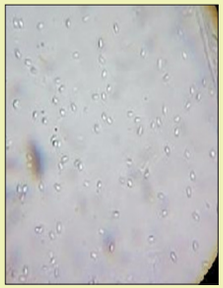
Pebrine infected worms



Pebrine spores under microscope

Flacherie infected worms

Infectious flacherie

Grassarie infected worms

Muscardine infected worms

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MANAGEMENT OF MUGA SILKWORM DISEASES

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MANAGEMENT OF DISEASE IN MUGA SILKWORM

Muga silkworm *Antheraea assamensis* Helfer is affected by several diseases caused by bacteria, viruses and fungi. The major diseases are flacherie, grassarie, pebrine, and muscardine. Crop loss due to diseases is a major challenge during pre-seed and seed crops as compared to commercial crops. During the seed crop rearing, the silkworms are exposed to very high or low temperature and humidity; and their fluctuations cause an outbreak of diseases which severely affects the production of seed cocoons. The incidence of different diseases varies from place to place and seasons. Except pebrine, the incidence of other diseases is directly related to the climatic conditions prevailing during silkworm rearing as such diseases have a direct or indirect correlation with temperature, relative humidity, and rainfall. The most common causes for the occurrence of diseases are poor quality seeds, less nutritive foliage, overlapping rearing at the same site, rearing at diseases contaminated plots, unhygienic rearing practics, contaminated rearing appliances, poor rearing management and prevalence of high temperature and humidity. The common diseases of muga silkworm, the season of occurrence, symptoms, causal organisms, and their control measures are briefly stated below.

PEBRINE

Pebrine is a microsporidian disease causing severe loss in muga silkworm rearing. It is locally known as *Phootuka Bemar* in the traditional muga rearing zone because of the appearance of black spots on the silkworm body during the severe stage of infection.

Occurrence:

It affects in all seasons but higher in autumn and winter season. It attacks in all stages of development of muga worms.

Symptoms :

The important symptoms of pebrine disease are:

Egg stage:

- Less number of eggs, less adherence, more unfertilized and dead eggs, poor and irregular hatching.
- Eggs fail to hatch in case of heavy infection

Larval stage:

- Larva shows poor appetite, retarded irregular growth, sluggish and irregular moulting.
- Under heavy infection, black spots appear on the skin as the parasite invades the hypodermal cells of the skin. These cells die here showing melanosis and appearing as dark pepper-like spots.
- Infected larvae may die before spinning or spin poor, flimsy cocoons.

Pupal Stage:

- Infected pupae flabby lustreless
- Black spots near the abdominal area and rudiments of wings
- Metamorphosis fails

Adult stage:

- Moth emergence delayed/improper
- Clubbed wings
- Discolouration of scales
- Round black spots in wings and abdomen
- Wings do not stretch fully, antenna distorted
- Egg laying capacity poor.

Causal organism:

It is caused by microsporidian *Nosema antheraea* of the family Nosematidae. *Nosema* sp. is found mainly in cells of the gut epithelium of insects and infection is characterized by enlargement of the affected tissue. Spores are bright and oval in shape when seen under a microscope and follow Brownian movement when the smear is prepared freshly. It is transmitted through silkworm eggs (*trans-ovarial or vertical transmission*) and also through contamination of infected leaves and rearing appliances (secondary transmission)

as well as infected litters in soil and non-disinfected surfaces in grainage, equipment and remnants in grainage operations (tertiary transmission). The life cycle of *Nosema* sp. is completed in a week after infection in winter and four days in summer.

Control Measures:

The following precautionary measures should be taken to control the pebrine disease:

- Mother moth examination during Grainage with Fujiwara method is the only procedure to control of this disease and stop the transmission of pebrine spore from mother moth to eggs.
- After examination, the disease free eggs should be treated in 0.2% sodium hypochlorite for 5 minutes to kill the germs of pebrine. Disinfection of tools and appliances of the grainage (kharika, chaloni, chakaripera etc.) by 0.2% sodium hypochlorite or 5 % bleaching is essentially necessary to control the pebrine disease.
- Conduct rearing with disease-free seeds and not using unreliable seed sources.
- The plants should be cleaned followed by spraying of 0.2% sodium hypochlorite or 5% bleaching powder solution at least 10-15 days prior to brushing of worms.
- Practise cellular method of seed crop rearing and microscopic examination of larvae at all stages to confirm disease-freeness.
- Strict monitoring during rearing, collection of irregular diseased/ undergrown worms and destroying them by burning.
- If the infection is detected in a lot, dead larvae, excreta etc. should be collected and destroyed by burning to prevent secondary contamination.
- Destroy the complete rearing in case of an outbreak of pebrine. Prune and defoliate the plants completely and disinfect with 0.2% sodium hypochlorite solution or sprinkling of 5% bleaching powder solution. Burning of eggs laid by infected mother moth for killing pebrine spores.
- Procure seed cocoons only after pupal testing and confirmation of disease freeness.

- After completion of rearing, the site should be thoroughly disinfected as prophylactic measures.
- The soil of the rearing field should be tilled and disinfected with a dusting of bleaching powder @ 200 gm/ m^2 area.
- Ideally rearing should not be conducted in the field for at least 5-6 months.
- After grainage operation, cut wings, abdomen of moths, grainage debris and smears etc. should be dumped in soak pits along with 5% bleaching powder solution as prophylactic measures.

FLACHERIE

Flacherie, a bacterial as well as viral disease and the most common and serious disease of muga silkworm. It is a very common and infectious disease of muga worms and is locally known as *Mukhlaga Bemar.* Prevalence of very high temperatures and humidity; and intermittent rainfall with bright sunny days with high fluctuation in temperature, unsuitable foliage is the major predisposing factors for flacherie as such conditions promote microbial growth.

Occurrence:

The disease predominantly occurs during monsoons and post-monsoon months i.e. July-September. Now-a-days due to climatic disturbances and the shortening of winter, the disease has been reported even in the months of October to December or throughout the year. The disease is transmitted from infected worms to other healthy worms when they come into contact and after feeding on contaminated leaves. Anal protrusion symptom is the most common symptom.

Symptoms:

The common symptoms of the flacherie disease are:

- Worms become lethargic, lose appetite and are motionless.
- Swelling of body segments, the colour of the haemolymph turns black.
- Vomits gut juices and excretes semi-solid faeces.
- Anal portion of the infected worm becomes swollen and ruptured. Excreta looks like a chain.

- The larva becomes soft and translucent black in colour. It loses its grip on the twig and topples and dies. Death usually occurs within a few days of infection.

Causal organisms:

The disease is caused by a number of bacterial species viz. *Pseudomonas* sp., *Bacillus thuringiensis* etc. *Pseudomonas aeruginosa* is the major causative organism for the outbreak of the flacherie along with high temperatures and humidity, and other abiotic factors. Maintenance of plantation with proper agronomical practices like pruning is required to ensure uniformity of age of leaves as the feeding of tender leaves by late age worms also leads to an outbreak of disease.

Control Measures:

- Use of disease-free seed for rearing.
- Disinfection of the rearing site with 0.2% sodium hypochlorite solution or sprinkling of lime and bleaching powder at 9:1 ratio before rearing.
- Proper disinfection of the field and rearing appliances like *chaloni* etc.
- Dusting of 3% slaked lime in case of a high incidence of the disease in the preceding crop.
- Avoid brushing of worms in a damp site of the rearing plot. Avoid overcrowding of the worms during brushing and transfer time.
- Manual separation of early-stage infected larvae and destruction. Collection of dead and diseased worms with forceps and burn them.
- Maintain hygienic conditions during rearing.
- Feeding silkworms with age-specific quality leaves.

GRASSARIE:

It is a contagious disease of muga silkworm and is commonly known as Jaundice or *Phularog* in the traditional muga rearing zone. Fluctuations in temperature and humidity result in an outbreak of the disease although it is not that common.

Occurrence:

This silkworm disease predominantly occurs during July-October, as fluctuations in high temperature, and relative humidity are the main cause of outbreaks of viral diseases. Silkworm gets infected when it feeds on contaminated host plant leaves and encounters diseased/dead worms. In addition, feeding of tender and succulent leaves by late-stage silkworms also triggers for outbreak of this disease.

Symptoms:

The important symptoms of grassarie disease are:

- The silkworm larvae fail to moult.
- The integument becomes fragile and inter-segmental portions become swollen.
- The body tissues and haemolymph of the infected larvae get disintegrated into turbid white fluid.
- The turbid fluid contains large number of hexagonal polyhedral bodies.

Causal organisms:

The disease is caused by *Borrelina* sp. of Baculovirus family and on examination under the microscope, polyhedral bodies of the virus can be seen. The source of infection is the feeding of contaminated foliage, disintegrating diseased silkworms, their body fluids and contaminated rearing sites and appliances.

Control measures:

- Proper disinfection and maintenance of hygiene of the rearing site.
- Disinfection of the rearing field with 0.2% sodium hypochlorite or dusting of lime and bleaching powder at 9:1 ratio prior to brushing.
- Dust 3% slaked lime in addition to usual disinfection in case of high incidence of disease in preceding rearing.
- Pick out growth retarded/ lethargic/ irregular moulters and destroy by burning them.
- Avoid overcrowding of the worms.

- Avoid frequent handling of worms.
- Ensure feeding of quality and nutritive leaves.

Infectious flacherie

It is a major viral disease of muga silkworm caused by Baculoviruses. High temperatures clubbed with high humidity, and poor-quality host plant leaves are predisposing factors.

Symptoms:

- The infected silkworms are sluggish in movement.
- Lethargic and weak.
- The anal portion of the larvae becomes swollen and ruptured.
- After 2-3 days of infection the silkworms die.
- Infectious flacherie is contagious in nature.

Control Measures:

- Feeding of quality and stage-specific leaf.
- Disinfection of the rearing site with 0.2% sodium hypochlorite solution or sprinkling of lime and bleaching powder at 9:1 ratio before rearing.
- Maintain hygienic conditions of the rearing field.

MUSCARDINE

It is a fungal disease which is commonly known as *Bhekur Rog*. Fungal disease is caused by parasitic fungi which appear in various forms based- on the colour of spores covering the body of the infected si1kworms. Generally, white and green muscardine diseases are found in muga silkworms. But rarely brown muscardine is observed.

Occurrence:

The muscardine disease generally occurs during late autumn and winter affecting muga rearing during *Aghenua* and *Jarua* crops.

Symptoms:

The important symptoms of muscardine disease are:

- Infected larva becomes inactive and loss of appetite.
- Infected worms become harder, paler and inactive followed by bending of the body dorsally

- Oozing of oily substance.
- Diarrhoea and vomiting appear before dead larvae.
- Body of dead worms compressed, reduced body fluid and spongy with fragile skin.
- Body of dead larvae initially soft but become stiff and harder after death.
- Dead body is covered with white powdery conidia after 2-3 days
- Chalky and mummified body.

Causal organism:

The disease is caused by different species of fungus e.g. *Beauveria* sp. The infection mainly occurs through the skin by penetration of conidia and develops inside the body cavity.

Control Measures:

- The rearing plots should be properly maintained and kept dry for avoiding dampness/moist conditions during rearing.
- Brush the silkworm on the south-east side of the rearing plot to get maximum exposure of worms to the sunlight.
- Proper disinfection and maintenance of hygiene during rearing.
- Ensure constant monitoring and collection of diseased worms.
- Removal and burning of dead larvae.
- Burning of rice husk/dry weeds at the rearing site to release smoke and make the site dry. This helps in reducing fungal incidence.
- Resort to light pruning of all the Som/Soalu plants utilized during rearing followed by burning of twigs as prophylactic measures.
- Spraying of Serichlor (2%) solution is effective.
- Spraying Blitox (fungicide) CoC (50% wp). @ 2.5 gms per liter of water on leaves and on the soil 4 -7 days before hatching.
- Sprinkling of lime+ bleaching powder mixture (9:1) ratio on the soil of the rearing plots before 7-10 days of brushing is effective.