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Wild Sericigenous Insects (Lepidoptera: Saturniidae) of Assam, India

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ABSTRACT

A survey was conducted to document the wild sericigenous insects (wild silk moths) and their diversity in certain districts of Assam, India. An opportunistic periodic survey was conducted during the year 2015 – 2019, to document the wild silk moths and their host plants. The study revealed the presence of about 11 species, belonging to 6 genera, namely *Samia*, *Antheraea*, *Actias*, *Attacus*, *Cricula,* and *Loepa* and also a variety of host plants. During day time, cocoons of wild silk moths were also collected from the forest area of Assam. The life cycle of few species has been studied to characterise the morphological characters and other growth parameters. The study also aims to highlight the importance of these less dominated wild silk moth species and the possible causes of the declining population with a view to conserve this for socio economic upliftment of the people.

Key words: *Assam, Diversity, Saturniidae, W ild silk moths.*

Introduction

The Saturniids are the largest family of Bombycoidea *sensu stricto*, containing about 3719 species (BOLDSYSTEMS) in 162 genera and nine sub families according to the classification of Lemaire and Minet (1998). The saturniids are "charismatic" insects which include some of the largest and most spectacular species of Lepidoptera, which ranges from univoltine to multivoltine depending upon the climatic conditions; and are distributed in both temperate and tropical region (Regier *et al.*, 2008). The silk moths of Saturniidae family exhibit a great range of variation in life history from egg to adult with characteristically different physiological conditions, morphological characters and feeding behaviour. Saturniids also occur in mountainous area, and high percentage (15-20%) of endemics occurs in arid and semi-arid regions (Lemaire and Minet, 1998). The genus Antheraea is the largest among all Saturniid genus', and is mainly used for silk production. Vanya silk includes the semi- domesticated species of sericigenous insects like *Antheraea assamensis* which produces the Golden Silk, Muga and the tropical and temperate tasar silk moths namely *Antheraea mylitta*, *Antheraea pernyi*, *Antheraea proylei*, *Antheraea roylei* which produce the Tasar silk. Vanya silk also includes the Fagaria silk which is produced by the world's largest moth *Attacus atlas*. The domesticated silk moth *Samia ricini* which produces the Ahimsa Silk, Eri also belongs to this family. The Indian sub – continent is rich in seribiodiversity with about more than 50 species of silk moths (Nassig *et al.*, 1996).

North eastern India is one of the major hotspots among the 25 hotspots of the world, with a rich floral and faunal diversity. About 3,624 species of insects has been recorded and a large number of in-

sects are hithertho unexplored from the region (Tripathi and Barik, 2003). North eastern India holds the distinction of producing all the major silks of the world namely Eri, Muga, Tasar and Mulberry.

Materials and Methods

Assam, being the gateway of North- east India, lies between 24º3′N and 27º58′N latitudes and 89º5′ E and 96º1′ E longitudes. Lying to the south of the eastern Himalayas, it has a total geographical area of 78,438 sq.kms. Assam shares its international borders with the kingdom of Bhutan and Bangladesh with a total length of 533.3km out of which Indo-Bangla being 267.5km and Indo-Bhutan being 265.8km. Assam is bounded on the north by Bhutan and Arunachal Pradesh, on the east by Nagaland and Manipur, on the south by Tripura, Mizoram and Bangladesh and on the west by West Bengal via the "Siliguri corridor" also known as "chicken's neck" which connects Assam to the rest of India. Considering the geographical constitution, North-east India is very rich in bio-diversity and falls under two biodiversity hotspot areas, the Eastern Himalaya and the Indo-Myanmar region. The state of Assam is a constituent unit of the Eastern Himalayan Biodiversity zone.

An extensive survey was carried out in certain districts of Assam from the year 2015- 2019 on the basis of available literature to collect wild silk moths and record their host plants (Table: 1). The survey was carried out predominantly during the autumn, summer and spring season as most wild silk moths tend to diapause during the winters. For the purpose, necessary data were collected from the State and Central sericulture departments, as well as from private rearers, local people by showing photographs of the moths, thus recording the absence/ presence of the same. Data were also collected using visual observation and opportunistic collection method (Sutherland, 1996). The adults of Lepidoptera (Saturniidae) were collected in the field manually with the help of sweep net and at night with the help of portable light traps having mercury vapour light source and some collections were also made by hanging a makeshift source of light (Philips UVA TL – D 18) on a white sheet or white washed wall (Intachat et.al.2001). The collected insects were preserved by using benzene. These were stretched, pinned, labelled, identified, stored in the wooden collection boxes.

Results

Eleven species of wild silk moths belonging to six genera and two tribes were collected during the study from the state of Assam. The tribe Saturniini comprises of the five genus and nine species *viz. Antheraea assamensis, Antheraea frithi, Antheraea mylitta, Antheraea helferi, Actias selene, Actias maenas, Cricula trifenestrata, Loepa katinka* and *Loepa sikkima* and the tribe Attacini comprises of two genus and two species *viz. Samia canningi* and *Attacus atlas* . Four species namely *Antheraea helferi, Actias maenas, Loepa katinka and Loepa sikkima* were collected only in their adult stage by light trapping so their host plants and larval descriptions could not be confirmed. The host plants recorded for all the species are available throughout the state, except for *Shorea robusta* (Sal) which is widely available in the lower parts of Assam. *Melastoma malabathricum* L. has been reported as a new host plant of *Antheraea frithi* Moore from Kamrup district. The wild silk moths, their distribution and host plants are given in the Table 1.

The life history of four sericigenous insects namely *Antheraea frithi, Samia canningi, Cricula trifenestrata* and *Attacus atlas* were studied to observe the different morphological parameters. These parameters are given in Table 2.

The eggs of *Antheraea frithi* are dirty white in colouration with two prominent brown bands encircling it. The species is found to be bivoltine with moths emerging from diapausing cocoons in the spring. Some larvae of *Antheraea frithi* have a pair of silver spots near the first and second abdominal segments. The eggs of *Samia canningi* are ivory white in colour. The larva at their late 4th instar stage produces a white powdery substance. The larvae of *Samia canningi* may be plain, spotted, or heavily spotted just like their domesticated counterparts *Samia ricini* with different colours like white spotted, plain green, etc. *Cricula trifenestrata* exhibits multivoltinism. The body of the larva has innumerable white hairs that arise from the tubercle. The eggs of *Attacus atlas* are dorsoventrally compressed and oval in shape. The moth of *Attacus atlas* is the largest in the world. The larva feeds voraciously and grows in size. The larva coats its body with a white powdery substance just like *Samia canningi.*


Samia canningi


Attacus atlas


Actias maenas (female)


Antheraea helferi (female)


Antheraea helferi (male)


Actias maenas (male)


Actias selene


Cricula trifenestrata (female)


Cricula trifenestrata (male)


Antheraea frithi (Female)


Antheraea frithi (Male)


Antheraea mylitta


Antheraea assamensis


Loepa katinka

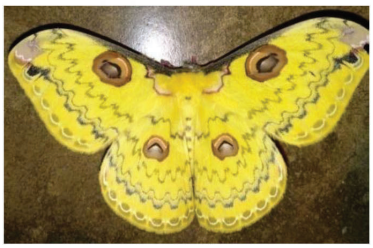
Loepa sikkima

Fig. 1. Wild sericigenous insects of Assam

Table 1. Collected wild silk moths, their distribution and recorded host plants during the study.

Sl. No.	Scientific Name	Distribution in Assam	Scientific name of Host Plant
1.	*Antheraea frithi*	Digboi	*Shorea robusta* Roth.
		Goalpara	*Melastoma malabathricum* L.
		Kamrup (Rural)	
2.	*Actias selene*	Digboi	*Azadirachta indica* A. Juss
3.	*Antheraea mylitta*	Kamrup (Rural)	*Ziziphus jujube* Lam.
		Tinsukia	*Tectona grandis* L.
		Goalpara	*Shorea robusta* Roth
4.	*Antheraea assamensis*	Brahmaputra Valley	*Persea bombycina* Kost.
			Litsea polyantha Juss
			Litsea salicifolia Roxb. ExWall
			Litsea cubeba (Lour.) Pers.
5.	*Samia canningi*	Tinsukia	*Ricinus communis* L.
		Jorhat	*Ailanthus excelsa* Roxb.
		Kamrup (Rural)	*Evodia fraxinifolia* Hook
		Dibrugarh	*Heteropanax fragrans* (Roxb.) Seem
		Golaghat	
6.	*Cricula trifenestrata*	Tinsukia	*Persea bombycina* Kost.
		Jorhat	*Mangifera indica* L.
		Kamrup (Rural)	*Litsea cubeba* Pers.
		Dibrugarh	*Psidium guajava*
		Chirang	
		Kokrajhar	
7.	*Attacus atlas*	Golaghat	*Ailanthus excelsa* Roxb.
		Kamrup (Rural)	*Citrus sp.*
8.	*Antheraea helferi*	Digboi	No host plants recorded
9.	*Actias maenas*	Kamrup (Rural)	No host plants recorded
		Silchar	
10.	*Loepa katinka*	Digboi	No host plants recorded
11.	*Loepa sikkima*	Digboi	No host plants recorded

Discussion

Wild silk moth diversity in Assam and other North-eastern states is quite high, the probable reason may lie in the fact that North eastern region of India falls under two major biodiversity hotspot regions. In the present study, eleven species of sericigenous insects have been found in Assam belonging to seven genera and two tribes. Kalita and Dutta (2014) and Kumar *et.al.,* (2016) reported the presence of only nine species of wild sericigenous insects in Assam which is not in accordance with the present findings. In the present investigation, four new species have been recorded for the first time from Assam namely *Actias maenas*, *Antheraea helferi*, *Loepa katinka* and *Loepa sikkima*. The possible reason for this may be attributed to the extensive survey work that has been carried out. Though it is quite encouraging to record a higher number of wild silk moths from the region, but emphasis must be laid on the fact that the distribution and abundance of these insects have drastically reduced. From Table 1, it is evident that most of the host plants recorded in the study are also good timber yielding plants, which mean that these plants are likely to be cut down for timber production thus, leading to deforestation and non availability of host plants for the insects. Another major reason for their scarcity may be due to threat from predators which include other insects as parasites which lay eggs during the larval stage and emerge during their pupal stage, thus destroying the cocoon.

Wild silk moths exhibit wide variation in life forms ranging from eggs to adult. *Cricula trifenestrata* was found to be the smallest moth while *Attacus atlas* was found to be the largest. Similar results have been reported by Kakati and Chutia (2009), Gogoi *et al.* (2014b), Shangpliang and Hajong (2015) and Lalmingliani (2015) from Nagaland, Arunachal Pradesh, Meghalaya and Mizoram respectively. The abundance of the wild silk moths was found to be the highest during the summer season which is in

Table 2. Morphological characters of selected wild silk moths from Assam.

Morphological Characters	*Antheraea frithi*	*Samia canningi*	*Cricula trifenestrata*	*Attacus atlas*
Egg Colour	Dirty white with two brown bands	Ivory white	Ivory white	Pale Brown/ dull white
Egg Size	2.8X 2.3 mm	1.6X1.2 mm	1.8X1.2 mm	3.04X2.5mm
Egg Shape	Oval	Oval	Oval	Oval dorsoventrally compressed
Early larval colour	Yellowish black	Yellowish black	Yellow to Yellowish Brown	Pinkish grey
Mature larvae weight	8.7 to 9.6 g	5.5 to 6.1 g	2.5 to 2.6g	27.8 to 30.3 g
Mature larvae body length	6.76 to 7.04 cm	6.9 to 7.2cm	5.6 to 6 cm	11.2 to 12.8 cm
Mature larval body colour	Dark green	Bluish white/ yellow/ Bluish green	Dark brown with black bands	Greenish with a white powdery deposition
Cocoon colour	Light golden	Brown	Bright golden with or without holes	Greyish Brown
Cocoon weight	3.39g	3.2g	2g	8g
Pupal Colour	Brownish black	Blackish brown	Brown	Brown
Pupal weight	2.5 – 4.5g	1.4- 2.3 g	2.03g	13g
Adult Male Moth Colour	Brownish Yellow	Dark Brown	Greyish brown	Reddish Brown
Adult Female Moth	Yellow Colour	Dark Brown	Dark brown to reddish Brown	Reddish Brown
Adult Male Moth Wing Expanse	12-13cm	115-126mm	56-78	19.1-25cm
Adult Female Moth Wing Expanse	13-15cm	14.1-15.5cm	7.5-8.1cm	21-27.5cm
Voltinism	Bivoltine	Bivoltine	Multivoltine	Bivoltine

accordance with the study of other authors. Three possible reasons may be attributed to the abundance of wild silk moths during the summer season. New tender leaves emerge with the advent of summer, which provides food for the newly hatched silkworm larvae. Increase in day length during summer increases their food intake and help them to growth faster. Increase in the temperature, rainfall and humidity in the environment facilitates their growth and development. Also most other wild silk moths were found to be diapausing in the winter, indicating their adaptability to the severe cold climatic condition in the region.

The diversified forest patterns like tropical evergreen and semi evergreen forests available in Assam may also be one of the reason for the diversity of wild silk moths in the region (Joshi *et.al.,* 2006). The wild silk moths are naturally adapted to distinct niches, thus helping them to manifest genetic diversity and natural variation in their wild conditions (Thangavelu, 1991). Wild silk moth population comprising diverse gene pool holds great potential utility for mankind. Genetically important trait such as reelability, voltinism and diapausing nature may be incorporated in further breeding programmes to improve the quality of the domesticated silk moths (Gogoi and Goswami, 1998). Also, the wild silk moths may be economically exploited for commercial purposes to obtain novel silk in future. This would not only help in economically uplifting the local communities, but also help in conserving our forests. Thus, emphasis should be given on both *ex-situ* and *in-situ* conservation of wild silk moths in well planned collaborative efforts by state and central government executives.

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Author contribution AS did the study, wrote the manuscripts and analyzed the result. KD

conceptualised, supervised the study and reviewed the whole experiments and the manuscript. All co-authors read and approved the manuscript for submission.

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Conflicts of interest. The authors declare that they have no conflicts of interest.

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