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Insect Pests of Muga Silkworm, *Anthereae Assamensis* (Lepidoptera: Saturniidae)

S. Subharani[1] & P. Jayaprakash[2]
[1]Central silk board, Muga Silkworm Seed Organization, P3 Unit, Narayanpur, North Lakhimpur, Assam, India
[2]National Silkworm Seed Organization, Central Silk Board Bangalore, India
*Corresponding Author

Abstract

Muga silkworm rearing being outdoor crop loss due to insect pests is a major problem encountered by the muga rearers. The loss due to these insect pests is alarmingly high in the preseed (Aherua and Jarua) and seed crops (Chotua and Bhodia) compared to the commercial crops (Jethua and Kotia). A preliminary study in 2010 to 2011 revealed 12 (twelve) insect pests belonging to the family Tachnidae, Vespidae, Ichneumonidae, Braconidae, Formicidae, Pentatomidae and Mantidae infesting the silkworm. These insect pests are classified depending on their period of activity and intensity of attack. Amongst the insect pests that attack muga silkworm, the most formidable ones are the dipteran endo parasitoid, *Exorista sorbillans* Widemann, otherwise called the uzifly with 25 % damage in the 4th to 5th instar larvae and 20 % at harvesting stage of cocoons during chotua crop (March-April) and the wasp, *Vespa orientalis* with 20 percent damage during Aherua (May-June) and Bhodia (August-September) crop. Application of insecticides for control of the insect pests is not advocated in muga rearing as it is lethal to the silkworm itself. Future research must focus on environmentally sound pests management strategies that are compatible with the needs and limitations of farmers. A detailed description of the pests, cultural methods of control, biological control, and integrated pests management for each pests are discussed briefly.

Key Words: *Antheraea assamensis*, Seasonal incidence, insect pests, Integrated pests management.

Introduction

The North eastern Region of India is one of the rich biodiversity amongst the 35 hotspots in the world. This zone and Assam in particular is endowed with a climatic condition favorable for Muga culture and hence, has established as an important cottage industry for the rural folk by providing them sustainable livelihood. The present production of Muga silk in Assam is 117 MT accounting to 98 % of total Muga silk produced in the country while rest is contributed by the other north eastern states of India (Singh, R.N., 2013).The Muga silkworm, *Antheraea assamensis* (Helfer) the producer of glittering golden yellow silk is endemic to Assam and is a semi domesticated, polyphagus, multivoltine species. This silkworm feeds on two primary food plants namely Som, *Persea bombycina* and Soalu, *Litsea polyantha* and completes six life cycles in a year. The six crop cycles are Jethua (Apr-May) and Kotia (Oct-Nov) which are considered as commercial crops, Chotua (Feb-Mar), Bhodia (Aug-Sep) as seed and Jarua (Dec-Jan) and Aherua (June-July) as pre seed crops (Chakravorty, 2004). However, Muga rearing being outdoor, its yield is constrained by several natural a biotic and biotic vagaries, one of which is predation of silkworm by insect pests that damages crop significantly. Information on pest's complex in a particular agro-climatic condition is a prerequisite, which helps in designing a successful pest's management strategy (Srilaxmi, K. and Paul, R. 2010). Earlier several authors have reported that insect pest infesting a particular crop differs from place to place. There are also reports that muga silkworm is attacked by different insect pests from different parts of the country and other country as well (Chaudhury, 1981; Thangavelu *et al.*, 1988; Singh & Das, 1996). The use of chemical insecticides for control of insect pest in sericulture is often impractical and undesirable, there is an urgent need for an alternative approach that can complement and partially replace chemical based pest management in sericulture (Singh & Saratchandra, 2008). Therefore, considering, the importance of Muga culture in this region, the scant information on diversity of insect pest on various growth phases of the silkworm and for development of suitable pest management strategies it was thought worthwhile to take up a detailed study on the insect pest of muga silkworm.

Materials and Methods

Studies were conducted for monitoring the insect pests infesting muga silkworm in the rearing field of Muga Silkworm Seed Organization, P3 Seed Station, Central Silk Board, Narayanpur during 2010 to 2011 under the agro climatic conditions prevailing in Narayanpur, Assam. The rearing field is situated at the geographical location with latitude 26^{O}59'47" N, longitude 93^{O}53'49"E and at an altitude of 88m above mean sea level. It covers an area of 11 acres with 10 plots and 4300 som plantations in 3Mx3M spacing. During every crop observations on the incidence of the insect pests were made at weekly intervals .Identification was carried out as per relevant keys and assistance of entomologists. The nature of attack, period of activity and extent of damage were recorded and accordingly they were ranked as major and minor pests.

Results and Discussion

The data recorded on the insect pests infesting muga silkworm are presented in Table 1. From the data it was observed that under the agro-climatic conditions of Narayanpur, altogether 9 (nine) insect pests belonging to 4 orders and 6 families were found infesting the silkworm. Of these, some were classified as major pests depending upon their

intensity of attack and the rest were classified as minor pests. Amongst the insect pests that attack muga silkworm, the most serious one is the dipteran endo parasitoid, *Exorista sorbillans* Widemann, with 15 to 20 % damage in the 4th and 5th instar larvae during Jaura (Jan- Feb) and Chotua crop (March-April). Singh *et al.*, 1993 also reported that the muga silkworm suffers heavy loss due to infestation by the uzi fly to the extent of as high as 86 % in Boko area during Jarua crop. Similarly, Reddy, 2011 had also reported that uzi fly is a serious endoparasitoid with maximum infestation in 5th instar larvae and at harvesting of cocoons during Chotua and Jarua crop in Upper Assam. The insect pests' infesting the silkworm belongs to the family Tachnidae, Braconidae, Formicidae, Pentatomidae, Vespidae and Mantidae. Singh & Das (1996) had reported a total of 39 (thirty nine) insect specimens belonging to twenty five families infesting primary muga food plants and muga silkworms (*Antheraea assamensis)* from RMRS, Boko, Assam where regional climatic conditions and growth stages of the crop varied. A detailed description of the insect pest and the integrated management to be followed for its control are described below**:**

1. **Uzifly:**

Exorista sorbillans

Adult fly

Larvae infested by uzi fly

Pupa

Description: Adults are blackish grey in colour. Male is longer in body length (about 12mm) than female (about 10mm).The Head is triangular in shape. The body is greyish with four longitudinal black bands on the dorsal side of the thorax. The abdomen is conical. Of the abdominal segments, the first one is black and the rest greyish-yellow.

Nature of attack: The Uzi fly mostly attack the 4th and 5th instar larvae ultimately killing the larvae. A single female prefers to lay eggs directly at inter segmental region of the larval body. After hatching, the maggots penetrates into the larval body and starts feeding on inner tissues/fat bodies then maggots comes out from the body and pupates in the soil. The silkworm parasitized by uzi fly in early instars are killed before attaining spinning stage, while those parasitized in the late 4th & 5th instars spin cocoons of weak built and from such cocoons uzi maggots emerge by piercing, thus rendering cocoons unfit for reeling and reduces the market value of the cocoons. Presence of egg(s) or black scar on the body of the silkworm larvae and maggot emergence hole in the cocoons indicates uzi infestation.

Period of Activity

The attack of this endo-parasitoid is severe during *Jarua* (Dec.-Jan.) and *Chotua* (Feb.-Mar.) crop seasons causing 15 to 20 % loss.

Management

i**. Manual control.**

- Rearing of silkworm under nylon net during peak infestation period (December to March), ensures 80-90% control.
- During transfer of late stage worms, the fly eggs should be removed from the integument of the silkworm larvae with the help of forceps.
- Dried leaves should be used for Jali (montage) to facilitate quick spinning of cocoons to minimize the time for emergence of uzi maggots to emerge out.
- Uzi infested worms should be mounted in separate 'Jali'.
- The uzi maggots which come out at three days after spinning in the Jali (mountage) should be collected and destroyed.
- Reeling cocoons should be stifled properly within 2-3 days after spinning which helps to kill uzi maggots and pupae noticed sometimes inside the cocoon.
- The uzi infested cocoons should be harvested on 4th and 5th day of spinning.

ii. **Cultural control:**

- Plough or dig the soil in rearing plots to expose the maggots/pupa for predators/strong sun light to reduce the infestation.
- Avoid rearing of muga silkworms continuously from Dec - April to minimize the uzi fly infestation.

iii. **Biological control** through hyperparasitiods. E.g. *Nesolynx thymus.*

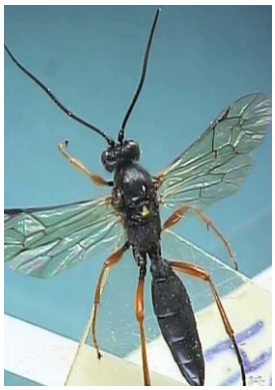
- Inundative release of pupal parasitoid, *Nesolynx thymus* Girault (Hymenoptera:Eulophidae) to reduce the infestation of uzi fly in muga culture.
- Release the parasitoids once in 2nd, 3rd, 4th & 5th instars and once in spinning and grainage @10000/release in the centre of the rearing field.

This parasitoid was also reported on 95 species of insects belonging to 20 families of Lepidoptera and one family of Hymenoptera worldwide in the absence of silkworm (Narayanaswamy & Devaiah, 1998) .Since this pest also attacks a no. of lepidopteron insects , it cannot be completely eradicated but only managed.

2. ***Apanteles*:**

Apanteles glomeratus

Larvae infested by *A. glomeratus*



Adult fly

Description: The adult *Apanteles* sp. is about 1/8 to 3/16 inch long with a black body and long antennae. The female has a short ovipositor at the end of the abdomen.

Period of activity: It is prevalent during summer and winter months of the year.

Nature of attack*: Apanteles glomeratus* usually infects the early stage silkworms. *Apanteles* lays eggs inside larval body of the silkworm by inserting the ovipositor through tubercles. The maggots of the fly feed on the tissue of the silkworm and come out through the tubercles after maturation. The mature maggots form fuzzy white cocoons in aggregation outside the body of the silkworm larvae.

Management

a. Rearing of silkworm under nylon mosquito net prevents *Apanteles* infestation.
b. Keep the rearing field clean and dust with bleaching powder during rearing.
c. Collect and destroy the maggots/pupae of the fly along with the silkworm larvae.

Several species of *Apanteles* attack leaf rollers. *Apanteles* sp. may play a key role in biological control of leaf rollers. It is nature misfortune that this beneficial creature of nature is also parasitoid our most valued muga silkworm crop.

3. **Ants :**

Oecophylla smargdina
Componotus sp.
Solenopsis sp.

Description: It is social insect with clear cut division of labour among the colony. The species attacking silkworm larvae are the red ants, black ants and carpenter ants.

Status: Major

Period of activity: Throughout the year. Peak attack is during Summer Season. i.e Aherua (May-June) & Bhodia (July-Aug).

Nature of attack: They attack in groups and carry the young larvae to their nests. They attempt to feed on the appendages including hairs and setae, of the advance stage larvae by biting.

Management: a. Remove ant nest from the plants before brushing of worms.
b. Keep the rearing field clean and dust with lime and bleaching powder before rearing.
c. Apply grease on the tree trunk so that ants cannot climb on the trees.

4. **Bug :**
*Eocanthecona furcellata (*Wolff.)

Description: Adult fly is black in colour and is recognized by the presence of the V shape scutellum on the dorsal side of the body. It has a long proboscis which sucks haemolymph from the host body.
Status: Major.
Period of activity: Peak activity is during Aherua (May-June) & Bhodia (July-Aug) crop. Its population starts declining by October and the bug goes under hibernation during December and February.
Nature of Attack: Feeds on the haemolymph of the hosts, which it sucks by piercing the larval body. They generally attack the middle of the body so that the larvae cannot escape. Generally the 1st and 2nd instars silkworm larvae are killed with one prick while later instars can withstand 4 to 5 pricks.
Management: Rearing under nylon net and mechanical control are the methods to prevent the attack. *Psix striaticeps* is also a promising biological control agent against the stink bug *C. furcellata* (Singh *et al.*, 1992,).

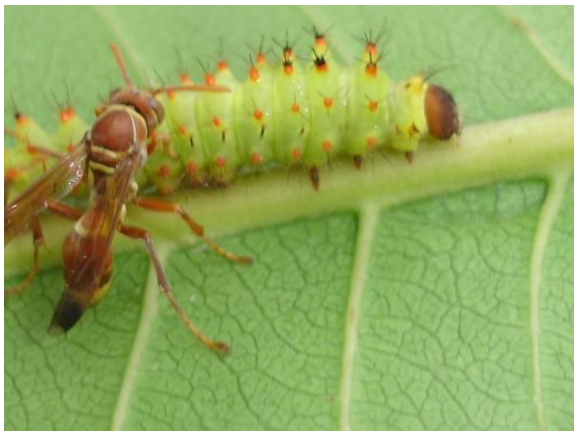
5. **Reduviid bug**:
Sycanus collaris

Description: The adult is black and about 2.5 cm long. The rostrum consists of three segments, and the antennae are filiform. The head is long and conical. The prothorax is narrow, distinct and well developed. The abdomen is broad at the middle and the margin of the segment beyond the wings is exposed. The wings lie flat on the abdomen. The legs are long, femora and tibiae are often spinned.
Status: Minor
Period of activity: Peak activity is during Aherua (May-June) & Bhodia (July-Aug) crop.
Nature of attack: Sucks the larval haemolymph with its long proboscis. Early instar larvae are more likely to be attacked by this predator. The bug can inflict injury to 30 – 40 silkworm larvae in a day. Early instars larvae are usually attacked by this predator.
Management: Rearing under nylon net and mechanical control are the only methods to prevent the attack.

6. **Praying Mantis :**
Heirodula westwoodii

Description: The adult is large (5-8 cm) and green, it is easily recognized by its peculiar raptorial forelegs. The head is deflexed and the prothorax is elongate. The antennae are filiform and conspiscous.The forewings are moderate in size, thickened, coloured and covering the large folded hind wings, which are hyaline and often coloured.
Status: Minor
Period of activity: The insect is active throughout the year.
Nature of attack: Nymphs and adult carry away the early instars larvae which are easy to feed on. They also inflict injury on the late instar larvae, which die however the injury is deep.
Management: Removal of egg mass from the rearing field and killing of the adult is the most ideal method to minimize the predator population. The egg masses are mostly attacked by the parasitic Chalcids. Besides this *Podagrion* sp. has been screened as an important parasitoid in oothecae of mantids (Singh et al., 2013).

7. **Wasps:** *Vespa orientalis*



Description: Generally 18-25mm in length. Body colour is light brown or reddish brown. Parts of the head and third fourth abdominal marking are yellow in colour. Queens and workers have a very effective sting.
Status: Major
Period of activity: Peak activity is during Aherua (May-June) & Bhodia (July-Aug) crop.
Nature of attack: They pick up the tiny silkworm larvae from the host plants and kill them. They cause maximum damage during early instars rearing.
Management: Rearing under nylon net and mechanical control are the only methods to prevent the attack.
Insects secreting honey dew like Aphids should be controlled because honey dew attracts wasp.

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TABLE 1. INSECT PESTS INFESTING MUGA SILKWORM

Sl.No.	Commom Name	Scientific Name	Order/Family	Type	Status
1.	Uzifly	*Exorista sorbillans*	Diptera/ Tachinidae	Parasitoid	Major
2.	Apanteles	*Apanteles glomeratus*	Hymenoptera/Braconidae	Parasitoid	Major
3.	Red Ant	*Oecophylla smangoline*	Hymenoptera/Formicidae	Predator	Major
	Carpenter ant	*Componotus* sp.	Hymenoptera/Formicidae	Predator	Major
	Fire ant	*Solenpopsis* sp.	Hymenoptera/Formicidae	Predator	Major
4.	Canthecona Bug	*Eocanthecona furcellata*	Hemiptera/Pentatomidae	Predator	Minor
5.	Reduviid bug	*Reduvius cincticrus*	Hemiptera/Pentatomid	Predator	Minor
6.	Wasps	*Vespa orientalis*	Hymenoptera/Vespidae	Predator	Minor
7.	Praying Mantis	*Heirodula westwoodi*	Mantoidea/Mantoidae	Predator	Minor