Agri Articles
(e-Magazine for Agricultural Articles)
Volume: 03, Issue: 04 (JULY-AUGUST, 2023)
Available online at http://www.agriarticles.com
©Agri Articles, ISSN: 2582-9882

Biology of Muga Silkworm

(*Gajjala Nitish[1], Arasakumar E[1], Navaneetha Krishnan[2], Vasanth V[1] and Nilav Ranjan Bora[1])
[1]Department of Sericulture, Forest College and Research Institute, Tamil Nadu Agricultural University, Mettupalayam - 641301, Tamil Nadu, India
[2]Department of Silviculture and NRM, Forest College and Research Institute, Tamil Nadu Agricultural University, Mettupalayam - 641301, Tamil Nadu, India
*Corresponding Author's email: gajjalanitish@gmail.com

Introduction

Hierarchy of Muga Silkworm:
Kingdom: Animalia
Phylum: Arthropoda
Class: Insecta
Order: Lepidoptera
Family: Saturniidae
Sub Family: Saturniinae
Genus: *Antheraea*
Species: *assamensis*

Muga silkworm(*Antheraea assamensis*) is a holometabolous insect, polyphagus,semi-domesticated and multivoltine insect.Muga silkworm is native of Assam and named after Assamese word "Muga" which indicates the amber (brown) colour of cocoon

- The golden muga silk is the pride of Assam associated with Assamese culture and tradition
- Muga culture is the monopoly of Assam
- The culture also spread in different neighbouring district of Assam - Meghalaya, Nagaland, Manipur, Mizoram, Arunachal Pradesh and West Bengal
- Also occurs in Myanmar,Sikkim,HimachalPradesh,Uttar Pradesh ,Gujarat ,Pondicherry, Bangladesh, Indonesia and Sri Lanka

PRODUCTION OF MUGA RAW SILK

Assam alone contributes 95% of the total Muga raw silk production

Host plants: Mainly feeds on primary food plant Som (Perseabombycina) and Soalu (Litseapolyantha)

Secondary host plants are Mejankari, Dighlotti, Ber, Champa, Bhomloti, Gamari, Katholua.

Fig: (A) *Persea bombycina* garden, (B) *Litsea monopetala* garden

- ✓ One tree can be utilized for two rearing in a year alternately during spring and autumn, thus one full grown tree can yield 1000 cocoons in a year and 5 trees are required to produce 5000 cocoons which yield one kg. of muga silk

Life cycle of Muga Silkworm

Average total number of days required during summer and winter:

Stage	Summer	Winter
Egg	7	15
Larval	24	70
Spinning	3	7
Pupal	14	55
Moth	2	3
	50	150

Species of Antheraea undergo diapause in the pupal stage except A.yamamai (undergo diapause in egg and pupal stage)

Fig: Eggs

Eggs: he eggs are oval,dorsoventrally flattened & bilaterally symmetrical. Eggs are creamy and brownish grey in colour,streakless. 2.8 × 2.5 mm in length and 2.5mm in diameter 9mg in weight,The follicular imprints of A. assamensis egg cell consisted of oval main cells and intracellular space on the entire egg surface expect the micropylar region. Egg stage 7 days in summer and 16 days in winter. Hatching usually commences in the morning hours and completed within 3 days.Maximum hatching (about 75%) occurs in the first day. Maximum hatching 82±5% occurs during the autumn (Kotia crop) with a mean temperature of 26˚C and 77%RH.Almost similar trend of hatching is found during spring (Chotua) crop. When temperature is between 17-25˚C-hatching increases whereas when temperature is more than 28-35˚C hatching decreases.

Larva:

1st instar: Newly hatched larvae is 0.7-1.2cm in length and weight 0.0069-0.008 gms.The newly hatched larva is characterized by prominent black inter segmental markings. Six tubercles in each body segments and are yellow in colour provided with hair like setae. Larval period last for 2-3 days in summer and 6-8 days in winter .It moulted after 3-4 days in summer and 6-8 days in winter.

2nd instar: The 2nd instar larvae are light yellow in colour.After 1st moult the body turns green. It measures around 1.4-1.8 cm, weight around 0.083-0.0912gm. The dorsal tubercles of the larva are blue in colour. Larval period last for 3-5 days in summer and 7-10 days in winter.

3rd instar: The 3rd instar larva are green in colour & measures around 1.8-2.5cm.Weight is 0.4-0.6 gm.The tubercles are violet in colour.Faint yellow lateral line is visible in lateral region.Clasper are triangular in shape and yellowish green in colour.Larval period last for 5-7 days in summer and 10-13 days in winter.

4th instar: The larva measures about 2.5 – 3.5 cm and weight around 2.00 -3.5 gm. Dorsal surface of the body is dark green while ventral surface is light green in colour. Tubercles are red in colour provided with setae. Stage last for 8-10 days in summer & 13-16 days in winter

5th instar: Newly transformed larva measures about 4-5.5 cm and weights 4.12-5.21 gm approximately. Dorsal body surface is light green while ventral is deep green. Head triangular and dark in colour.Body tubercles are brick red in colour with setae.Lateral line is prominent extending from prosterior part to anterior abdominal segment U shaped marking are seen on the anal flap with a black inner and a deep brown outer border.

Each segment of the 5th instar larva bears a pair of dorsal tubercles, a pair of upper lateral, a pair of lower lateral tubercle. Dorsal tubercles project backwards while lateral tubercles project forward. Larval period last for 10-12 days in summer and 16-19 days in winter. Fully matured larva attains 10-15 gm weight.

Pupa: After completing the 5th instar the ripened worms crawl down from the branches in the evening time and are collected in a bamboo basket 'Chaloni" and the worms are released into mountage ('jali'). Jali are made up of semi-dry leaves from jackfruit leaves etc , and the host plant Som itself.The worms generally preferred 2-3 semi-dry leaves for spinning.Spinning duration is 3 days in summer and 7days in winter.

During spinning the larva transform itself into pupae inside the cocoon.Transformation of larva into pupa through an intermediary stage is called pre-pupal stage.

During this transformation,dissolution of larval organs occurs followed by formation of adult organs .During the pupal stage, the concentration of juvenile hormone increases and ecdyson hormone decreases which results in the transformation of external,internal organs.

Weight of pupa is 6.5gm approximately, and are dark brown in colour. Cocoon weigh, shell ratio, pupal weight and silk filament length vary in different seasons. Pupal stage last for 14 days in summer and 40 days in winter.

Moth: Moth emergence commence from 14-55 days after spinning. Before emergence the moth secretes proteolytic enzyme which softens the peduncle end of the cocoon enabling the moth to pierce its way out easily. Under humid condition the anterior portion of the cocoon remains wet

Seed cocoons

Double cocoon

facilitating easy emergence. While under dry condition the anterior portion of the cocoon dries off quickly and therefore moths cannot come out of it easily, they die within the cocoon at time. Male moths emergence is more in the early part and female in the later part.Exhibit sexual dimorphism(such as of colour or size)

1. Curvature of wing-tips of the forewing have sharp curve in male moths
2. Abdomen:narrow abdomen in males and broad,large and swollen abdomen in females
3. Antennae-boarder antennae in males
4. Colouration-wings & body are copper brown to dark white in male while female is yellowish light brown in colour

Male moth

Female moth

Coupling of moths- After moth emerged from the cocoon coupling takes place. Under normal condition muga moths coupled overnight,but 4-6 hrs coupling is sufficient for optimum egg laying and hatching. The coupled moths are usually tied on the "khorika"with a thread and are left undisturbed.

Coupling of moth

The hind wings of the female moth are tied to the Kharika in order to avoid stray egg laying. After coupling,the fluttering of the wings of the male moth cease and the coupled moths remain still for a day. When male moths are less in number,single male moth can be stored and used again for second coupling without affecting fertility and egg laying in the same khorika sometimes more than one pair of moths is tied to minimize the quantity of khorikas.

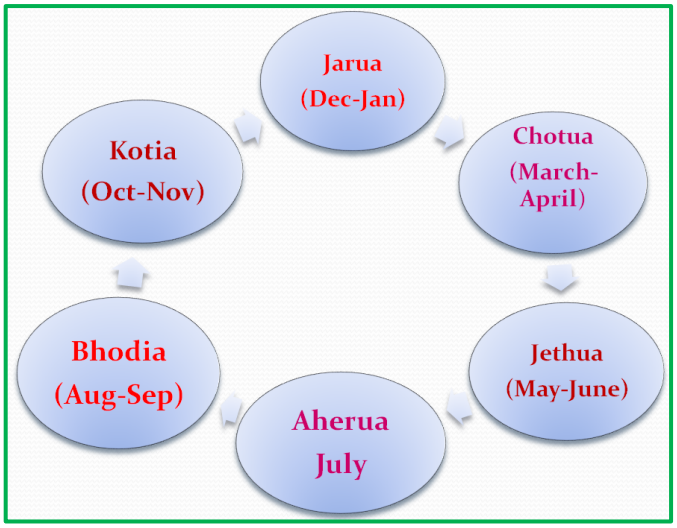
Oviposition: After decoupling, female moths start depositing eggs on the kharika. Oviposition starts in the evening and continues till dawn. Egg laying continues for 5-6days but egglaid upto 4th day are only considered for rearing.

Laying of eggs

Eggs laid after 4th day are less viable and produce weaker caterpillar with poor larval development. Maximum eggs are laid during autumn and spring season with 220 & 200 approximately eggs per laying and minimum during summer season 101 eggs. Seasonal factors affect the oviposition behaviour of the muga silk moth. Moths dies within 7-12 days after emergence.

Problems associated with rearing of muga silkworm

1)constraints of pre-seed and seed crop rearing: There are six muga crops of which two are commercial crops i.eJethua and Kotia.Two seed crops i.eChotua and Bhodia and 2 pre seed crops i.eJarua and Aherua.



These crops are overlapping and the avaibility of commercial seeds depends on the success of raising pre seed and seed crops linking to commercial crops. During preseed and seed crop the climatic condition remain unsuitable with high fluctuations in temperature leading to high incidence of diseases like flacherie, muscardine, grasserie etc. Hence quality muga silkworm seed, which plays vital role in productivity, sustainability and profitability of muga industry, continues to be the main constraint.

2)Influence of climate and season: The optimum conditions for rearing of muga silkworm are 20–31°C & 65-95% RH . Change of climatic factors, specially temperature and relative humidity. Affects their development and survival.

Influences the consumption and utilization of food in muga worms.The seed crops are low productive (14-40% crop loss). Air pollution caused by rampant use of pesticides in neighbouring tea gardens, pollution from the brick kilns and burning of natural gases emitting from oil wells.

3)Incidence of pest and disease in seed crops: Muga silkworm is subjected to viral, bacterial, fungal and protozoan diseases that result in heavy crop losses up to 40% for individual diseases. It is estimated that 20–30% of the loss is due to pebrine (microsporidian) disease, which sometimes kills an entire silkworm culture.

Pebrine: Prevalent throughout the year. Most serious disease of muga silkworm caused by a protozoan of *Nosema sp*.If infection is primary, more than 50% larvae die before 3rd moult. Secondary infection during early 4th instar larval stage produces flimsy cocoon.

Flacherie: It caused by a virus followed by secondary infection with bacteria incidence.The incidence is highest in summer.

Grasserie: It caused by a virus can cause heavy crop losses. Infects larvae mainly in summer & rarely in winter.

Muscardine: It is a less prevalent disease caused by a fungus (Fusarium spp.). It infects larvae mainly in winter. Patnaik also stated that fungal infection is a rare occurrence in muga crops.

The muga silkworm is attacked by a wide range of parasitoids and predators. During winter, the muga silkworm is prone to parasitisation by the uzi fly (Exoristabombycis), which can result in a crop loss of 80%

Apanteles (Apantelesstantoni): Infects early stage silkworms. Eggs are laid inside the silkworm body larvae. Mature maggots form pupae in aggregation outside the body of the silkworm. Prevalent during summer and winter.

Wasp (*Vespa orientalis*)

- Attacks early instar worms
- Occurs during June-July to Aug-Sept

Red ants:

- Serious pest
- Attacks 1st stage worms
- Loss 5-10%

Spider:Attacks 1st instar worms

Grass hopper: Attack 2nd & 3rd worms
Lost is minimal