Diseases & Pests

**Mulberry Diseases & Pests**

- **Diseases**
  - Leaf spot
  - Leaf rust
  - Powdery mildew
  - Fungal Leaf blight
  - Bacterial Leaf blight
  - Root knot
  - Root rot

- **Pests**
  - Pink mesly bug (Tuka)
  - Papaya moaly bug
  - Thrips
  - White fly
  - Jassid
  - Scale Insect
  - Leaf roller
  - Cutworm
  - Bihar hairy Caterpillar
  - Wingless grass hopper

**Silkworm Diseases & Pests**

- **Diseases**
  - Grasserie
  - Flachorio
  - Muscardine
  - Pebrine

- **Pests**
  - Uzi Fly
  - Dermastid beetles

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**Leaf spot**

**Pathogen**  *Cercospora moricola*

**Occurrence**  It is more prevalent during rainy season followed by winter. The disease starts progressing 35-40 days after pruning (DAP)/leaf harvesting and becomes severe on the 70th DAP.
Leaf spot

Crop loss: 10-12 %

Symptoms: Brownish necrotic, irregular spots appear on the leaf surface. Spots enlarge, extend and join together leaving characteristic "shot hole". Leaves become yellow and wither off as disease becomes severe.

Factors responsible for spreading of the disease:
- The disease is air borne dispersing by uredospores through water droplets and wind current.
- Temperature of 22-26° C and high relative humidity above 70 % are favourable for the disease development.

Control measures to be adopted:
- Spraying of 0.2 % Bavistin (Carbendazim 50% WP) solution on the leaves.
- Safe Period: 5 days.
Leaf spot

Leaf spot disease can be predicted by following formula.

**Predicted Leaf spot disease (%)** = 7.09 + 0.59** (DAP) ? 1.07* (Max.Temp.) with \( R^2 = 0.82 \), where DAP: is Days After Pruning (favourable range = 45-70), Max. Temp.: Maximum Temperature (favourable range = 22-30 °C).

For Example: Days After Pruning (DAP) = 48, Max. Temp. = 25°C

Predicted severity of leaf spot (%) = 7.09 + 0.59** (DAP) ? 1.07* (Max. temp)

\[
= 7.09 + 0.59(48) - 1.07(25) \\
= 7.09 + 28.32 - 26.75 \\
= 35.41 - 26.75 \\
= 8.68%
\]

If the disease severity is more than 5%, it was suggested that need based preventive measure is needed.

Leaf rust

**Pathogen**

*Cerotelium fici*

**Occurrence**

The disease is more prevalent during winter and rainy seasons. It starts progressing 45-50 DAP becoming severe on 70th DAP. The mature leaves are more prone to the disease.

**Crop loss**

10-15 %

**Symptoms**

Initially, circular pinhead sized brown eruptive lesions appear on the leaves and later leaves become yellow and wither off.
**Leaf rust**

**Factors responsible for spreading of the disease:**
- The disease is air borne spreading by conidia primarily through rain droplets.
- Temperature of 24-26 °C and 70-80 % relative humidity are most congenial for the disease development.

**Control measures to be adopted:**
- Follow wider spacing of plantation (90 cm x 90 cm) or paired row planting system [(90 +150) x 60 cm].
- Avoid delayed leaf harvest.
- Spraying 0.2% Kavach (Chlorothalonil 75 % WP) on the leaves.
- Safe period: 5 days.

**Prediction of this Leaf rust disease can be predicted by following formula.**

\[
\text{Predicted Leaf Rust disease (\%)} = -66.18 + 0.80 \times (\text{DAP}) + 0.45 \times (\text{AH})
\]

with \( R^2 \) value of 0.95, where DAP: Days after pruning (favourable range 45-70), AH : Av. humidity (favourable range 68.9 ? 84.4 %)

For Example: Days After Pruning (DAP) = 50, Average Humidity = 75 %

\[
\text{Predicted Leaf Rust disease (\%)} = -66.18 + 0.80 \times 50 + 0.45 \times 75
\]
\[
= -66.18 + 44 + 33.75
\]
\[
= -66.18 + 77.75
\]
\[
= 11.75\%
\]

If the disease severity is more than 5%, it was suggested that need based preventive measure is needed.

**Powdery Mildew**

<table>
<thead>
<tr>
<th>Pathogen</th>
<th><em>Phyllactinia corylea</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Occurrence</td>
<td>Disease is prevalent during winter and rainy seasons and progresses 40th DAP/leaf harvest becoming severe on 70th DAP.</td>
</tr>
<tr>
<td>Crop loss</td>
<td>5-10 %</td>
</tr>
</tbody>
</table>
**Powdery Mildew**

**Symptoms**

White powdery patches appear on the lower surface of the leaves. The corresponding portions on the upper surface develop chlorotic lesions. When severe, the white powdery patches turn to brownish-black; the leaves become yellow, coarse and loose their nutritive value.

**Factors responsible for spreading of the disease:**
- The disease is air borne spreading by conidia primarily through wind current.
- Temperature of 24 - 28°C and high relative humidity (75-80 %) are responsible for infection and disease development.

**Control measures to be adopted:**
- Follow wider spacing of plantation (90 cm x 90 cm) or paired row planting system [(90 +150) × 60 cm]
- Spraying of 0.2 % Karathane (Dinocap 30% EC) / Bavistin on the lower surface of the leaves. Safe period 5 days.
- Or spray Sulfex (80WP) 0.2%, safe period 15 days.

**Fungal leaf blight**

**Pathogen**

*Alternaria alternata, Fusarium pallidoroseum*

**Occurrence**

The disease starts progressing 45th DAP becoming severe on 70th DAP and is prevalent during summer and rainy seasons.

**Crop loss**

10-12%
**Fungal leaf blight**

**Symptoms**

The disease starts as browning/blackening of leaves starting either from the leaf tip or edges of leaf lamina in the form of isolated irregular brown coloured patches. As the disease spreads the entire leaf surface is affected resulting in fall of leaves.

**Factors responsible for spreading of the disease:**

- The disease is air borne dispersing by conidia through water droplets and wind current.
- Temperature of 25-30°C and relative humidity of 40-60% are favourable for the outbreak of fungal blights.

**Control measures to be adopted:**

- Remove the infested leaves, collect in a polythene bag and destroy by burning.
- Follow wider spacing of plantation (90 cm x 90 cm) or paired row planting system [(90 +150) × 60 cm]
- Spray 0.2% Indofil M-45 (Mancozeb 75% WP) solution on the leaves.

**Bacterial leaf blight**

**Pathogen**

*Pseudomonas syringae pv. mori/Xanthomonas campestris pv. mori*

**Occurrence**

The disease is more prevalent during rainy and winter seasons and starts progressing 35th DAP becoming severe on 70th DAP.

**Crop loss**

5-10%

**Symptoms**

Numerous blackish brown irregular water soaked patches appear on the leaves resulting in curling and rotting of leaves.
**Bacterial leaf blight**

Factors responsible for spreading of the disease:
- Though the disease is air and soil-borne, soil is the primary source of infection and the secondary infection through irrigation and cultivation practices.
- High temperature (28-30 °C) and high humidity (more than 80%) are favourable for the disease development.

Control measures to be adopted:
- Remove the infested leaves, collect in a polythene bag and destroy by burning.
- Follow wider spacing of plantation (90 cm x 90 cm) or paired row planting system [(90 +150) × 60 cm]
- Spray 0.2% Streptomycin solution or 0.2% Indofil M-45 (Mancozeb 75% WP) on the leaves.

**Root knot**

<table>
<thead>
<tr>
<th>Causal organism</th>
<th>Meloidogyne incognita (Nematode)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occurrence</td>
<td>The disease is out break through out the year and more common in sandy soils under irrigated conditions.</td>
</tr>
<tr>
<td>Crop loss</td>
<td>20 %</td>
</tr>
<tr>
<td>Symptoms</td>
<td><img src="image" alt="Severely affected mulberry plants" /></td>
</tr>
</tbody>
</table>

- Severely affected mulberry plants show stunted growth with low water moisture in leaves, later yellowing of leaf margins.
- Formation of knots / galls on roots is the main indicator of the disease symptom.
- Galls are spherical and vary in size; young galls are too small and yellowish-white in colour, old galls are big and pale brown.
### Root knot

**Factors responsible for spreading of the disease:**

- Disease spreads primarily through contaminated soil, farm implements and run-off irrigation.
- Planting of infected saplings along with other susceptible crops increases the disease intensity, some susceptible weeds in and around the mulberry gardens act as the secondary sources of infection.
- Temperature between 27-30 °C, soil moisture of less than 40 % and pH of 5 to 7 are favorable for the development of the root knot disease.

**Control measures to be adopted:**

- Apply neem oil cake @ 800 kg/acre/yr in 4 split doses during intercultural operation or after pruning the plant or after leaf harvest by making the trenches of 10 ?15 cm deep near the root zone of plant and cover with soil and irrigate.

### Root rot

- **Causal organism**: *Rhizoctonia bataticola* (= *Macrophomina phaseolina*);
- Associated secondary microbes: *Fusarium solani* / *F. oxysporum* / *Botryodiplodia theobromae*

**Occurrence**: Through out the year in all types of soils especially when the soil moisture and organic matter in soil are low.

**Crop loss**: 15 % and above depending on the soil health and climate.
Root rot

Symptoms
Initially the above ground symptom of the disease appears sudden withering of plants and leaves fall off from the bottom of the branches and progressing upwards.

• The below ground symptoms include decaying of root cortex or skin, turn black due to fungal spores/mycelium below the bark.
• The severely affected plants loose the hold in the soil and can be easily uprooted.
• On severity, the entire root system gets decayed and plants die.
• Affected plants after pruning, either fail to sprout or plant sprouted bears small and pale yellow leaves with rough surface.

Factors responsible for spreading of the disease:
• The disease occurs in soils of high temperature (28 - 34ºC), low moisture (below 40 %) and low organic matter.
• The disease spreads primarily through contaminated soil, farm implements and irrigation. The secondary source of infestation is through diseased saplings, irrigation and cultivation practices.

Control measures:
A target specific new formulation ?Navinya? (herbal 80% & chemicals 20%) is used for the control of root rot disease of mulberry.
**Root rot**

**Method of application:** Prune off the dried shoots above 15-30 cm from ground. Make shallow ring around stump and apply the Navinya solution made by adding 10g of Navinya in 1 liter of water (i.e. 1 kg Navinya in 100 liter water; sufficient for 100 plants @ 1 liter/plant). Pour the solution over the pruned stump to drench completely. Cover with soil around the stump to prevent exposure to sunlight. Treat the surrounding mulberry plants also to prevent spreading of the disease.

**Precautions to be taken:**
1. Do not irrigate the treated mulberry plants during the first 4-5 days.
2. Remove the dead mulberry plants and burn and expose the soil to sunlight.
3. Plant the new saplings after dipping their roots in 0.2 % Navinya solution for 30 minutes before planting.
4. Maintain optimum organic content >0.5% in soils by applying compost/manure.
5. During summer months irrigate the garden to keep the soil moisture around 50-60% to prevent the disease.

**Note:** The product Navinya has been commercialized and available with M/s. Nandi Agro vet, Bangalore, Karnataka (☎: +91 9449016259)

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**Pink Mealy Bug (Tukra)**

**Occurrence & Symptoms**

Pink mealybug, *Maconellicoccus hirsutus* (Green) causes deformity symptom in mulberry which is popularly called as Tukra. Leaves become dark green, wrinkled & thickened with shortened inter nodal distance resulting in bunchy top appearance/resetting of leaves. It occurs throughout the year, but severe during summer months. Mulberry leaf yield is reduced by 4,500 kg/ha/yr due to this pest.
Pink Mealy Bug (Tukra)

Control Measures

**Mechanical control:** Clip off the infested portion by secateur, collect in a polythene bag and destroy by burning. This will help in reducing the chances of recurrence of pest. This practice may be followed when the silkworms attain 4th age.

**Chemical control:** Spray 0.2% DDVP 76% EC (@ 2.63 ml/lit water) 15-20 days after pruning. Safety period: 15 days.

**Biological control:** Release predatory lady bird beetles Cryptolaemus montrouzieri @ 250 adult beetles or Scymnus coccivora @ 500 adult beetles in two equal splits at an interval of 6 months.

Availability of predatory lady bird beetles

Pest Management Laboratory, CSR & TI, Mysore, Karnataka (☎: 0821-2903285).

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Papaya Mealy Bug
**Papaya Mealy Bug**

**Occurrence & Symptoms**
The papaya mealy bug, *Paracoccus marginatus* is an exotic pest which infest a variety of crops such as papaya, guava, teak, vegetables, Jatropha, and weed plants like Parthenium, Sida, Abutilon etc. In mulberry its infestation causes malformation of affected portion, stunted growth of leaf, presence of red/black ants, honey dew secretion, growth of sooty mould, and outright killing of the plant. At present occurrence of papaya mealy bug is sporadic.

**Control Measures**

1. Release exotic parasitoid, *Acerophagus papayae* @1 vial per acre (1 vial= about 100 adult parasitoids).

2. Do not remove or destroy alternate host plants such as Parthenium, Sida, Abutilon, Jatropha etc., containing mummified mealybugs.

3. Do not spray any insecticide for its control, which may still worsen the situation.

**Availability of Exotic parasitoids**
National Bureau of Agriculturally Important Insects (NBAII), ICAR, Bangalore [opp: CBI, Ganganagar, Bangalore]. (☎: 080-23511982/98).

**Thrips**
### Thrips

**Occurrence & Symptoms**

Pseudodendrothrips mori, is a major pest in Tamil Nadu and minor pest in Karnataka & Andhra Pradesh. It occurs throughout the year and severe during summer (February - April). Both adults and nymphs lacerate the leaf tissues and suck the oozing sap. Affected leaves show streaks in early stages and yellowish/brown blotches in the advanced stage of attack.

**Control Measures**

- **Mechanical/ Physical control:** Use sprinkler irrigation to disturb thrips population & eggs on the underside of mulberry leaves.
- **Chemical control:** Spray 0.1% Rogor (@ 3 ml/lit water) 15 days after pruning. Safety period: 20 days.
- **Biological control:** Release predatory lady bird beetles (Scymnus coccivora @ 500/acre).

### White fly

**Occurrence & Symptoms**

The name white fly is derived from the whiter appearance of the adults and their tendency to fly when disturbed. Adults have a pair of floury wings which are usually white with a few veins. In the recent years outbreak of Dialeuropora decempuncta has occurred on mulberry in southern state of Kerala and Karnataka.

The spiraling of waxy material is the typical symptom of white fly attack. Prolonged dry spell followed by the hot humid weather favours the white fly flare up. Occur during the months March-June; October-December. Both nymphs and adults pierce and suck the sap from foliage and the damaged leaf become unfit for silkworm rearing.
White fly

Control Measures

**Mechanical/Physical control:** Use sprinkler irrigation to disturb white fly population. Fix yellow sticky traps @ 75-80 traps/acre to trap the adults.

**Chemical control:** Spray 0.076% DDVP (@ 1 ml/lit water) 12 days after pruning (safety period: 10 days) and second spray with 0.05% Rogor 30% EC @ 1.5 ml/lit (safety period: 10 days)

**Biological control:** Release predatory lady bird beetles Scymnus coccivora @ 500 adult beetles/acre.

Jassid

**Occurrence & Symptoms**

Jassid, Empoasca flavescens or leaf hopper, is a minor pest that occurs from November to February. Both adults and young hoppers jump very actively and move side-ways. Most obvious sign of injury is the reduced stem height. They suck sap from leaves and cause characteristic hopper burn, ie., yellowing of leaves all along the leaf margin. In the final stage of attack, the leaf becomes cup shaped and wither off prematurely.

**Control Measures**

**Mechanical/Physical control:** Light traps and yellow sticky traps.

**Chemical control:** Spray 0.1% Rogor 30% EC (@ 3 ml/lit water). safety period: 20 days.

Scale Insect
**Scale Insect**

**Occurrence & Symptoms**

Scale insect, *Saissetia nigra* is a minor pest that occurs throughout the year, but severe during summer months. They are found on the underside of leaves and on stem. Both nymphs (crawlers) and adults feed on plant sap by sucking. Feeding causes the plant to become stunted and affected shoots start dying from the distal end.

**Control Measures**

**Physical control:** Scrape the stem with the help of wooden plate to dislodge the insect.

**Chemical control:** Spray 0.05% Rogor 30% EC (@ 1.5 ml/lit water) or 0.15% DDVP (@ 2 ml/lit water). safety period: 10 days.

**Mulberry Leaf Roller**

**Occurrence & Symptoms**

Incidence of Leaf roller, *Diaphania pulverulentalis* in mulberry starts with the onset of monsoon. It occurs from June to February but reaches peak during September ? October months. The larva binds mulberry leaf blades by silken thread, stay inside & feed. Its feacal matter can be seen below the infested portion.
**Mulberry Leaf Roller**

**Control Measures**

**Mechanical control:** Remove the infested portion (along with the larva) by secateur, collect in a polythene bag and destroy by burning.

**Chemical control:** Spray 0.076% DDVP (@ 1 ml/lit water) 12 to 15 days after pruning. Safety period: 7 days. Second spray of 0.5% commercial neem pesticide (0.03% Azadirachtin) @5ml/Lit water, 10 days after first spray. Safety period: 10 days.

**Biological control:** Release Trichogramma chilonis egg parasitoid @ 1 Tricho card/week (for 4 weeks). Do not spray any insecticide after the release of trichogramma parasitoids.

**Cut Worm**

**Occurrence & Symptoms**

Cutworm, *Spodoptera litura* is a polyphagus pest which occurs sporadically on mulberry from August to February. The caterpillars attack shoots of young mulberry plants and cut them, hence the name cutworm. The cut portion of the shoot dries up and falls off. They also feed on mulberry leaves, voraciously.

**Availability of Tricho cards**

Krishi Vigyan Kendra, Suttur, Nanjangud taluk, Mysore Dist. or Parasite Breeding Lab., Dept. of Agriculture, (Near DC Office, Mandya)
**Cut Worm**

**Control Measures**

**Mechanical/Physical control:** Collect and destroy egg masses and young caterpillars. Plough infested garden and dig neat the base of mulberry plant to expose the pest to sunlight and predators.

**Chemical control:** Spray 0.15% DDVP (@ 2 ml/lit water) during evening hours, 20 days after pruning. Safety period: 10 days. Dust 5% Malathion near the base of the plants immediately after pruning.

**Pheromonal control:** Use spodolure, a pheromone trap @ 2 lures/acre twice at an interval of 15 days from 25th day after pruning, to attract and kill male moths.

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**Bihar Hairy Caterpillar**

**Occurrence & Symptoms**

Incidence of Bihar hairy caterpillar, Spilarctia obliqua in mulberry starts with the onset of monsoon. It occurs throughout the year and in certain pockets it appears sporadically. Young larvae are gregariously found feeding on the underside of leaf giving an appearance of mesh and one can make out from distance. Grown up ones are solitary, very active, spread throughout the field and feed voraciously on the foliage.

**Control Measures**

**Mechanical/Physical control:** Collect the egg masses or gregarious young caterpillars and destroy by dipping in 0.5% soap solution or by burning.

**Chemical control:** Spray 0.15% DDVP (@ 2 ml/lit water) 20 days after pruning. Safety period: 10 days.

**Biological control:**

Release egg parasitoids Trichogramma chilonis @ 1 Tricho card/week for 4 weeks. Do not spray any insecticide after the release of trichogramma parasitoids.

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**Wingless grass hopper**
**Wingless grass hopper**

**Occurrence & Symptoms**

Wingless grass hopper, *Neorthecris acuticeps nilgirensis*, occurs during monsoon and post monsoon periods with peak infestation during October and then declines. From January onwards till the onset of monsoon infestation does not occur. Both nymphs and adults feed voraciously on sprouting buds and leaves of mulberry. Sometimes, they also feed on green bark.

**Control Measures**

**Mechanical control:** Deep ploughing immediately after the onset of monsoon to expose egg masses to sunlight and predators. Field sanitation by keeping mulberry garden free from alternate host plants.

**Chemical control:** Spray 0.076% DDVP (@ 1 ml/lit water) on mulberry foliage to kill nymphs and adults. If infestation is severe, second spray 10 days after first spray. Safety period: 10 days.

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**Grasserie**

**Causative agent**  
*Bombyx mori* Nuclear Polyhedrosis Virus

**Occurrence**  
The disease prevails all through the year but its severity is more during Summer and Rainy seasons.

**Source of infection**  
Silkworm gets infected when it feed on contaminated mulberry leaves. The milky white fluid released by the grasserie larvae, contaminated silkworm rearing house and appliances are the sources of infection.

**Predisposing factors**  
High temperature, low humidity and poor quality mulberry leaves.
**Grasserie**

**Symptoms**

- The skin of infected larvae becomes shining before moult and fails to moult.
- Inter segmental swelling appears and the colour of the body becomes yellowish.
- The infected larvae move restlessly in the rearing bed/ along the rim of the trays.
- Infected larval body rupture easily and turbid white haemolymph oozes out.

**Management**

- Practice thorough disinfection of rearing house, its surroundings and appliances with any recommended disinfectant (0.05% Asthra solution / 2.5% Sanitech or Serichlor in 0.5% slaked lime solution / 2%Bleaching powder in 0.3% slaked lime solution / 2% Formalin solution / Decol / any recommended disinfectant).
- Conduct an optional disinfection with 0.3% slaked lime solution when high incidence of disease noticed in the previous crop.
- Practice personal and rearing hygiene.
- Collect the diseased larvae and ensure its proper disposal.
- Maintain optimum temperature and humidity in the rearing house.
- Do not feed tender leaves in the late instars, feed quality mulberry leaf and avoid overcrowding.
- Apply bed disinfectant, Vijetha/Ankush/any recommended bed disinfectant as per schedule and quantity.
- Feed Amruth as per schedule to control grasserie disease.

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**Flacherie**

**Causative agent**

- *Bombyx mori* Infectious flacherie virus/Bombyx mori Densonucleosis virus or different viz., Streptococcus sp./Staphylococcus sp./Bacillus thuringiensis/Serratia marscesence individually or combined infection of bacteria and viruses.

**Occurrence**

- The disease is common during Summer and Rainy seasons.
**Flacherie**

**Source of infection**
Silkworm gets infected by eating contaminated mulberry leaf. Dead diseased silkworm, its faecal matter, gut juice, body fluid are the sources of pathogen contamination. The infection can also takes place through injuries/ cuts/ wounds.

**Predisposing factors**
Fluctuation in temperature, high humidity and poor quality of leaves.

**Symptoms**
- The larvae become soft and flaccid.
- The growth of infected larvae retarded, becomes inactive and vomit gut juice. The faeces become soft with high moisture content. Sometimes chain type excreta and rectal protrusion also observed.
- Larval head and thorax become translucent.
- When infected with Bacillus thuringiensis symptoms of toxicity such as paralysis and sudden death are observed. After death, larvae turn black in color and gives foul smell.
- Some times, the dead larvae turn red when infected with *Serratia sp*.

**Management**
- Disinfect the rearing house, its surroundings and equipments with recommended disinfectant mentioned above.
- Pick up diseased larvae and dispose them by burning.
- Provide good quality leaf grown under good Sunlight and recommended inputs. Do not provide over matured/over stored /dirty leaf to the silkworms
- Avoid starvation, overcrowding and accumulation of faeces in the rearing bed.
- Rear silkworms under optimum temperature and humidity.
- Avoid injury to the larvae.
- Apply bed disinfectant, Vijetha/Ankush/any recommended bed disinfectant as per schedule and quantity.
- Feed Amruth as per schedule to control flacherie disease.
**Muscardine**

<table>
<thead>
<tr>
<th>Causative agent</th>
<th>Among fungal diseases, White Muscardine is common. The disease is caused by <em>Beauveria bassiana</em>.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occurrence</td>
<td>The disease is common during Rainy and winter seasons.</td>
</tr>
<tr>
<td>Source of infection</td>
<td>The infection starts when conidia come in contact with silkworm body. Mummified silkworms / alternate hosts (most are lepidopteron pests), contaminated rearing house and appliances are sources of infection.</td>
</tr>
<tr>
<td>Predisposing factors</td>
<td>Low temperature with high humidity.</td>
</tr>
</tbody>
</table>
| Symptoms        | - The larvae lose appetite and become inactive.  
                   - Presence of moist specks on the skin.  
                   - The larva vomits and turns flaccid.  
                   - After death, larva gradually becomes hard followed by mummification due to growth of aerial mycelia and conidia over the body and body turns chalky white. |
| Management      | - Disinfect the rearing house, its surroundings and equipments with recommended disinfectant as mentioned above.  
                   - Control mulberry pests in the mulberry garden.  
                   - Pick up diseased larvae before mummification and dispose them by burning  
                   - Avoid Low temperature and high humidity in the rearing house. If required use heater/stove to raise the temperature.  
                   - Regulate bed humidity during rainy season by dusting slaked lime powder during moult.  
                   - Apply bed disinfectant, Vijetha and Vijetha supplement/Ankush/any recommended bed disinfectant as per schedule and quantity. |

**Pebrine**
### Pebrine

<table>
<thead>
<tr>
<th>Causative agent</th>
<th><em>Nosema bombycis</em> / different strains of microsporidia.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occurrence</td>
<td>Non-seasonal.</td>
</tr>
<tr>
<td>Source of infection</td>
<td>Silkworm gets infected through eggs (Transovarian/Transovum transmission) or by eating contaminated mulberry leaf. Infected silkworms, faecal matter, contaminated rearing house and appliances and alternate hosts (mulberry pest) are the sources of infection.</td>
</tr>
</tbody>
</table>

#### Symptoms
- Irregular hatching of silkworm eggs.
- Irregular size of the larval body and moulting.
- The infected larva looses its appetite and becomes inactive with wrinkled skin.
- Black pepper-like spots appear on the body of the infected worms.
- White postules appear on the silkgland when examined under microscope with presence of shining oval spores.

#### Management
- Disinfect the rearing house, surroundings and with recommended disinfectant as mentioned above.
- Conduct strict mother moth examination and surface disinfection of silkworm eggs to produce and rear disease free layings.
- Follow strict hygiene maintenance during rearing.
- Control mulberry pests in and around the mulberry garden.
- Apply bed disinfectant, Vijetha/Ankush/any recommended bed disinfectant as per schedule and quantity.
- Monitor seed crops constantly to eliminate the microspodian infection.
Select any recommended disinfectant for disinfection purpose. CSR&TI, Mysore has recommended the following disinfectants:

- **0.3 % Slaked lime solution** (optional disinfection if viral diseases noticed in previous crop? Add 300g of slaked lime to 100 liters of water and stir thoroughly. Keep for 10 minutes and use supernatant).
- **2% Formalin** (Dissolve one part of market available formlin with 17 parts of water).
- **2% Bleaching powder in 0.3% slaked lime solution** (To prepare 100 liters of solution, add little water to 2 kg bleaching powder and 300g slaked lime powder and make a paste. Add this paste to the rest of water and stir thoroughly. Keep for 10 minutes and use the supernatant).
- **2.5 % Sanitech/Serichlor in 0.5% Slaked lime solution** (To prepare 100 liters of solution, take 250g of activator in to a basin/bucket and add 2.5 liters of Sanitech/Serichlor solution. Keep it for 10 minutes. Add activated solution to the rest of water. To this solution, add 500 g slaked lime powder and mix thoroughly).
- **0.05% Asthra solution** (Add 50g Asthra powder in 100 liters of water and stir thoroughly and keep for 2 hours for dissolution of the powder).

The total requirement of disinfectant solution for disinfection is estimated based on the rearing house floor area (Length × Breadth of floor).

The quantity of disinfectant solution required is 1.5 lt./sq. m or 140 ml/sq. ft. floor area of rearing house (height 3 m /10 ft.) + 10% of total quantity of disinfectant solution.

Disinfect the rearing house, appliances and surroundings by spraying the solution with power sprayer. Two times disinfection recommended for each crop (once 3days before initiation of rearing and after completion of rearing).
## Uzi fly

### Occurrence & Symptoms

The uzi fly, *Exorista bombycis* is a serious endo-larval parasitoid of the silkworm, *Bombyx mori*, inflicting 10-15% damage to the silkworm cocoon crop in the premier silk producing states of Karnataka, Andhra Pradesh and Tamil Nadu.

Uzi fly occurs throughout the year, but severe during rainy season. Presences of eggs or black scar on the silkworm body and maggot emergence hole at the tip of the cocoon are the typical symptoms of uzi fly attack.

As soon as the uzi fly enters into rearing house, it lays one or two eggs on each silkworm larva. After 2-3 days, egg hatches, enters inside the larva and feed on internal contents for 5-7 days, after which it comes out by rupturing the larva. The maggot pupates in a dark corner or cracks & crevices in about 18-24 hours. The pupal stage lasts for 10-12 days. If the uzi fly infests at last instar, the uzi maggots come out after cocoon formation by making a circular hole.

### Control Measues

**Exclusion method:** Provide wire mesh/nylon net on all windows/doors.

Provide doors with automatic closing mechanism.

Provide anteroom at the entrance of the rearing house.

Keep the leaf in the verandah of the rearing house and observe for the uzi fly before shifting leaf into the rearing house.

**Physical control (using uzi trap):** Dissolve one table in 1 litre of water and keep the solution in white trays both inside and outside the rearing house at window base from 3rd instar onwards up to spinning.

Place uzi traps inside the rearing house/mounting hall after spinning up to 20 days under close-door condition to trap uzi flies emerging inside.

**Biological control:** Release *Nesolynx thymus* (a pupal parasitoid of the uzi fly) inside rearing house on 2nd day of V instar.

After mounting of all spinning worms transfer the same pouches near the chandrikes.

After harvesting of cocoons keep the same pouches near the manure pit.

Two pouches are required for 100 dfls.

**Proper disposal of silkworm litter after cocoon harvest:** Separate the silkworm litter from mulberry twigs.

Do not throw silkworm litter in open space/litter pit, as it contains hundreds of Uzi fly pupae. Instead, pack it in plastic bags and keep for 15 to 20 days to prevent the emergence of uzi fly from the litter. Alternatively, it can be buried in soil or burnt immediately.
**Uzi fly**

Availability of *Nesolynx thymus* Available at Pest Management Lab., CSRTI, Mysore. Place indents on the day of brushing, indicating the number of pouches required and brushing date of silkworms. Supply is made by courier on receipt of advance payment @ Rs 30 per pouch.

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**Dermestid beetles**

**Occurrence & Symptoms**

Dermestid beetles, *Dermestis ater* are known to attack pierced cocoons in cocoon storage rooms. The female beetles lay about 150-250 eggs in the floss of cocoons. The beetles migrate from cocoon storage room to grainage and attack green cocoons as well as moths also. Generally they attack the abdominal region of the moth. The damage is estimated to be 16.62% on cocoons and 3.57% on moths.

**Control Measures**

**Preventive measures:** Storage of rejected cocoons and perished eggs for long period should be avoided.

Rearing house & cocoon storage rooms should be cleaned periodically.

Grainage premises should be cleaned before & after moth emergence.

Provide wire mesh to door & windows in pierced cocoon (PC) storage rooms.

Wooden articles of storage room & grainage should be dipped in 0.2% malathion solution for 2-3 minutes. Trays etc., should be thoroughly washed & sun dried for 2-3 days before reusing.

**Mechanical control:** Collect the grubs and adults by sweeping or by using a vacuum cleaner, destroy by burning or dipping in soap water.

**Chemical control:** Store pierced cocoons in Deltamethrin treated bags ie., soak the bags in 0.028% Deltamethrin solution (1 ltr : 100 ltr water) and dry in shade.

Spray 0.028% Deltamethrin solution on walls and floor of PC room once in 3 months.

Sprinkle bleaching powder (200 gm/sq.mt) all around inner wall of PC room to prevent crawling of grubs from PC room.