International Journal of Advanced Research in Biological Sciences
ISSN: 2348-8069
www.ijarbs.com
DOI: 10.22192/ijarbs Coden: IJARQG (USA) Volume 8, Issue 7 -2021

Research Article

DOI: http://dx.doi.org/10.22192/ijarbs.2021.08.07.017

Ichneumon wasp *Xanthopimpla pedator* - a pupal parasitoid of Muga silkworm *Antheraea assamensis*

Mahasankar Majumdar[1], Lopamudra Guha[2*], Vikram Kumar[3], Bitopan Das[2], Prabhat Borpuzari [4,2]

[1.] P4 Unit Mendipathar, Muga Eri Silkworm Seed Organization, North Garo Hills, Meghalaya, India
[2.] Muga Eri Silkworm Seed Organization, Reshomnagar, Khanapara, Guwahati, Assam, India
[3.] P3 Unit Rompara, Muga Eri Silkworm Seed Organization, Resubelpara, Meghalaya, India
[4.] P4 Unit Tura, Muga Eri Silkworm Seed Organization, West Garo Hills, Meghalaya, India

*Corresponding author: Lopamudra Guha PhD
Muga Eri Silkworm Seed Organization, Reshomnagar, Khanapara, Guwahati, Assam 781022 India
E-mail: *lopasumi@gmail.com*

Abstract

Muga silkworm, *Antheraea assamensis* is a multivoltine mono race that is geographically endemic in Assam and parts of Meghalaya, and the rearing is conducted outdoor on Som (*Persea bombycina*) and Soalu (*Litsaea polyantha*) plants. Muga rearers' faces crop loss due to insect pests due to outdoor rearing. A preliminary study had revealed insect pests belonging to the family Tachinidae, Vespidae, Ichneumonidae, Braconidae, Formicidae, Pentatomidae and Mantidae attack muga silkworm during rearing. The economic damage due to insect pests is alarmingly high in the pre-seed and seed crops compared to the commercial crops. The major insect pests that attack muga silkworm are *Exorista sorbillans*, (uzifly), *Apanteles glomeratus* (brachonid fly) and ants. During the winter season (November to February) 4th and 5th instars muga larvae are mainly inflicted by uzifly and 20-30 % crop loss being reported during cocoon harvest in March-April. Uzifly, a dipteran endo-parasitoid that damages pre-seed (Jarua) and seed crop (Chotua) thus adversely affecting seed production and availability for Jethua (April-May) commercial crop. In summer *Apanteles glomeratus* (brachonid fly), ants attack early instars and *Vespa orientalis* (wasp) inflict damage to late instars during April to September. Application of chemical control is lethal to the silkworm itself hence for controlling the insect pests is not advocated in muga rearing. In the present study, the incidences of a pupal parasitoid Ichneumon wasp (*Xanthopimpla pedator)* on muga silkworm, *Antheraea assamensis H*. is being first time reported from different muga growing locations of West Garo Hills Meghalaya during different muga summer crops.

Keywords: *Antheraea assamensis*, Ichnemon wasp, seasonal incidence, insect pests, integrated pest management.

Introduction

Muga silkworm, *Antheraea assamensis* H. is a holometabolous multivoltine, oligophagous lepidopteran insect. In poikilothermic insects, abiotic factors such as temperature, humidity, rainfall, light, etc. highly influence growth and development (Back, 1980). Outdoor rearing of muga silkworm exposes silkworm to the various fluctuating environment throughout the year, which often leads to an outbreak of diseases and pest attacks in rearing affecting the productivity (Srilaxmi, K. and Paul, R. 2010). The predators of muga silkworms are natural enemies in abundance in the rearing field and cause crop loss up

to 20-25% (Singh et al.1992). Muga primarily feeds on leaves of Som, *Persea bombycina* and Soalu, *Litsea polyantha* and there are six crop cycles throughout the year namely Jarua (Dec-Jan), Chotua (Feb-Mar), Jethua (Apr-May), Aherua (June-July) Bhodia (Aug-Sep) and Kotia (Oct-Nov) (Chakravorty, 2004). Earlier several authors have reported that insect pest infestation of a particular crop of muga differs based on meteorological and geographical conditions (Chaudhury, 1981; Thangavelu et al., 1988; Singh & Das, 1996). The insect pest complex of the muga ecosystem has been studied extensively but the endoparasitoid reported to date is *Exorista sorbillans* which causes serious damage (15 to 20 %) during Jarua (Dec-Jan) and Chotua (Feb- Mar) crop (Subharani & Jayaprakash, 2015).

During Aherua (pre-seed) and Bhodia (seed) crop in summer season abiotic factors like temperature, humidity, rainfall and disease outbreak like flacherie and cytoplasmic polyhedrosis (CPV) causes severe loss of worms during rearing. Due to extreme fluctuation of weather, heavy rainfall/hailstorms in the early stage of rearing and incidence of diseases and predators in the late stage drastically reduces the percentage of effective rearing rate (ERR). These two crops (Aherua and Bhodia) are very difficult for the multiplication of muga seeds that is essential for Kotia commercial crop. The two commercial crops, Jethua and Kotia collectively contribute to the raw silk production and any setback in seed multiplication drastically reduces the production of raw silk. Hence, the pre-seed crop of Aherua and seed crop Bhodia is crucial for ensuring a good harvest during Kotia commercial crop.

During summer no pupal parasitoid is reported in muga. Ichneumon wasp, *Xanthopimpla pedator* was first observed from a farmer field in the Jengjal area of West Garo Hills District in 2018. In the Ichneumonidae family, *Xanthopimpla* is the genus which includes the highest pupal parasitoids (Babendreier 291). It has been found that *Xanthopimpla* has a sexual preference for male cocoons in parasitism for tasar silkworms (Velide & Bhagavanulu 140). *X. pedator* is a major parasite in Tasar silkworm but has never been reported in muga silkworm, to ensure that the attack is not accidental, the present study was carried out during the year 2018 to 2020 in Jengjal (25.52175°N, and 90.21905° E), Okkapara (25.4963° N, 90.0903° E) and Garobandha (25.5859° N, 90.0233° E) West Garo Hills District, Meghalaya to study the effect of the parasite on *Antheraea assamensis* during seed crop rearing cycles.

Materials and Methods

The study was carried out in the rearing fields of adopted seed rearers of muga in Jengjal, Okkapara and Garobandha of West Garo Hills District, Meghalaya during the year 2018 to 2020. The seed crops reared from June to August were considered for the present study. Abiotic factors like temperature, relative humidity and rainfall corresponding to Aherua and Bhodia crops were recorded to study the outbreak or infestation of ichneumon wasp. The predisposing factor is cocoons have been kept outside for spinning in the farmers' field.

Results and Discussion

Three years of pooled data recorded on the insect pest *Xanthopimpla* infesting muga silkworm about crop and place wise incidences of the pest with temperature, relative humidity and rainfall were collected and presented in Table 1 and 2. In the present study, the Ichneumon wasps were observed in the month of June-July and the population persisted up to September then reduced from October.

Table .1- Incidences of *Xanthopimpla pedator* in muga silkworm, *Antheraea assamensis* H. during different seasons at different rearing sites (in percentage)

Location	Insect	Mortality %					
		June-July (Aherua Crop)			Aug.-Sept. (Bhodia Crop)		
		2018	2019	2020	2018	2019	2020
Jengjal	Ichneumon wasp	3.57	3.78	4.24	4.78	4.42	4.46
Okkapara	Ichneumon wasp	3.68	3.23	4.26	3.79	3.97	4.34
Garobandha	Ichneumon wasp	3.19	4.54	4.35	3.67	3.47	4.88

Table . 2- Meteorological conditions in different locations during the occurrence and incidences of Ichneumon wasp, *Antheraea assamensis* H.

Location	Parameters	June-July			Aug.-Sept.		
		2018	**2019**	**2020**	**2018**	**2019**	**2020**
Jengjal	Max. Temp. (^{0}C)	30.3	31.2	30.1	30.8	31.4	30.5
	Mini.Temp. (^{0}C)	23.8	22.4	23.7	24.0	23.5	22.8
	Max. RH (%)	100	100	100	100	100	100
	Mini. RH (%)	76	82	85	78	80	84
	Rainfall (mm)	388.5	338	402	250	268	305
Okkapara	Max. Temp. (^{0}C)	30.5	31.4	29.9	30.9	30.4	30.3
	Mini.Temp. (^{0}C)	23.6	22.7	23.6	23.8	22.6	23.0
	Max. RH (%)	100	100	100	100	100	100
	Mini. RH (%)	78	83	84	80	79	82
	Rainfall (mm)	383	340	396	252	266	306
Garobandha	Max. Temp. (^{0}C)	30.6	31.6	30.3	30.4	31.5	30.2
	Mini.Temp. (^{0}C)	23.5	22.8	23.8	24.1	22.4	23.1
	Max. RH (%)	100	100	100	100	100	100
	Mini. RH (%)	79	80	84	81	80	83
	Rainfall (mm)	389	286	398	253	262	302

Figure. 1- Farmer's field in Jengjal area Figure 2 & 3- Sorting of cocoons after harvesting

Figure. 4- Emergence of Ichneumon wasp from muga cocoon

Figure. 5- Ichneumon wasp resting on muga cocoon

During June- July heavy rainfall with fluctuating temperature and humidity was recorded but precipitation decreased from August to September in the West Garo Hills region. This season is difficult for muga rearers due to predators and pest loss is maximum. The ichneumonid wasp is evolutionary a pupal parasitoid that is found majorly in the forest ecosystem. Ichneumonids have moved out of the forest due to deforestation, agricultural practices in adjoining areas of forest and found to morphologically evolve in disturbed forest ecosystems (NG & Idris, 2015). The present area/sites of study are adjoined by Nokrek National Park which is a biodiversity hotspot in West Garo Hills, Meghalaya. The ecological disturbances and shifting agricultural practices might be one of the potential reasons for *Xanthopimpla pedator* to infest muga cocoons.

Price (1970) reported that the ichneumonid, *Pleolophus indistinctus* (Hymenoptera: Ichneumonidae) would oviposit in a sawfly cocoon depending on the cocoon size and ability of the insect to penetrate the cocoon shell to elicit their oviposition response. Based on the observations of Price it is inferred that size of cocoon matters in the parasitic behaviour of ichneumon flies and as female cocoons are bigger in size and shell thickness is more hence spinning larvae of females were normally not preferred for oviposition by *X. pedator* and this may be one of the contributing factors for male-specific parasitic behaviour (Bhatia & Yousuf). In this present study, the male cocoons of muga have been found infested with *Xanthopimpla* although the study is a preliminary one it can be concluded that the thin shell of male cocoon facilitates the emergence of adult ichneumon wasp and thus parasitic behaviour of *X. pedator* towards male cocoons could be explained. However, more research on life cycle studies of *Xanthopimpla* infestation in muga silkworms is needed.

Xanthopimpla pedator is found to be a minor pest of muga but the infestation of this pupal parasitoid during summer pre-seed and the seed crop is definitely a concern for muga seed sector as it directly affects the seed multiplication chain and output of raw silk during Kotia commercial crop.

The use of chemical control of insect pest is not at all feasible for management as its usage impact the host insect (Singh & Saratchandra, 2008). Therefore during rearing of muga silkworm integrated pest management strategies needs to be implemented for minimizing the crop loss.

References

Babendreier, D. 2000. Life History of *Aptesis nigrocincta* (Hymenoptera: Ichneumonidae) a cocoon Parasitoid of the Apple Sawfly, *Hoplocampa testudina* (Hymenoptera: Tenthredinidae)," Bulletin of Entomological Research. 90(4):291-297.

Beck, S. D. 1980. Insect Photoperiodism, Academic press, New York, II Edition.

Bhatia, N.K. and Yousuf M. 2013. Parasitic Behaviour of *Xanthopimpla pedator* Fabricius (Hymenoptera: Ichneumonidae) on Tropical Tasar Silkworm, *Antheraea mylitta* Drury (Lepidoptera: Saturniidae) Reared on Seven Forestry Host Plants in Uttarakhand, India. Int. J. Indust. Entomol. 27(2) 243-264.

Chakrabaty, R. 2004. Diversity of muga and eri sericulture and its prospects I Himalayan states. Proceedings of thye national workshop on potential and strategies for sustainable development of vanya silks in the Himalayan states.Nov. 8-9: 9-16 .

Chaudhuri, S.N. 1981. Muga Silk Industry. Directorate of Sericulture and Weaving, Govt. of Assam, Guwahati, India. 3(13): 3.

Narayanaswamy, K. C. & Devaiah, M. C. 1998. Silkworm Uzi fly. Zen publishers. 1489: 232.

NG, Y.F. & Idris A.B. 2015. Diversity, Abundance and Morphological Variations of the *Xanthopimpla* (Ichneumonidae: Pimplinae) in Different Forest Habitats. Sains Malaysiana 44(1): 1–6.

Price PW. 1970. Trail odors, recognition of insects parasitic on cocoons. Science 170 (3957), 546-547.

Reddy, Eswara S.G. 2011. Integrated management of Uzifly, *Exorista bombycis* (Louis) (Dip: Tachinidae) in Muga Silkworm, *Antheraea assamensis* Helfer (Lepi. Saturniidae) under outdoor rearing conditions of Assam (India). Munis Entomology & zoology, 6 (20): 1012-1013.

Singh, P.K & Das, P.K. 1996. Some records of Pests and Predators of Primary Muga Food Plants and Muga Silk Worms (*Antheraea assama* Ww.) in Assam. Sericologia 36 (4): 763-765.

Singh, P.K and Das, P.K. and Negi, B.K. 1993. Studies on the incidence of uzi fly. Annual Report. Regional Muga Research Station, Boko, Assam, India, p 7.

Singh, R.N and Saratchandra, B. 2008. Push Pull Strategies for pest management in Sericulture. Indian Silk., 47 (7): 4-6.

Singh, R.N., Bajpayee C.M., Jayaswal J. and Thangavelun. 1992. Perspective of biological control in tasar culture. Indian silk. 31 (7): 48-50.

Singh, R.N., Bajpeyi, C.M., Tikader, A and Saratchandra, B. 2013. Muga Culture., Published by A.P.H. publishing Corporation. p. 422.

Singh, R.N., Thangavelu, K., Mishra., P.K. and Jayaswal,J.1992. Reproductive strategy and sex ratio of stink bug Psix striaticeps (Dodd) (Hymenoptera: Seclionidae) parasitoid in tasar ecosystem. Ent Germany 6:151-155.

Srilaxmi, K. and Paul, R. 2010. Diversity of Insect pest of pigeonpea (*Cajanus cajan* L. Mill Sp.) and their succession in relation to crop phenology in Gulbarga, Karnataka. The Ecosan 4 (4):273-276. 11. Thangavelu, K., Chakraborty, A.K., Bhagowati., ISA MD. 1988. Hand Book of Muga Culture. Central Silk Board, Bangalore, India, 4-6.

Subharani S. and Jayaprakash, P. 2015. Biodiversity of Insect Pests Complex in Muga Ecosystem in Narayanpur, Assam, Int.J.Curr.Microbiol. App.Sci 4(12): 209-214.

Velide, L. and Bhagavanulu, M.V.K. 2012. Study on infestation of *Xanthopimpla pedator* on the cocoons of tropical tasar silkworm *Anthereae mylitta* drury. International Journal of Plant Animal Environmental Sciences. 2(3):139-142.

Access this Article in Online

Website: www.ijarbs.com

Subject: Entomology

Quick Response Code

DOI:10.22192/ijarbs.2021.08.07.017

How to cite this article:

Mahasankar Majumdar, Lopamudra Guha, Vikram Kumar, Bitopan Das, Prabhat Borpuzari. (2021). Ichneumon wasp *Xanthopimpla pedator* - a pupal parasitoid of Muga silkworm *Antheraea assamensis*. Int. J. Adv. Res. Biol. Sci. 8(7): 152-156.

DOI: http://dx.doi.org/10.22192/ijarbs.2021.08.07.017