick and damp, litter.
- \* Growth of micro organisms - fermentation, Heat, oxygen, injunous gases.
- \* Remove of the litter process removal called Bed cleaning.

- iv) By removal of the litter
- v) removal of the litter
- vi) removal of the litter

Frequency of Bed cleaning :-

- \* Bed cleaned before each feeding
- \* frequent cleaning is uneconomical not only
- \* Additional labour.
- \* Schedule for bed cleaning.

I Instar - pre moulting stage	IV Instar - V moulting.
II Instar - I & II Moulting.	V
III Instar - III Moulting	

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## Mountages :-

\* The most important device that helps or supports the silkworms for comfortable spinning their cocoon is called coconage or mountage.

- \* It determines both the quality and quantity of the cocoons.
- \* Different types of coconages are used in different parts of india.
- \* These are made of wood, bamboo, card board plastic, ~~grasses~~, dry leaves; <sup>bamboo</sup> twigs etc...
- \* Mounting is the final operation in silkworm rearing.
- \* The final instar larva after attaining full growth.
- \* Sits through its spinneret and spins a cocoon around itself and transforms into pupa inside it.
- \* The pupa after metamorphosing into an adult moth.
- \* The Aim of Sericulture is to rear the silkworms
  - \* good cocoon
  - \* high level of silk content
  - \* Harvest process
  - \* Moth stages.
  - \* Spinning (Boriya)
- \* The two major problems in mounting
  - \* Environmental conditions
  - \* Mountages.

# Methods of Mounting

## 1. Hand picking :-

- \* Ripe worms are picked one by one by hand
- \* Collected in a tray and then transferred to the mountages.
- \* Some worms are likely injured while more labour.
- \* More uniformly distributed
- \* diseased worms removed.

## 2. Simultaneous Mounting :-

- \* Only a number of mature larvae appear on trays
- \* All are collected and transferred.
- \* Mixture of mature and immature and overripe worms.
- \* Thin and shelled cocoons all more.

## 3. Net Method :-

- \* When ripe worms are noticed
- \* Straw rope nets, rush nets on cleaning beds
- \* Alone crawl on the nets.
- \* Continue feeding
- \* Handling is avoided in this method.
- \* less labour

## 4. Branch method :-

- \* This is similar to net method
- \* Ripe worms crawling
- \* Early ripening larvae (10-20%)
- \* Rest and shaken off the shoot transferred



4  
5. Free Mounting: -

- \* This method is not popular in India.
- \* Russia and Japan method for this.
- \* Sheets or newspaper for faecal matter
- \* Saves labour.
- \* More than disadvantages.

- മിശ്രിത രീതിയിൽ കർമ്മം ചെയ്യുന്നു.
- ⇒ മിശ്രിത രീതിയിൽ കർമ്മം ചെയ്യുന്നതിന് എളുപ്പമാണ്.
- ⇒ കർമ്മം ചെയ്യുന്നതിന് കൂടുതൽ ചെലവുണ്ട്.
- ⇒ കർമ്മം ചെയ്യുന്നതിന് കൂടുതൽ സമയം വേണ്ടി വരും.
- ⇒ കർമ്മം ചെയ്യുന്നതിന് കൂടുതൽ ശ്രമം വേണ്ടി വരും.
- ⇒ കർമ്മം ചെയ്യുന്നതിന് കൂടുതൽ ശ്രമം വേണ്ടി വരും.

Harvesting of cocoons

\* The aim of silkworm rearing is to harvest the cocoons produced and ~~sell~~ <sup>sell</sup> them to the reeling Agencies.

Time of harvesting :- <sup>കർമ്മം ചെയ്യുന്നതിന് കൂടുതൽ സമയം വേണ്ടി വരും.</sup>

- \* The larva after spinning the cocoon moults and becomes transformed into a pupa.
- \* The newly formed pupa is pale in colour.
- \* Very soft cuticle
- \* The cuticle ~~very~~ hardens structure
- \* The larval organs dissolved Adult organs are differentiated.
- \* Adult emerges - from the pupa breaks open the cocoon and comes out.

Harvesting :-

- \* Harvesting must be done after the pupa cuticle before adult emerges.
- \* Tropical - Multivoltine and bivoltine 3 or 4<sup>th</sup> day



- \* Temperate - uni and bivoltines 4 or 5th spinning.
- \* Recommended time of harvesting
  - 5th day spinning - tropical races
  - 7 or 8th day - temperate races.
- \* Delay of cocoon harvesting - pierced cocoon by moth emergence.
- \* Too early harvesting leads to inside soiled cocoons due to putrefaction of pupa injured by harvesting.

Methods of harvesting:-

- \* Normally cocoons are harvested by ~~hand~~ hand.
- \* Cocoon from rotary cardboard mountages of Japan are harvested by simple devices.
- \* Harvested cocoons are cleaned
- \* Removing any faecal pellets on them and sorted according to size.
- \* Defective cocoons are separated.