



## Sericulture in Assam: A decade of trends, challenges, and opportunities

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### Abstract

The art of silkworm rearing, cocoon processing, and fabric production is an age-old tradition among the Assamese people. For the people of Assam, silk is more than just a commodity; it embodies the cultural identity of various tribes and is a legacy passed down through generations. Assam's geographical and climatic conditions provide an ideal habitat for sericigenous insects, including the commercially viable Eri, Muga, Tasar, and Mulberry silkworms. Among these, Eri and Muga silkworms are the primary contributors to the state's annual raw silk production. The quality and endemicity of Muga silk to the state of Assam contribute to its increased popularity on the international market. Despite numerous environmental obstacles, the state's marginal sericulture farmers persevere in making the greatest contributions to this industry. This study focused on the trends in Assam's sericulture industry over the past ten years in order to assess the state of the industry in terms of employability, raw silk output, cocoon production, and area acquisition for host plants. The present instability in Assam's sericulture industry begs many questions for the relevant authorities; ideally, these will be answered quickly so Assam may take the lead in the country's silk output.

**Keywords:** Sericulture, mulberry silk, eri silk, muga silk, production trend, Assam

### Introduction

Sericulture is known to be a promising, potential, and sustainable sector worldwide as the sericulture reduces soil erosion, increases afforestation, preserves biodiversity, and maintains ecological balance. Silk is called the "Queen of Textiles", which represents luxury and beauty and also reduces the huge demand around the world. The qualities that further fuel its demand in the global market are the qualities that attract every eye to it because of its subtle quality, natural glow, stability, high absorption capacity, light, comfort, glamour, and subtle texture. It plays an important role in the redistribution of wealth, just as the sericulture is of particular importance in transferring wealth from the rich to the poor, since silk is mainly used by the rich, along with the money spent among the rural poor, thus benefiting the sectoral value addition primarily to rural households. In a country like India, the sericulture serves as a tool to remove socio-economic inequalities and eliminate inequalities. The tradition of sericulture in Assam has been deeply rooted since ancient times. Most people had the knowledge and skills necessary to rear silkworms, rotate silk, and weave clothing. The climatic condition of Assam favors habitat for all major types of silk producing insects which includes mulberry silkworm (*Bombyx mori*), Eri silkworm (*Samia ricini*), Tasar silkworm (*Antheraea mylitta*) and Muga silkworm (*Antheraea assamensis*). Among the various types of silk, the Muga silk, known as the golden thread that shines in Assam, occupies a special place. It is the first Geographical Indication (GI)-registered product of Assam and gained immense popularity in the global silk market. Assam stands out to be the third largest producer of silk in the country, with a significant contribution in Muga and Eri silk. The socio-cultural and traditions of the people of Assam are intricately associated with this natural silk, especially for ceremonies like weddings and various festivals. For a very long time, Assam has been known for producing silk of the highest calibre,

which is exported both domestically and beyond. They have been doing this for a very long time; historical accounts of the manufacture of dukula, a type of silk fabric made in ancient Assam, can be found in works like the "Ramayana" and the "Arthashastra" of the Kautilya. Dukula came in three varieties. The first, known as Vangaka, resembled modern-day Paat silk in that it was white and silky. The second Paudraka resembles silk from Eri. Suvarnakudya, the third, was golden and resembled modern-day Muga silk. The 'Kalika Purana' also mentions the use of silk in ancient Kamrup deity worship. According to some historical researchers, the Bodo people, who migrated from China about 3000-2000 BC, brought with them the knowledge of manufacturing silk. Additionally, silk was trafficked by a route known as the Silk Road that connected Turkmenistan to the main Silk Road after passing through Myanmar and Assam in China. According to the Sanskrit scripture 'Harshacharita,' silk and other valuables were handed by King Bhaskarvarman of Kamrup to King Harshavardhan during his coronation (Borghain and Borah, 2022) <sup>[1]</sup>. In this communication, the present study will focus on the various trends related to sericulture industry of Assam which will comprises cocoon production, raw silk output, area under host plant for silkworm, employability and sericulture villages engaged with sericulture industry.

### Material and methods

#### Study area

The state of Assam is situated in northeastern India. Its borders are to the north with Bhutan and Arunachal Pradesh, to the east with Mizoram and Tripura, to the south with West Bengal, and to the west with Nagaland and Manipur. One of the largest rivers in Asia is the Brahmaputra River. This river passes across Assam in a west to east direction. Assam's entire land area is around 78,438 square kilometres (30,285 square miles). With a total area of 78,438 square kilometres, 99.4% of Assam is made up of rural areas.

Between latitudes 24°8'N and 28°2'N and between 89°42'E and 96°E, there is a geographically uneven area. Agriculture drives the economy of Assam. Assam's high humidity and favourable temperature are ideal for the production of all major types of silk, but particularly for Vanya silk, or Eri and Muga silk.

**Source of data**

The current study based on secondary data source. Datasets of last 10 years (2013-2014 to 2022 to 2023) time series covering various aspects such as the production of different types of raw silk, cocoon production and employment generate in sericulture activities have been collected from primarily annual reports published by Central Silk Board, Ministry of Textiles, Govt. of India and Statistical Handbook of Assam published by Govt. of Assam.

**Analysis of data**

Basic statistical analysis such as descriptive statistics (Annual Growth Rate and Compound Annual Growth Rate), graphical (column bar chart and line graph) and tabular methods has been used.

**Results and discussion**

**Cocoon production in Assam over the last decade**

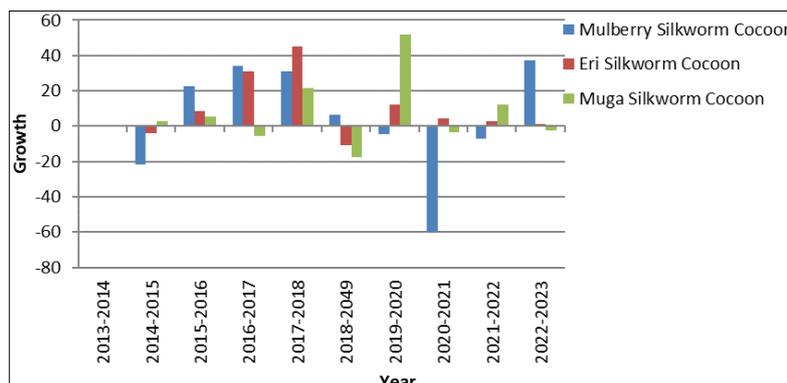
It is evident from the secondary data that Assam's cocoon production pattern throughout the last ten years has been unstable (Table 1). The production of cocoons for mulberry silkworms was 341 MT in 2013–2014, and it increased to 611.82 MT in 2018–2019. This shows the potential for mulberry sericulture in Assam. However, production decreased gradually from 2019–2020 and ended at 298.44 MT with a positive annual growth rate of 37.20 in 2022–2023, resulting in a cumulative CAGR value of -1.32% for the previous ten years and indicating a negative trend in this industry (Figure 1). However, from a different angle, it has

also been seen that, although there was a decline in output in 2020–2021, it has recovered to 298.44 MT in 2022–2023, falling short of the starting production value of 341 MT in 2013–2014. On the other hand, with the exception of 2014–15 and 2018–2019, the Eri silkworm cocoon production has been increasing during the past ten years (Figure 2). The state's Eri-culture industry is thriving, as evidenced by the CAGR of 7.97% for Eri cocoon production during the past ten years (table 2). The production of Eri silkworm cocoons increased from 3182 MT in 2013–2014 to 6847.90 MT in 2022–2023, indicating a strong trend in cocoon production. Likewise in Muga-culture, the no. of cocoon production has been improved if we compare the initial (2013-2014) and final (2022-2023) production value it has been increased from 6361 lakh to 10439.94 lakh with CAGR value of 5.08%, but if we observed year on year growth it is seems instability in Muga cocoon production (Table 1). From figure 2 it is clearly noticed that, the trend in Muga cocoon production shows both positive and negative output over the last decade. Though Muga cocoon production has been increased over the years but 2022-2023 records AGR value of -2.22 which puts a question on all the stakeholders of Muga-culture to re-evaluate their process and makes the best out of it. Similar improvements have been made in Muga culture, where the number of cocoons produced has increased from 6361 lakh to 10439.94 lakh with a compound annual growth rate (CAGR) of 5.08%. However, year-over-year growth suggests instability in Muga cocoon production (Table 1). Figure 2 makes it evident that during the past ten years, the trend in Muga cocoon production has shown both positive and negative output. Even if Muga cocoon production has increased over time, the AGR value of -2.22 for 2022–2023 calls into question all Muga-culture stakeholders to reassess their procedures and make the most of them.

**Table 1:** Cocoon Production status of Assam for the period of 2013-2014 to 2022-2023

Cocoon production status									
Year	Mulberry silkworm cocoon (Weight in MT)	AGR	CAGR	Eri silkworm cocoon (Weight in MT)	AGR	CAGR	Muga silkworm cocoon (Weight in Lakh no.)	AGR	CAGR
2013-2014	341	-	-1.32%	3182	-	7.97%	6361	-	5.08%
2014-2015	267.64	-21.51		3049.89	-4.15		6528.21	2.62	
2015-2016	327.84	22.49		3317.28	8.76		6864.50	5.15	
2016-2017	439.05	33.92		4350.58	31.14		6480	-5.60	
2017-2018	575.89	31.16		6300	44.80		7865.50	21.38	
2018-2019	611.82	6.23		5632.81	-10.59		6494.25	-17.43	
2019-2020	584.89	-4.40		6311	12.04		9865.66	51.91	
2020-2021	234.84	-59.84		6573.61	4.16		9497.91	-3.70	
2021-2022	217.52	-7.37		6769.96	2.98		10677.71	12.42	
2022-2023	298.44	37.20		6847.90	1.15		10439.94	-2.22	

Source: Annual Reports, Central Silk Board, Govt. of India



**Fig 1:** Annual Growth Rate of cocoon production in Assam for the period of 2013-2014 to 2022-2023

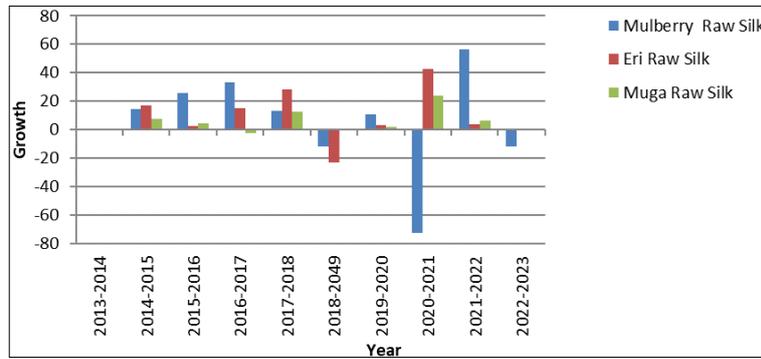


Fig 2: Annual Growth Rate of raw silk production in Assam for the period of 2013-2014 to 2022-2023

**Raw silk output of Assam over the last decade**

Over the last ten years, Assam’s raw silk output has followed a similar trajectory to that of cocoon production (Table 2). Over the last ten years, the state’s mulberry raw silk production has had a compound annual growth rate (CAGR) of -2.03%, indicating a decline in mulberry silk production. When compared to other significant silk-producing states in India, the mulberry silk production sector was under threat during the remarkable period spanning from 2013–2014 to 2017–2018. However, from

2020–21, the trend declined to a negative state. Conversely, the raw silk output in Eri and Muga has been increasing over the past ten years, with respective CAGR values of 5.70% and 5.29% (Table 2). Although the AGR value for the production of Eri silk fell between 2018 and 2021, and for the production of Muga silk during the same period in 2016, both sectors recovered in the following years, indicating the state’s stronghold over Vanya silk production, which primarily consists of Eri and Muga silk.

Table 2: Raw Silk Production status of Assam for the period of 2013-2014 to 2022-2023

Raw silk production status									
Year	Mulberry raw silk (Weight in MT)	AGR	CAGR	Eri raw silk (Weight in MT)	AGR	CAGR	Muga raw silk (Weight in MT)	AGR	CAGR
2013-2014	27	-	-2.03%	2613	-	7.70%	126	-	5.29%
2014-2015	31	14.81		3055	16.91		136	7.93	
2015-2016	39	25.8		3143	2.88		142	4.41	
2016-2017	52	33.33		3619	15.14		139	-2.11	
2017-2018	59	13.46		4645	28.35		157	12.94	
2018-2019	52	-11.86		3563	-23.29		157	0	
2019-2020	57.6	10.76		3680	3.28		159.90	1.84	
2020-2021	16	-72.22		5248	42.60		198	23.82	
2021-2022	25	56.25		5465	4.13		211	6.56	
2022-2023	22	-12		5487	0.40		211	0	

**Contribution of Assam in Indian silk industry over the last decade**

The state’s overall raw silk production has increased over the last ten years from 2766 MT to 5720 MT; nevertheless, the production of raw silk from mulberries has declined dramatically from 27 MT to 22 MT on a per-mulberry basis. Conversely, the output of raw silk in Eri and Muga has increased over the past ten years, rising from 2613 MT to 5487 MT and 126 MT to 211 MT, respectively. It is evident

that the state contributes most to the production of Eri and Muga raw silk, making it the top producer of Vanya silk (Eri and Muga) in the country. Among all the Indian states that produce sericulture, Assam is special due to its exclusivity on the production of Muga or golden silk. Over the past ten years, Assam’s share of the state’s raw silk production has climbed from 12% to 16%, which is good news for all parties involved in the state’s sericulture industry (Table 3).

Table 3: Contribution status of Assam in Indian silk industry for the period of 2013-2014 to 2022-2023

Contribution Status												
Year	Mulberry Raw Silk Production (Weight in MT)			Eri Raw Silk Production (Weight in MT)			Muga Raw Silk Production (Weight in MT)			Total Raw Silk Production (Weight in MT)		
	Assam	India	Contribution (%)	Assam	India	Contribution (%)	Assam	India	Contribution (%)	Assam	India	Contribution (%)
2013-2014	27	19476	0.13	2613	4237	61.67	126	148	85.13	2766	23861	12%
2014-2015	31	21390	0.14	3055	4726	64.64	136	158	86.07	3222	26274	12%
2015-2016	39	20478	0.19	3143	5060	62.11	142	166	85.54	3324	25704	13%
2016-2017	52	21273	0.24	3619	5637	64.20	139	170	81.76	3810	27080	14%
2017-2018	59	22066	0.26	4645	6661	69.73	157	192	81.77	4861	28919	17%
2018-2019	52	25344.50	0.20	3563	6909.60	51.56	157	233.40	67.26	3772	32487.5	12%
2019-2020	57.6	25238.60	0.22	3680	7204	51.08	159.90	240.50	66.48	3897.5	32683.1	12%
2020-2021	16	23896	0.06	5248	6947	75.54	198	239	82.84	5462	31082	18%
2021-2022	25	25818	0.09	5465	7364	74.21	211	255	82.74	5701	33437	17%
2022-2023	22	27654	0.07	5487	7349	74.66	211	261	80.84	5720	35264	16%

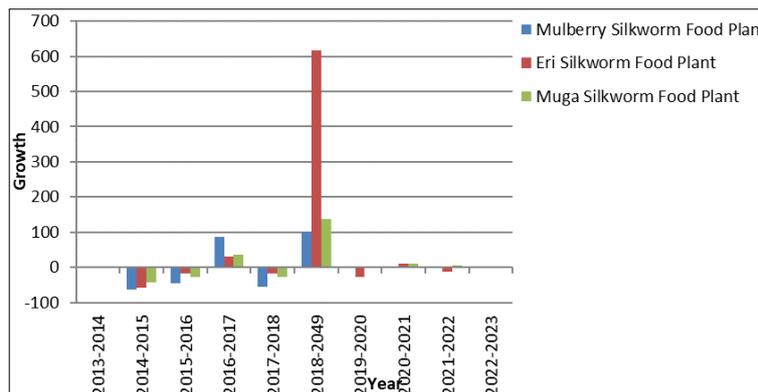
**Area under silkworm host plant over the last decade**

The host plants play a vital role in the sericulture sector because they enable the healthy development of offspring and the continuation of their life cycle. With a CAGR value of -10.08%, the area acquisition trend under the host plant for Mulberry silkworms appears to have been negative during the past ten years. However, the CAGR values of the Eri and Muga silkworm host plants, which are 2.027% and 6.31%, respectively, indicate encouraging developments (Table 4). The area covered by mulberry silkworm host plants decreased from 7623 hectares in 2013–2014 to

2634.48 hectares in 2014, indicating the potential demise of this business in the state since it directly affects the production of cocoon and raw silk, as previously noted (Tables 1 and 2). On the other hand, owing to an increase in area from 5936 hectare to 42471.01 hectare, there is a sharp slope in the acquisition of land for the Eri silkworm host plant in 2018–2019, with an AGR value of 615.48. Comparably, the area occupied by the Muga host plant has expanded as well, rising from 10371 hectares in 2013–2014 to 12661.64 hectares (Fig. 3).

**Table 4:** Status of area under silkworm host plant in Assam for the period of 2013-2014 to 2022-2023

Host plant area status									
Year	Mulberry silkworm food plant (Area in Hectare)	AGR	CAGR	Eri silkworm food plant (Area in Hectare)	AGR	CAGR	Muga silkworm food plant (Area in Hectare)	AGR	CAGR
2013-2014	7623	-	-10.08%	15796	-	6.31%	10371	-	2.02%
2014-2015	2821.32	-62.98		6600.60	-58.21		5994.98	-42.19	
2015-2016	1541.32	-45.36		5509.89	-16.52		4383.08	-26.88	
2016-2017	2875.35	86.55		7176.13	30.24		5931.58	35.32	
2017-2018	1279.97	-55.48		5936	-17.28		4368.78	-26.34	
2018-2019	2591.05	102.43		42471.01	615.48		10389.88	137.82	
2019-2020	2526.34	-2.49		30319.40	-28.61		10762.49	3.58	
2020-2021	2569.94	1.72		33433.73	10.27		11861.28	10.20	
2021-2022	2624.42	2.11		29096.29	-12.97		12557.78	5.87	
2022-2023	2634.48	0.38		29116.03	0.06		12661.64	0.82	



**Fig 3:** Annual Growth Rate of area under silkworm host plant in Assam for the period of 2013-2014 to 2022-2023

**Employment generate in sericulture sector of Assam over the last decade**

A large amount of labour is required in sericulture, which increases household employability. Family-run farms make up the majority of sericulture growers in rural areas. Since both the Muga and Mulberry industries are losing the families that work in them, the state's employment generation trends have been seen to be declining. In 2013–2014, there were 352541 and 57966 families engaged in mulberry sericulture and Muga-culture, respectively. As of

right now, their numbers have dropped to 28473 and 32353 families, respectively. However, with a CAGR of 2.29%, family engagement in Eri-culture has increased from 191566 nos. (2013-2014) to 240350 nos. (2022-2023) (Table 5). However, following a series of declines, the AGR value of households involved in mulberry sericulture improved from 2021 to 2022. Similarly, starting in 2021–2022, the Muga-culture and Eri sectors both improved employability (Fig. 4).

**Table 5:** Status of families and villages involved in sericulture sector of Assam for the period of 2013-2014 to 2022-2023

Status of families and villages involved in sericulture sector of Assam												
Year	Mulberry sericulture (in Nos.)	AGR	CAGR	Eri -culture (in Nos.)	AGR	CAGR	Muga -culture (in Nos.)	AGR	CAGR	Sericulture villages (in Nos.)	AGR	CAGR
2013-2014	352541	-	22.25%	191566	-	2.29%	57966	-	-5.66%	11411	0	-2.65%
2014-2015	68298	-80.62		552063	188.18		32045	-44.72		11281	-1.13	
2015-2016	38887	-43.06		425382	-22.94		32632	18.31		11281	0	
2016-2017	27546	-29.16		271318	-36.21		20541	-37.05		9935	-11.93	
2017-2018	29059	5.49		249295	-8.11		27690	34.80		8726	-12.16	

2018-2019	29905	2.91	240939	-3.35	30164	8.93	8828	1.16
2019-2020	29205	-2.34	249615	3.60	30710	1.81	8642	-2.10
2020-2021	8207	-71.89	294419	17.94	29231	-4.81	8640	-0.02
2021-2022	28473	246.93	239810	-18.54	31653	8.28	8627	-0.15
2022-2023	28473	0	240350	0.22	32353	2.21	8722	1.10

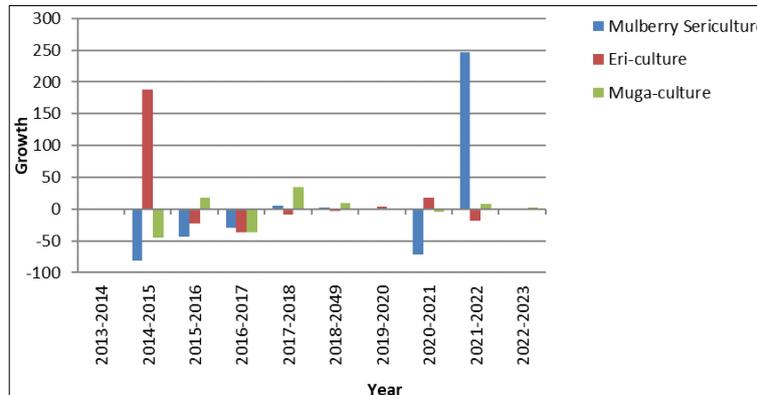


Fig 4: Annual Growth Rate of employability in sericulture sector of Assam for the period of 2013-2014 to 2022-2023

**Villages involved with sericulture sector of Assam over the last decade**

The expansion of the state's sericulture industry depends on the involvement of these villages as, as was previously said, sericulture in Assam has historically been practiced mostly in villages. A CAGR of -2.65% has been observed in the total number of villages in Assam involved in sericulture; in

2013–2014, there were 11411 villages; by 2022–2023, that number had dropped to 8640 (Table 5). With 1.10 value of AGR in 2023–2024, the AGR of sericultural villages showed a favourable approach for the sericulture sector. However, the AGR of sericultural villages had a steep fall from 2016–2017 onwards in the verse of redemption (Fig. 5).

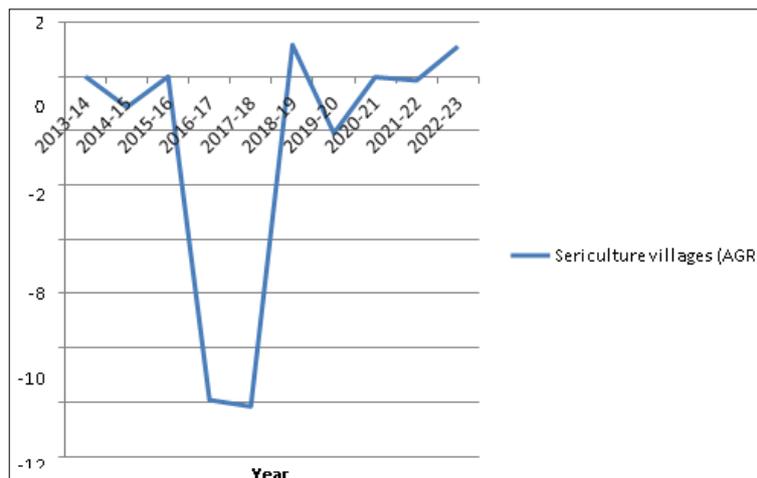


Fig 5: Annual Growth Rate of sericulture villages of Assam for the period of 2013-2014 to 2022-2023

Using the Karl Pearson correlation coefficient, the relationship between Assamese sericulture village and families involved in the practise has been examined which is mentioned below-

Karl Pearson Correlation = 0.63;  
 P value = 0.025  
 N = 10

There is a moderately positive association between involved families and sericulture villages, as indicated by the Karl Pearson correlation coefficient of 0.63. The statistical significance of the association is indicated by the p-value of 0.025, which is below the standard threshold of 0.05. Thus, with confidence, it can be said that the two variables actually have a relationship.

Comparing sericulture to other agricultural crops, it is a very favourable employment with little investment and great

income. Sericulture uses simple methods that are accessible to all farmers, regardless of literacy level, and doesn't require expensive equipment. The majority of Assamese tribal people who own small, marginal plots of land engage in sericulture. The silk industry is crucial to improving the socioeconomic status of society in emerging nations like India. In India, the silk industry employs over 8 million people in rural and semi-urban areas in 2019–20 (Borgohain & Borah, 2022) [1]. For women in rural and semi-urban regions, it is the sole cottage industry that offers a plentiful amount of employment. This industry's strengths include a sizable local market, a high potential for exports, and a diverse range of products that can help improve the financial circumstances of the underprivileged. Variability and instability are essentially susceptible to a number of constraints, both environmental and socioeconomic in nature. Some of the fundamental problems encountered in

the production of sericulture include changing weather patterns, frequent floods (Akhtar, 2015) <sup>[2]</sup>, a lack of capital (Hatibaruah *et al.*, 2021) <sup>[3]</sup>, a lack of insurance facilities, and the use of pesticides during the production process. When projecting the future trend, it has been noted that the state's production of sericulture has the potential to increase with careful planning and execution. While there is limited control over environmental limitations, there is greater emphasis on managing socio-economic restrictions to promote production stability and reduce the risk of loss for silkworm growers (Saikia *et al.*, 2016; Devi *et al.*, 2021) <sup>[4]</sup>. The results of our investigation also point to the instability that has been present over the past ten years in the Assamese sericulture industry, which is mostly responsible for the production of cocoons, silk, host plant area, and employability. Nonetheless, the current situation gives all parties involved in the state of sericulture hope for the industry's advancement throughout the state.

### Conclusion

Assamese people have long been involved in sericulture, which is a traditional agro-based economic structure in the state. Particularly for the Muga silkworm, which is native to Assam, the climate of Assam is ideal for sericulture. Assam currently ranks first for non-mulberry or Vanya silk production and third nationally overall, accounting for a significant portion of the nation's total silk production. According to the aforementioned analysis, Assam's raw silk output has not grown steadily, but rather in irregular steps. Comparatively speaking, Assam's contribution to the production of mulberry silk lags below that of Muga and Eri silk. Assam's endemic Muga silkworm population makes it evident that the state dominates the production of raw Muga silk, and the state is also seeing an increase in Eri silk production annually both of which is positive signs for the state and could propel it to the top of the Indian sericulture sector. However, the region where silkworm host plants are planted currently shows a positive trend. Concerns are raised for the overall industry by the fall in the number of families and villages involved in the sericulture sector over the past ten years. The sericulture industry has numerous obstacles due to a variety of biotic and abiotic causes, including climate change, flooding, pests and diseases, a lack of scientific temperament among farmers, awareness, unorganized cocoon market, etc. The government of India and Assam has implemented various programs to address these issues. These include the Silk Samagra scheme, Intensive Bivoltine Sericulture Development Project (IBSDP), Intregated Sericulture Development Project (ISDP), establishment of a new Eri spun silk mill, and the promotion of sericulture activities in Assamese districts that are desired. In addition to this, the government should launch other initiatives to focus on other facets of the silk business. Since Muga is the most valuable resource in Assam and a source of national pride, new initiatives centered around Muga should be unveiled. Assam's Muga will have a significant positive impact on the Indian sericulture industry and help India become the world leader in this field. The state government ought to place a strong emphasis on the in-situ conservation of the wild varieties of Muga and Eri, as this will aid in the breeding program to enhance the quantitative and qualitative traits of the existing varieties.

### Conflict of interest

Authors declare there is no conflict of interest.

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