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Muga Silk Production and Engagement of Family in Different Category of Silk Production: A Study in Lakhimpur District of Assam, India During 2013-23

Dharitri Gogoi[1], Dr. Khirod Kumar Phukan[2]

[1]Guest Faculty, Department of Economics, Madhabdev University, Lakhimpur, Assam, India.
[2]Associate Professor, Department of Economics, Madhabdev University, Lakhimpur, Assam, India.

Abstract
Sericulture or silk production is regarded as well-suited agro-basedlabour-intensive cottage industry that significantly contributes to the socio-economic development of rural communities in Assam. It offers valuable employment opportunities to small and marginal farmersas well as agricultural labourers. It requires minimal investment while yielding profitable returns within a short period of time. Among the three category of silk production in Assam, Muga is the most luxurious and unique fabric produced in the region which is known for its natural golden hue and durability. The scientific name of Muga silk is “Antheraea assamensis”.There are few studies regarding silk production in Assam, especially in the Lakhimpur district which contributes the largest portion to the state's silk production.Therefore, this study attempts to examine the growth pattern of Muga silk production in Lakhimpur district since 2013 and aims to compare the percentage of families engaged in different categories of silk production.Based on secondary sources from government websites and articles, the study found that the growth pattern of Muga silk production has fluctuated over the period of timewith variations in the production of Muga cocoons and yarn/raw silk. Additionally, it revealed that most families are engaged in Eri silk production due to its easily manageable process and accessible tools, followed by Muga and Mulberry silk production respectively.

Keywords: Sericulture, Muga Silk, Lakhimpur district, agro-based labour-intensive industry

Introduction:

Sericulture is the process of silk production. It is an agro-based, labour-intensive cottage industry that offers substantial employment opportunities and income generation for marginalized communities in the rural and semi-urban regions of Assam (Kherkatary& Daimari, 2017).Assam is well-known for its production of different varieties of silk, such as Muga, Eri, and Mulberry. The silk industry provides employment opportunities to weaker sections of society, especially womenby engaging them in various stages of silk production, such as rearing silkworms, spinning, and weaving. This contribute to the economic empowerment of rural communities in general and rural women in particular and supports traditional artisanal skills that have been passed down for generations.Muga silk, often referred to as the "queen of all fabrics," is an integral part of Assamese culture and heritage. Its natural durability and rich,

lustrous golden hue make it highly prized. Muga silk plays a significant role in the socio-economic life of the Assamese people with its production and weaving deeply embedded in the traditions of the region. The fabric's long-lasting quality and luxurious appearance contribute to its esteemed status.

Lakhimpur is one of the most economically uplifted district in Assam located between 26°48' and 27°53' N latitude and 93°42' and 94°20' E longitude (Bonia, 2020). The district is home to many communities, each with its rich diverse culture and socio-economic status. People of this area choose agriculture, sericulture, horticulture and different services as their primary occupation. These sectors also contribute an enormous amount to the state income. It is indeed a matter of great pride that Lakhimpur district has established a strong foothold in the production of Muga silk which is an indigenous variety of silk unique to the region. The industry's growth towards self-reliance highlights the dedication and skill of the local artisans and it underscores the significance of preserving traditional crafts. Muga silk is known for its natural golden sheen which is an important cultural and economic asset. It contributes to both regional pride and the country's textile heritage.

Review of literature:

Assam is one of the climatically sound region which is suitable for fruit, vegetable production, plant production, sericulture and horticulture. Most of the Assam industry depends on the seasonal production of the state. Sericulture is labour intensive agro-based cottage industry adopted by most of the rural and tribal community in Assam. Its origins trace back to the Ahom dynasty, reflecting a long-standing historical tradition. It shows the socio economic and cultural status of the North Eastern region. There are two type of silk produce in this region- cocoon production and raw silk/yarn production. Some studies aim tounderstand the relationship between climate and silk production of the state and also try to examine the growth pattern in raw silk production and assess the employment generation in this sector to uplift the standard of living. The number of family engagement and number of village engagement in seri production has increased over time. But the food plants are not able to ensure the more cocoon and raw silk production in the state (Borah, et al. 2024; Kherkatary & Daimari, 2017; Bonia, 2020; Saloi & Hazarika, 2014). Data has collected from both primary and secondary sources. The climate and the Muga silk production are inversely related with each other and this poses the key challenge of the local small and cottage industries. Both winter and summer season produce different categories of silkworm. The silkworm faced different issues and prospects due to gradual change of climatic condition, such as- temperature, rainfall, heat stress, humidity etc. (Lalitha, et al. 2020). Most of the people in Assam adopt sericulture as their primary or secondary occupation. It is one of the traditional practice that has transmitted over the years. So, the growth pattern in raw silk productionand employment generation in sericulture has fluctuated over time, rather than following a smooth trajectory. But some studies found that though the growth rate fluctuates in the silk production, but still able to achieve the positive growth and upward trend as compared to the other states in North-Eastern region. The Eri silkworm showed the fastest growth rate compared to Muga and Mulberry silkworms (Dekaraja & Borah, 2024).

Muga silk is a prestigious variety of silk native to Assam, known for its natural golden sheen. It was reserved for royalty due to its rarity and luxurious quality. The durability of Muga silk increases with each wash, making it a unique textile that ages gracefully. There has the historical perspective of Muga Silk industry in Assam. Some studies finds that the origin of Muga silk in Assam is often traced back to the Ahom regime, which spanned from 1228 to 1828. This period is widely recognized for fostering the cultivation and production of Muga silk, a practice that became integral to Assam's cultural and

economic identity during this time. But there is ample evidence exist suggesting the use of Muga silk prior to the Ahom regime and also in various part of India (Phukan, 2012). The golden Muga silk mostly produced in the Brahmaputra valley in Assam, specially Dhemaji, Lakhimpur, Sivasagar, Jorhat, Tinsukia etc. The valley is ecologically and climatically suitable for silk production. Therefore, it contributes more than 30%-40% silk production in the state each year (Das, 2021). Some studies found that the traditional method of silk production is organic, eco-friendly, viable, sustainable and cost effective. But it needs scientific explore, verify and modify to increase the production to compete with the global market (Chakravorty, et al. 2010).

Climate is crucial to the health and productivity of silkworms worldwide. Environmental factors like temperature, humidity, heat, and rainfall significantly affect the embryonic development of silkworm eggs, the nutritional efficiency of silkworm larvae, and the reproductive capacity of silkworm moths(Rahmathulla, 2012). Besides Assam, sericulture plays an important role in various regions of India, such as West Bengal, Karnataka, Andhra Pradesh, Jharkhand, Meghalaya, and Tamil Nadu. In many parts of West Bengal, it continues to be a primary source of livelihood.Household size and male hired in this sector has positively been rising, while education acts as the significant reducing factor in this region (Bhogat, 2023).

Scope of the Study:

Numerous studies conducted by researchers have focused on the growth trends in silk production and the employment rate in sericulture across different regions of India. Some studies have specifically highlighted silk production and employment rates in Assam. Lakhimpur district has made significant contributions to state's silk production. Therefore, there is a scope to study the unique and prestigious Muga silk production as well as the engagement of family in different category of silk production especiallyin Lakhimpur district.

Objective:

Following are the objectives of the study —

1. To analyse the trend of growth of Muga silk production in Lakhimpur district during the period 2013-23.
2. To compare the engagement of family in different category of silk production.
3. To analyse the standard of living who are engaged in Muga silk production.

Research Methodology:

1. **Research approach:** This study adopts both qualitative and quantitative research approach to analyse the data about the growth of Muga silk production and the percentage of family engagement in Eri, Muga and Mulberry silk production in Lakhimpur district during the period 2013-23.
2. **Sources of Data Collection:**This study is basically based on the secondary data.Data has been collected from different reliable and publicly available secondary sources. It includes publications of Statistical Handbook of Assam, Department of Central Silk Board and Directorate of Sericulture, Government of Assam, National Statistic Office and other relevant scholarly articles.
3. **Data Period:** The data used in the analysis spans a specific period to ensure consistency and comparability; the data period is 2013 to 2023.
4. **Data Analysis:**The study involves conducting descriptive statistics to provide an overview of growth

pattern of Muga silk production and family engagement in Eri, Muga and Mulberry silk production.

Background of the Study:

Sericulture is one of the important department in the economy, culture, anddevelopment of Lakhimpur district.It plays vital role in income generation, export opportunities, cultural heritage and rural development. Most of the sericulture or silk production industry in this region is agro-based cottage industry which refers small business that make products using raw materials from farming. These businesses are usually run from homes or small workshops and often involve local people. The district has favourable climate for silk production. Several locations in the district have government offices of this sector, including Narayanpur, North Lakhimpur, Dhakuakhana, Ghilamara, and Dhalpur. Apart from the government offices, there are lots of small and cottage industry in most of the places of the district. Even approximately 70% of people in Lakhimpur district choose silk production for their personal use.Muga silk has indeed garnered significant demand in the global market, it is known for its rich golden colour and durability. Some portion of the production in the Lakhimpur district is export in different parts of the India. Meghalaya, West Bengal and Mizoram often imported cocoon from the region for their production. The tradition of silk production has been passed down through generations, with each one preserving and refining the tools and techniques used in the craft. The local artisans have not only upheld these traditional practices but have also honed their skills to a high level of expertise. As a result, they are often more skilled and experienced in silk production compared to government employees. They acquired deep knowledge and hands-on training through years of practice and cultural transmission.

Climate is the key factor influencing silk production. However, our observations over the past decade reveal significant changes in climate conditions. Lakhimpur district has experienced significant changes in its climate, primarily characterized by rising temperatures and altered rainfall patterns.Various medications have been utilized to safeguard the life cycle of raw silk and its cocoon.But still growth pattern is not that much steady as compared to the previous years. Muga silk production in this district over the last decade will be examine on the basis of the amount of yield of cocoon and production of yarn/raw silk. Engagement of family in the production of Eri, Muga and Mulberry silk production has put emphasize to see the comparison among them (Bonia, 2020).

Analysis of the Study:

Silk production is a vital aspect of Assam's rich culture which carried the region's unique identity. This craft is primarily carried out by the handloom industrywhere skilled weavers create exquisite fabrics that reflect the heritage and artistry of the area. By using traditional methods, the people of Assam have passed down this culture from generation to generation. It plays crucial role to preserve different traditional and simple tools for weaving. There are three types of silk- Eri, Muga and Mulberry. All of them has their own unique identity. Mahatma Gandhi states that every Assamese woman is a born weaver and they weave fairy tales in her cloths. His statement beautifully highlights the innate artistry and craftsmanship of Assamese women in the tradition of weaving. He is emphasizing that weaving is not just a skill for them, but a part of their cultural identity that passed down through generations. The reference to "fairy tales" suggests that the fabrics they create are more than just textiles—they tell stories, carry deep cultural meanings and reflect beauty and creativity, much like a fairy tale does in words.

Most of the study have done to examine the trend of silk production in Assam. A steady and continuous increase in its production has been consistently observed. This upward trend can be attributed to the ongoing rise in demand, which has driven the need for greater output and capacity expansion. A significant increase in production within a region leads to the creation of more employment opportunities. This sector provides equal employment opportunities for both men and women. Additionally, promoting women's empowerment is a key objective of these agro-based cottage industries. Silk production contributed a decent amount in the state revenue. Muga silk is the richest silk among all, it has a long history since Ahom Regime. ButBhagadatta wore a small Muga silk cloth on his hand when he fought against the Pandavas in the Mahabharata war (Phukan,2012).Apart from Assam, the silk production culture also adopted in different parts of India. Such as- Meghalaya, West Bengal, Nagaland, Arunachal Pradesh, Mizoram, Karnataka, Andhra Pradesh, Tamil Nadu etc. Some researchers believe that China was the first country to embrace the culture of silk production.The Chinese discovered that silkworm cocoons could be unraveled and woven into cloth.

Though, Assam is famous for silk production. But not all places are suitable for it. It needs approximately 23°–27°C temperature, 65-85% humidity, 600-2500 mm of annual rainfall and fresh air. Only some part of Assam has such kind of climate, including- Sivasagar, Lakhimpur, Jorhat, Dhemaji, Boko, Tinsukia, Tezpur etc. Lakhimpur district is one of the most climatically balance district which is suitable for silk production. Therefore, it leads to the highest production of silk across the state. The increasing growth pattern of production in Lakhimpur district contributes yearly 25%-30% of the state's total silk production. Many people in district adopted sericulture as their primary or secondary occupation.

Assam produces three distinct types of silk.Each type has its unique identity and beauty. Among them, Muga silk is often referred to as the queen of silk. It is derived from the cocoons of the Antheraea assamensis silkwormwhich is indigenous to Assam (Dekaraja& Borah, 2024). The production process of Muga silk begins with feeding the larvae leaves from the som and sualu trees. After a few months, once the silkworms mature, the cocoons are collected. The next step involves boiling the cocoons in water for 15 to 20 minutes to soften them and finally the fibres are reeled using a bhir or bhowri (Chakravorty, et al. 2009)

Growth pattern of Muga silk production (2013-23):

Lakhimpur is home to vast forest cover filled with several Som and Sualu tree, favourable climate and a high labour force which help the region to produce a large amount of silk. Approximately 60%-70% people engage directly or indirectly in this sector each year. So, the district is known for its rich culture of silk production. The following table shows the growth rate of yield of Muga cocoon and production of yarn/raw silk in Lakhimpur districtduring the period 2013-23 –

Table No. 1 Growth pattern of Muga silk production during the period 2013-23

Sl. no	Year	Yield of Muga cocoon (in Lakh)	Growth (in %)	Production of yarn/raw silk (in MT)	Growth (in %)
1	2013	640		12	
2	2014	600	-6%	12	0%
3	2015	672	12%	12	0%

4	2016	675	0%	13	8%
5	2017	875	30%	17	31%
6	2018	1355	55%	27	59%
7	2019	312	-77%	43	59%
8	2020	2055	559%	41	-5%
9	2021	2164	5%	42	2%
10	2022	1738	-20%	35	-17%
11	2023	2450	41%	45	29%

Source: Statistical Handbook of Assam (2013-23) MT: Metric Ton

The above table shows that from 2013 to 2023, the district has experienced different growth rates in the yield of Muga cocoon and the production of yarn/raw silk. It is evident from the table that production is not static and does not increase steadily, rather than it fluctuates over time. In 2013, the yield of Muga cocoon was 640 lakhs which decreased to 600 lakhs in 2014 and the growth rate was -6%. However, in the case of yarn/raw silk production, it was 12 MT in 2010-15 but increased to 13 MT in 2016. So, the growth rate was 8%. This also indicates that 2013 has higher production of Muga cocoon without a corresponding loss in collecting raw silk compared to 2014.The region had the highest production in 2019 becausedespite the lowest yield of cocoon, it was able to produce the maximum amount of yarn, i.e., 43 MTwithout any damage. The lowest production of yarn/raw silk occurred from 2013 to 2015; cocoon yield was approximately equal during this period of time. The highest cocoon yield was 2450 lakhs in 2023, followed by 2164 lakhs in 2021 and 2055 lakhs in 2020. Similarly, the highest production of yarn/raw silk was 45 MT in 2023, followed by 43 MT and 42 MTin 2019 and 2021 respectively. The lowest cocoon yield was 312 lakhs in 2019and the lowest raw silk production was 12 MT from 2013 to 2015. The growth rate was highest in the yield of Muga cocoon was 559% in 2020 and lowest was -77% in 2019, while the highest growth rate of production of Muga yarn/raw silk was 59% in 2018-19 and the lowest growth rate was -17% in 2022.

The Trend of growth rate of Muga cocoon production and yarn/raw silk production in Lakhimpur district since 2013 are presented graphically-

Growth rate is calculated using the formula

Growth Rate per year: [(current year-previous year)/ Previous year] x 100

Fig: 1Yield of Muga Cocoon (in Lakh)

Source: Compiled from the collected data

Growth rate is highest in the year 2020
Growth rate is lowest in the year 2022
Trend line of growth rate of Yield of Muga cocoon shows declining trend in the year 2014, 2019, 2022 with no growth in the year 2016.

Fig: 2 Production of yarn/raw silk (In MT)

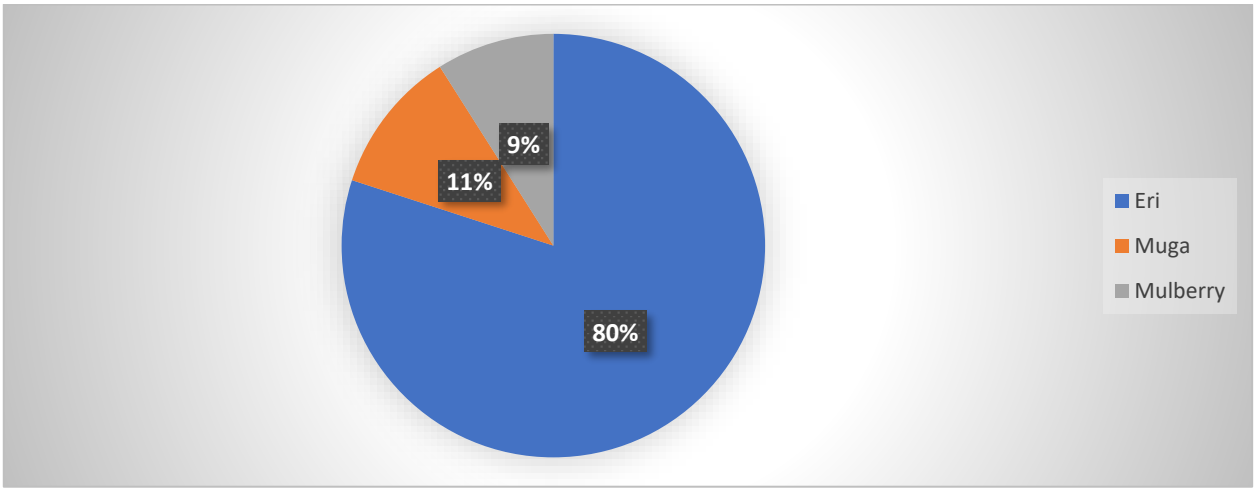
Source: Compiled from the collected data

Growth rate is highest in the year 2018 and 2019
Growth rate is lowest in the year 2022
Trend line of growth rate of Production of Muga yarn shows declining trend in the year 2020 and 2022 with no growth in the year 2014, 2015 respectively.

Engagement of family in different category of silk production: A comparison

Let us look at the engagement of family in different category of silk production with the help of the following pie-chart:

Fig: 3 Engagement of family in each category of silk production (in %)



Source: Statistical Handbook of Assam (2013-23)

According to the latest report published in the *Statistical Handbook of Assam, 2023*, most of the families are engaged in Eri silk production. This is because it is relatively easy and less time-consuming to produce compared to Muga and Mulberry silk. For any category of silk production, the winter season requires more time than summeras the larvae need a warm climate to mature into adults. The warmth helps in their metabolic processes which are essential for growth and development. In a warm environment, enzymes function more efficientlyallowthe larvae to digest food properly and grow faster. The warmth also provides the right conditions for the larvae to go through various stages of development. A cooler climate can slow down these processes, also makes harder for the larvae to mature at the right pace.After Eri silk, Muga silk ranks second in terms of family involvement in production. Mulberry silk has fewer contributors compared to Muga and Eri silk.Despite fewer people being involved, the demand for Muga silk is very high in the global market due to its unique quality. It is rare and difficult to producewhich makes it more sought after by buyers.

The status and standard of living of peoplewho engaged in Muga silk production during the period:

The price of Muga cocoon and Muga yarn/raw silk in India is currently Rs. 700 per kg and Rs. 24000 per kg respectively. Based on this rate, the table below outlines the income earned by the family engaged in Lakhimpur district from Production of Muga cocoon and Muga yarn/raw silk in Indian Rupees.

The study has already noted that Muga silk production depends primarily on the weather and climate of a particular area.Moreover, cocoons are found two categories based on the climatic condition in the North East India. It is observed that cocoon produced in between October to January are generally smaller in size due to it's cold and dry climate, while cocoon produced during April to July are big in size as in this period climate is hot and humid. Typically, around 2500 small-sized cocoons are needed to produce 1 kg of Muga silk, whereas only about 1200 large-sized cocoons are required to produce the same weight. Therefore, the study assumes an average of 1850 cocoons for 1 kg of Muga silk. In Lakhimpur district, Muga cocoon production has increased over time due to advancements in technology and improved skills among producers. It boosts both the income and standard of living for families involved in Muga silk production.

Table No. 2 Status and standard of living who are engaged in Muga silk production during the period

Sl. no	Year	Yield of Muga cocoon (In Lakh)	Total Income (In Million)	Production of Muga yarn/raw silk (In MT)	Total income (In Million)
1	2013	640	24	12	288
2	2014	600	22	12	288
3	2015	672	25	12	288
4	2016	675	25	13	312
5	2017	875	33	17	408
6	2018	1355	51	27	648
7	2019	312	11	43	1032
8	2020	2055	77	41	984

9	2021	2164	81	42	1008
10	2022	1738	65	35	840
11	2023	2450	92	45	1080

Source: Compiled from the collected data 1 MT=1000 KG Muga

silk commands a high price in the global market primarily because of its rarity, quality, and distinctive characteristics. Its eco-friendly production methods and cultural significance in India, especially for traditional attireattract consumers who value sustainability and authenticity. Though the total income generated from Muga yarn/raw silk production fluctuates over time, but the variations have not been significant enough to result in a deficit in the district. As shown in the above table, the income of families involved in Muga silk production has steadily increased.In 2013, their income was 288 million which rose to 408 million by 2017. By 2021, it had surged to 1008 million and by 2023, it reached 1080 million. However, production of Muga yarn and raw silk declined in 2020 and 2022, leading to a drop in income compared to the previous years.Despite these occasional decreases, it is evident that the overall income of families engaged in sericulture has risen, contributing to an improved standard of living for these families.

Yield of Muga cocoon (In Lakh) and Total Income (In Million)

Correlations			
		Yield_mugacocoon	Income
Yield_mugacocoon	Pearson Correlation	1	0.964**
	Sig. (2-tailed)		.000
	N	11	11
Income	Pearson Correlation	0.964**	1
	Sig. (2-tailed)	.000	
	N	11	11
**. Correlation is significant at the 0.01 level (2-tailed).			

Pearson correlation coefficient established that r = 0.964, which is significant at 0.01 level of significance [p<0.01]. Thus, it can be stated that there is a significant correlation exist between yield of Muga cocoon (in lakh) and total Income (in million). As correlation is significant and positive, so standard of living is high.

Production of Muga yarn (In Lakh) and Total Income (In Million)

Correlations			
		Prod_mugacocoon	Income
Prod_mugacocoon	Pearson Correlation	1	0.983**
	Sig. (2-tailed)		.000
	N	11	11
Income	Pearson Correlation	0.983**	1
	Sig. (2-tailed)	.000	
	N	11	11

**. Correlation is significant at the 0.01 level (2-tailed).

Pearson correlation coefficient established that r = 0.983, which is significant at 0.01 level of significance [p<0.01]. Thus, it can be stated that there is a significant correlation exist between production of Muga yarn (in lakh) and total income (in million). As correlation is significant and positive, so standard of living is high.

Conclusion:

The fluctuating growth pattern of Muga silk production in Lakhimpur district reflects both the rich cultural heritage and the economic significance of sericulture in the region. Production has been influenced by several factors over time which include climatic conditions, traditional knowledge, government initiatives, and market demand. While the district has shown promising growth, there are challenges such as pest infestation, inadequate infrastructureand fluctuating prices that need to be addressed to sustain and enhance production. Continued support through technological advancements, capacity building for farmers and improved market access will be essential for the long-term growth and sustainability of Muga silk production in Lakhimpur. The district has the potential to become a leading hub for Muga silk in Assam by adopting the measures, contributing to the state's economy and preserving this unique craft for future generations.

Policy Implications:

This study examines the trends in Muga silk production over the past decade by highlighting fluctuations in Muga cocoon and raw silk production in Lakhimpur district. By analysing the growth patterns of Muga silk production across different time periods, this study focuses on its potential as a significant livelihood source in the region. Many people remain unaware of the profitability of this sector.So, this study will help to encourage skill development related to Muga silk cultivation. Furthermore, it assesses the cultivable potential for Muga silk in the Lakhimpur district. In this respect, Government should take initiatives to boost production and enhance the district's export capacity. Increased government support could help streamline the production process, making Muga silk farming a more profitable venture for local farmers and communities. This development would subsequently uplift the district's economy by positioning Lakhimpur as a prominent contributor to the nation's silk industry.

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