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Biology of *Antheraea frithi* Moore (Lepidoptera: Saturniidae) on Sal (*Shorea robusta*) in South Kamrup District of Assam

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Abstract: ***Antheraea frithi Moore is a wild temperate tassar silk moth found abundantly in the North Eastern region of India. They primarily feed on Oak (Lithocarpus dealbata), but some wild isolated populations of this species found in the South Kamrup region of Assam have been reported to feed on Sal (Shorea robusta) and Melastoma malabathricum. The present investigation has been designed with a view to study the biology of Antheraea frithi on Shorea robusta . Various evaluation descriptors and seasonal study have revealed the influence of season, host plants and rearing conditions on the viability and other growth parameters. Growth parameters like larval weight, cocoon weight, shell weight, etc. varied from season to season with Autumn season showing the highest productivity followed by Summer and Spring. A visible few cocoons also showed a diapausal activity during the winters. Differences in larval size were also observed in different larval stages in different seasons. Average fifth instar larvae had a length of 7.04 ± 0.04 cm and weight 9.634 ± 0.30 g in Autumn season followed by Summer and Spring.***

Keywords: Assam, assist, rearing performance, seasonal, sericulture industry, Temperate Tasar, wild silk

1. Introduction

India ranks second in the production of Tasar silk in the World preceded by the next door neighbour China. India also has the distinction of exclusively producing the tropical tasar silk which is obtained from the silk moth *Antheraea mylitta*. Most of India's production comes from the tropical tasar, augmented by Temperate tasar. Tropical tasar exists in Bihar, Orissa, Madhya Pradesh, Andhra Pradesh, West Bengal, and Maharashtra whereas Temperate tasar is abundant in North Eastern India. The wild temperate tasar, *Antheraea frithi* is one of the Oak tasars, as it feeds mainly on Oak (*Lithocarpus dealbata*) (Ibohal *et.al.,* 2006). However, its occurrence has also been recorded in the temperate forests of Assam (Choudhury, 1981) and has been found to be feeding on Sal (*Shorea robusta*) leaves, as the food plant (Hazarika and Bhuyan, 2003). A study on rearing performance of *Antheraea frithi* Moore on Sal under in situ outdoor and indoor captive conditions was carried out by Saikia *et. al.*,(2011). Chutia *et.al.,* (2014) studied the life history of *Antheraea frithi* Moore on *Terminalia arjuna* in North Eastern Region of India.

The present study was conducted in a small area of the South Kamrup (91º13'48" EL; 25º57'49" NL) region of Assam which has a large Sal forest cover. This belt of South Kamrup region is a natural home to quite a few species of wild silk moths. Among them, *Antheraea frithi* is the most abundantly occurring wild silk moth which feeds on the Sal plants and also a wildly occurring shrub *Melastoma malabathricum*. Since, these two host plants are naturally available in the region, possibility of the domestication/ semi domestication of this species may pave a new path for the commercial utilisation of this species for Temperate tasar silk production. Thus, the present investigation has been designed with a view to study the biology of *Antheraea frithi* on *Shorea robusta* to access the possible ways for its sustainable utilisation for domestication/ semi domestication.

2. Materials and Methods

Cocoons were collected from the wild manually and adult moths were collected by light traps at night using mercury vapour light source and hanging a makeshift source of light (125 watt mercury vapour lamp) on a white sheet or white washed wall. The cocoons were allowed to emerge in an insect bag. The emerged male and female moths were allowed to copulate inside the insect bag and lay eggs. The eggs were later collected and kept in egg boxes in which they were allowed to incubate at room temperature. After 7 days of incubation, the newly hatched larvae were transferred to sal twigs which were inserted in watered bottles. Fresh twigs were supplied twice a day and the room was cleaned and disinfected to prevent diseases. The rearing was conducted throughout the year to see the differences in various seasons. The year was divided into six seasons namely Jethua* (April-May), Aherua* (June- July), Bhodia* (Aug-Sep), Kotia* (Oct- Nov), Jarua* (Dec- Jan) and Chatua* (Feb- Mar). The mean value and standard deviation were calculated from the obtained observations.
*refers to the Assamese vernacular seasons, prevalent for Muga (*Antheraea assamensis*) rearing.

3. Observations and Discussions

Oviposition (Plate - 1)
Antheraea frithi Moore had an average oviposition of 156-192.
Eggs (Plate – 2)
The eggs of *A. Frithi* are round and dorso-ventrally flattened. The colour of the eggs varies from creamish yellow to light brown with two distinct brownish band

encircling the eggs. The weight of the eggs varies from 0.006-0.009. The embryonic period is about 6-9 days.

First instar larvae (Plate – 3)
Head is smooth and black to brown in colour. The colour of the larvae after hatching is brownish which later changes to yellow before the moulting. Two black markings are seen, one beneath the head and other above the anal aperture. The colour of the tubercles is white. The larvae have a maximum size of 1.92 cm in season II followed by season III, Season I and Season IV. The weight of the larvae varies from 0.0168 – 0.0172 in different seasons. The first instar larval duration varies from 7-10 days depending on different seasons.

Second instar larvae
The larvae after moulting retain its yellow colour for some time and then gradually changes to pale green. The tubercles are yellowish bearing dull white setae. Head is brownish and turns black later. The larvae range from 2.61 cm to 2.72 cm in different seasons with season II having the highest length. Similarly, the weight also varies from 0.32g to 0.36g in different seasons with season II having the highest weight. The second instar larval duration is 5-8 days.

Third instar larvae
The larvae are light green in colour. Head is mostly brownish black in colour. Tubercles are mostly green in colour with black tips. The anal tubercle also has a black tip. The setae are mostly dull white with a few black setae. The larvae measure 3.62cm – 3.86cm in length in different seasons with season II showing the highest. Similarly, the weight varies from 0.92g – 0.97 g. The larval duration is about7-9 days.

Fourth instar larvae (Plate – 4)
The larvae are green in colour. Tubercles are green in colour with white setae. At this stage, most of the larvae bears 2-8 mirror like beads at each segment, except a few which does not possess this mirror like beads. Head is mostly black in colour. At the later stage of the larvae, the spiracles and the lateral line are almost distinct. The larvae measures 4.77cm to 4.86 cm in length. The weight of the larvae varies from 4.72g to 4.77g. In all the stages, season II has the highest measure in both length and weight. The larval duration continues for 7-9 days depending on the seasons.

Fifth instar larvae (Plate – 5)
The larvae are almost similar in colour and other characteristics with the 4th instar larvae except for its size and weight. The larvae measures 6.76cm – 7.04cm in length. The weight varies from 8.7g to 9.6 g in different seasons. The spiracles and lateral line is distinct at this stage. The mirror like beads is also distinctly visible. The fifth instar larval duration is 6-9 days in different seasons.

Pupa and Cocoon
The cocoon is light golden in colour with a peduncle. The pupa is metallic red. The female cocoons are mostly larger in size and greater in weight than the male cocoons. Most of the cocoons enter diapause at Season V except a few visible cocoons which remain upto season VI to get into diapause. This is a significant finding as the same population shows two different diapausal behaviour at the same time.
Adult (Plate – 8)
The adult moth is yellow in colour. The male and the female moths vary distinguishably. The forewing of the male moth is pointed at the tips compared to the female moths which have blunt tips. The male moths have a pinkish tinge in the wings which is not visible in the female moths. The eyespots are transparent in the middle surrounded by pinkish boundaries.

Table 1: Productivity parameters and cocoon characteristics of A.frithi M. (Female moth life span in days, all weight in grams)

Sl. No.	Parameters	Season-I	Season-II	Season-III	Season-IV	Season-V
1.	Female Moth Life span	8.6±0.2	8.3±0.1	8.7±0.2	9±0.1	7.9±0.07
2.	Fecundity(Nos.)	168.2	192.6	173.5	198.6	-
3.	Hatching(%)	75.5	96.6	92.42	93.65	66.2
4.	Cocoon Colour	Light Golden	Light Golden	Light Golden	Light Golden	Light Golden
5.	Pupal Weight	2.45	2.47	2.87	2.76	-
6.	Coccoon Weight	3.06	3.35	3.70	3.26	-
7.	Moth Colour	Yellow	Yellow	Yellow	Yellow	-

Table 2: Morphometric parameters in different seasons (all length in cms, all weight in grams)

Sl.No.	Parameters	Season-I	Season-II	Season-III	Season-IV	Season-V
1.	1st instar larval length	1.82±0.05	1.98±0.01	1.89±0.03	1.76±0.02	-
2.	1st instar larval weight	0.0168±0.004	0.0172±0.003	0.0171±0.02	0.0168±0.023	-
3.	2nd instar larval length	2.61±0.16	2.72±0.14	2.69±0.11	2.61±0.11	-
4.	2nd instar larval weight	0.32±0.083	0.36±0.036	0.34±0.12	0.33±0.11	-
5.	3rd instar larval length	3.624±0.19	3.86±0.14	3.72±0.15	3.70±0.12	-
6.	3rd instar larval weight	0.92±0.14	0.97±0.2	0.95±0.16	0.093±0.3	-
7.	4th instar larval length	4.77±0.12	4.86±0.16	4.82±0.13	4.80±0.11	-
8.	4th instar larval weight	4.73±0.11	4.77±0.12	4.75±0.1	4.72±0.2	-
9.	5th instar larval length	6.76±0.11	7.04±0.04	7.01±0.02	6.81±0.02	-
10.	5th instar larval weight	9.24±0.16	9.634±0.30	8.8±0.08	8.7±0.03	-

4. Conclusion

From the present study it has been found that *Antheraea frithi* Moore can be a potential choice for the production of temperate tasar silk with various attributes. As compared to other silkworms, it is disease free, multivoltine (except for a few which underwent diapause) and polyphagous. Thus, *A.frithi* M can be sustainably exploited with other silkworm species commercially. A careful and sustainable utilization plan may be devised to commercially exploit the species within its natural habitat. This in turn will benefit the local tribal community of South Kamrup region to commercially rear the species for their economic upliftment. Community based conservation measures if started may also help in maintaining the wild stock of the population. Thus, such an endeavour may turn out to establish a new species of silkworm *Antheraea frithi* Moore to assist the production of tasar silk in the country, which otherwise is mostly contributed by tropical tasar, *Antheraea mylitta*, thereby maintaining a flourishing sericulture industry.

5. Acknowledgements

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Photographic Plate

Plate 1: Oviposition

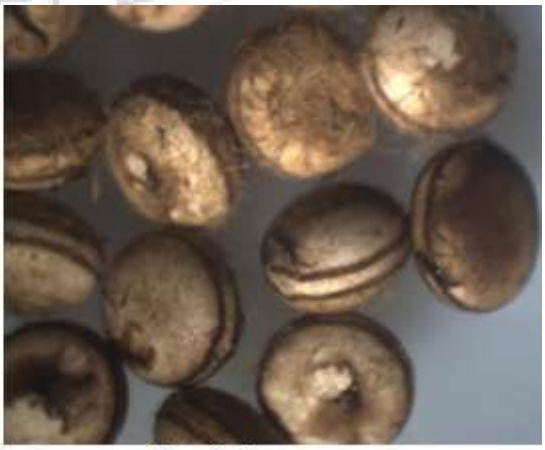

Plate 2: Eggs

Plate 3: 1st instar larva

Plate 4: 4th instar larva

Plate 5: 5th instar larvae

Plate 6: Female moth

Plate 7: Male moth