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A Study on the Rearing Performance of the Muga Silkworm, *Antheraea assamensis*, Helfer on the Basis of The Different Host Plant.

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Abstract

The Muga Silkworm, *Antheraea assamensis* is a polyphagous insect having many host plants. The quality and quantity of the pupation and silk content are greatly determined by the avaibility of the plants, the nutritional level of the leaves along with the growing conditions of the particular area. The study was conducted by feeding the Silkworm with its two primary host plants, *Persea bombycina* (Som) and *Litsea monopetala* (Soalu) to draw a quantitative estimate on the rearing performance of the two host plants. It was seen that the male and female larval weight was more in case of Soalu plant which can be attributed to the greater moisture content of the plant. The male and female shell weight was greater in case Som plant. In case of cocoon weight, Som fed males had heavier cocoons whereas Soalu fed females had heavier cocoon. The ERR was more for the silkworms fed with Som plant.

Keywords: Silkworm, Atheraea assamensis, Som, Soalu, Rearing Performance

Introduction:

North-eastern region of India is rich in flora and fauna including the various sericigenous insects along with their host plants. The climatic condition of the north eastern region is considered to be most suitable for the growth and development of various sericigenous insects. Sericulture has been a traditional occupation of this region. Both Eri culture and Muga culture have been adopted by the rural people of Northeastern region from time immemorial. Muga silk is the monopoly of this region, produced by *Antheraea assamensis* (Helfer). It is considered the costliest silk (Singha et al., 2015). Its economic value makes it a very important insect of this area.

Muga Silkworm is unique and native to the North Eastern India, particularly in the Assam province (Devi et al., 2021). *Antheraea assamensis* (Helfer) belongs to order Lepidoptera and family Saturniidae. The silkworm is multivoltine in nature. In a year 5 to 6 rearing cycles of the silkworm can be done. Muga silkworms are primarily wild. The Muga silkworm is single species with very little genetic variation among the population.

In Assam rearing of Muga silkworm for commercial production of silk is practiced mostly along the Brahmaputra valley. On the other hand, pre-seed crops are mostly reared in lower Assam and in the foot hills of Meghalaya bordering Assam. From there the traditional Muga rearers from upper Assam collect the seed

cocoons during summer and winter for multiplication in the plains for raising seed cocoon for preparation of commercial Muga seed (Borpuzari et al., 2020).
The silk that is produced by this insect is called Golden Silk and is highly lustrous and is golden yellow or creamy white in color. The filament length of the cocoon is 500–800 m (Jolly et al., 1975). The silk is known for its extraordinary durability and natural yellowish-golden gleaming hue making it the most expensive of all silks produced on the planet (Central Silk Board, 2020). The Muga silk is stain free and requires no use of dyes.

Taxonomy:
Phylum : Arthropod
Class : Insecta
Order : Lepidoptera
Family : Saturniidae
Genus : *Antheraea*
Species : *assamensis*

Life History:

The Muga silkworm, *Antheraea assamensis* takes four phases to finish their life cycle. The phases include egg, larva, pupa and adult (Mandal, 2017). The length of the life cycle varies according to the season. In the winter, they live for 79-85 days, while in the post monsoon; they live for 53-63 days. While easting on Sualo trees, they finish their life cycle in 65.34 days, but when eating on Som, they finish it in 63.86 days (Baruah, 2021).
The larval stage of the silkworm comprises of four moults which gives rise to five instar stages. Generally muga silkworm completes the five larval instars on a specific outdoor host plant from which they are collected and then placed in dry leaves of Mango, Jackfruit, Som and Sualo etc. (Sarmah et al., 2010). They weave a silk thread cocoon around their bodies, which takes 3 days in the summer and 7 days in the winter to complete. The larvae inside the cocoon go through an intermediate stage before becoming pupas. It's known as the pre-pupal stage. The colour of the pupa is copper brown. Food is not necessary at this stage because the body is already fatty. In each season, the cocoon size and weight, shell thickness, pupal weight, and thread length vary. The pupal stage lasts around 14 days in the summer and 60 days in the winter, depending on the temperature and relative humidity (Kumar and Rajkhowa, 2011) .
The pupa changes into a moth on its own inside the cocoon. The male and female moths may be distinguished by their colour, wings, abdomen size, and antenna (Baruah, 2021). Male moths like to mate with female moths in the evening, and they prefer a dark environment in this period. The female moth lays egg on the khorika after 8 to 10 hours after mating (Sarmah et al., 2010). The female moth can lay eggs for up to six days, although the first three or four days are ideal for rearing.

Host Plants:

Muga producing silkworm, *Antheraea assamensis* (Helfer) is a polyphagous insect, which means it can eat a wide variety of plants (Nath et al., 2008). Food plants of the Muga silkworm were divided into two groups based on feeding behaviour and food preferences, primary and secondary. Silkworm rearers regard Som (*Persea bombycina)* and Soalu (*Litsea monopetala*) to be the principal and most recommended feeding plants for commercial growing (Neog et al., 2016). Despite the fact that 37 species from eight families: Magnoliaceae, Lauraceae, Celastraceae, Verbenaceae, Apocynaceae, Symplocaceae, Rutaceae, and Rhamnaceae – had previously been described, only P. bombycina and L. monopetala have been economically exploited and are used in silkworm rearing (Devi et al., 2021).
In addition to the primary host plants, more than 22 species have been identified as secondary host plants for muga silkworm rearing. These plants can be found in woods, wastelands, and certain village planting areas (Tikader et al., 2013). If the preferred food plants are unavailable, the silkworm has been reported to eat *Magnolia pterocarpa*, *Michelia champaca*, *Zizyphus jujuba*, *Gmelia arborea*, *Celastrus monospermus*, *Zanthozylum* ((Neog, 2013).
The availability of food and plants and the nutritional level of their leaves, as well as the ambient conditions throughout the rearing phase, determine the quantity and quality of pupation or silk content. Foliar elements such as moisture, nitrogen, protein, minerals, fat, crude fibres, sugar and starch content determine the importance of these food plants and their choice for muga silkworm rearing (Borpuzari, 2020).

Because host plants are so vital for effective cocoon production, it's critical to assess the best host plant among the primary and secondary host plants in order to propagate the best one for commercial uses. The purpose of this study is to compare Muga silkworm rearing performance on two different host plants.

Figure 1: ***Persea bombycina***

Figure 2: Leaves of ***Persea bombycine***

Figure 3: ***Litsea monopetala***

Figure 4: Leaves of ***Litsea monopetala***

Methods and Methodologies: The study presented here has been carried out during March-May, 2021 (spring) at Resham Nagar, Khanapara, Guwahati, Assam, India (latitude 26.122317′N and longitude 91.816333′E). The aim was to study the performances of the muga silkworm on the two primary host plants: Som and Soalu with reference to economic traits.

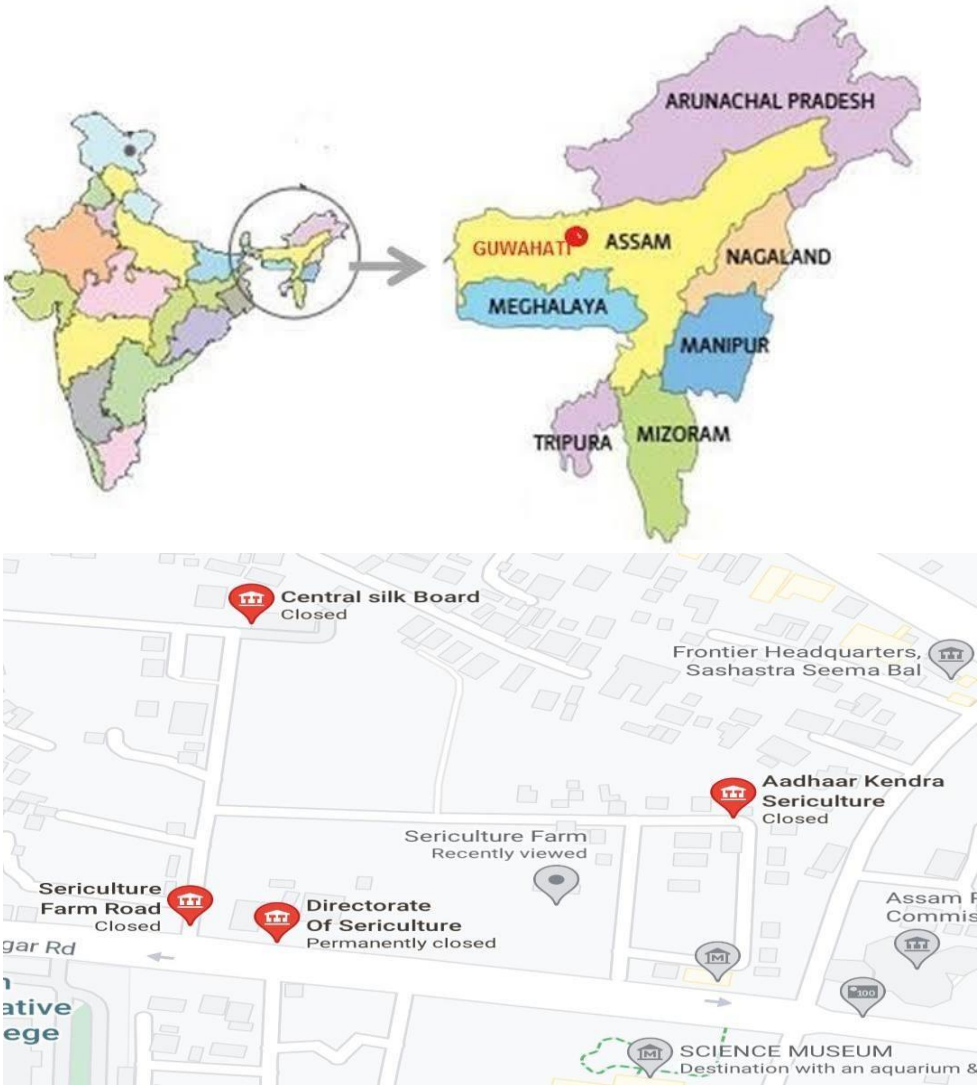

Figure 5: Figure showing the location of Resham Nagar Khanapara

The average temperature during the period was recorded as 25.03° C and the average rainfall was recorded as 190mm. The lowest humidity was recorded in the month of March (57%) and the highest was seen in the month of May (83%). The average humidity was 71%.
All pictures have been clicked and stored using a phone camera of 64 megapixel.
The details of the methodology that were adopted during the study has been given below.
Experimental food plant species used in the study:
1. Som (*Persea bombycina* Kost)
2. Sualo (*Litsea monopetala* Roxb)

Species used in the experiment**:** *Antheraea assamensis* Helfer
Experiment-I (E1): Rearing of the silkworm larvae was done with Som plant throughout the larval duration.
Experiment-II (E2): Rearing of the silkworm larva is done with Sualo plant throughout the larval duration.
The cocoons were collected once the raising and mounting process was completed, and the following data were recorded: larval time, larval weight, effective rate of rearing (ERR), single cocoon weight, single shell weight, and cocoon yield for both male and female larva.
Following standard formula is used to calculate various ERR

$$ERR = \frac{\text{Total number of cocoon harvested}}{\text{Total number of larvae brushed or counted after 3}^{rd}\text{ moult}} \times 100$$

Result and Discussion:

The results obtained from the study have been represented in the Table 1 given below. The tables provide information on the rearing performance as well as other economic parameters of the Muga silkworm reared on the two primary host plants. From the study we can know that the E.R.R was highest in the larva fed with Som which was 67.58% whereas in the case of Sualo it was 61.63%.
Mature larval weight of both male and female was recorded highest in the Sualo fed larva (11.39g and 14.51g respectively). Larval duration in case of Som was 26 days while for Sualo it was 28 days.
Male cocoon were heavier in Som fed larva (5.72g) and in case of female cocoon weight it was heavier in Sualo fed larva (6.78g). Male and female shell weight both was more in case of Som which was 0.53g and 0.49g respectively.
Rahamathulla, et al.,(2006) emphasised the relevance of dietary moisture content, stating that phytophagous insects require a lot of water to develop normally. They also found a link between host plant moisture and food usage, moulting ratio, and larvae weight. According to them, the moisture content of the leaf and larva has a positive relationship with many factors such as growth rate, larval weight, single cocoon weight, and single shell weight. Aside from that, certain leaves have more soluble sugar and soluble protein than others.
According to Kishi (1954), the increased carbohydrate content of som leaves is beneficial to the silkworm larvae's good growth. According to Qader (1987), roughly 70% of the silk protein generated by the silkworm is obtained directly from the protein of the leaves.

Sample	Larval duration (days)	Male larval weight(g)	Female larval weight(g)	Male Cocoon weight(g)	Female Cocoon weight(g)	Male shell weight(g)	Female shell weight(g)	E.R.R
Som(E1)	26	8.68	10.45	5.72	6.43	0.53	0.49	67.58
Sualo(E2)	28	11.39	14.51	5.13	6.78	0.51	0.48	61.63

Table 1: Table denotes Larval duration, Male and female larval weight, Female and male Cocoon weight,male and female shell weight and E.R.R of larva fed with Som and Sualo leaves.

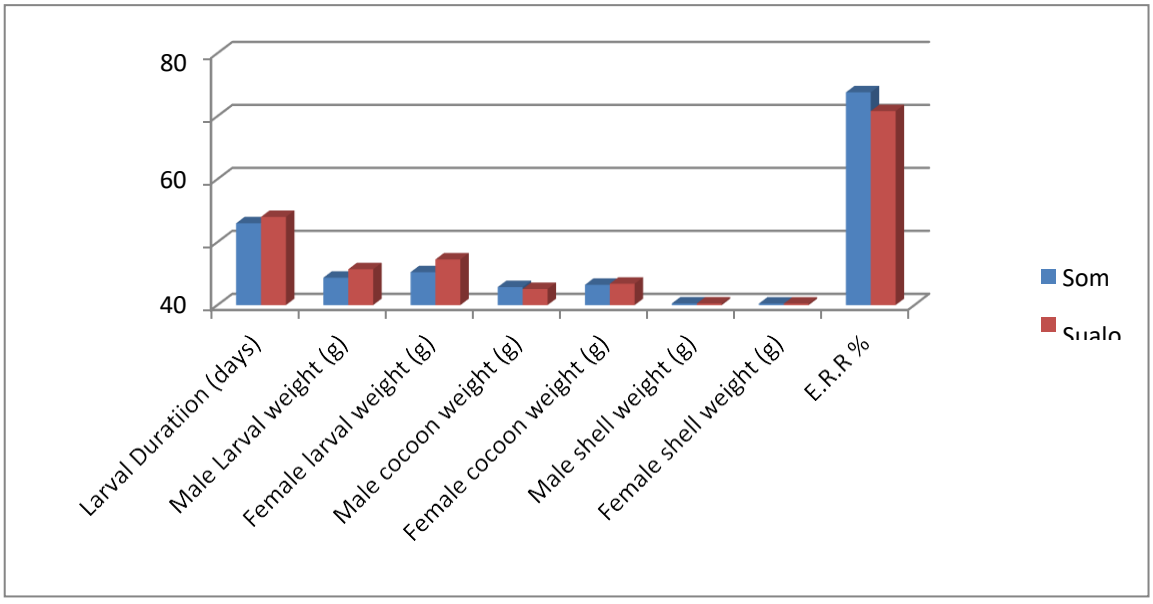

Fig 6: Graph denotes Larval duration, Male and female larval weight, Female and male Cocoon weight,male and female shell weight and E.R.R of larva fed with Som and Sualo leaves.

Conclusion:

From the study it is clear that the larva fed with Som plants gave better result in almost every aspect like weight of larva, cocoon, shell weight and E.R.R compared to the larva that was fed with Sualo leaves. The reason behind this difference in yield can be accounted to the difference is quality of the plant leaves in all ages. The nutrional values and moisture content of the two plant species are different hence the economical

output from the larva is affected by it and shows different results.
Som leaves excelled in all the maturity levels. This superiority in nutritious quality of the Som leaves when compared to the Sualo leaves is correlated to the enhanced commercial characters of the silkworms fed with Som.
Hence we can say the leaves of Som plant have nutritional values higher than that of the leaves of Sualo plant which enhances the commercial characters of the silkworm.

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Glimpses of the Study:

Figure 7: Female Muga Moth laying eggs on Khorika

Figure 8: Female Muga Moth

Figure 9: Sorting of the seed cocoon

Figure 10: Protection from Predators and Prey

Figure 11: Muga 5th Instar Larva

Figure 12: Larva collection on Chaloni

Figure 13: Punia or Khokha