



Challenges Confronted by the Muga (*Antheraea assamensis* Helfer) Farmers in Adoption of the Scientific Practices in Sonitpur District of Assam, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: <https://doi.org/10.9734/jabb/2024/v27i7997>

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/117878>

Original Research Article

Received: 06/04/2024

Accepted: 09/06/2024

Published: 12/06/2024

ABSTRACT

The investigation was conducted in the year 2020-21 at Sonitpur district of Assam with a sample size of 120 muga silkworm rearers. The study revealed that major problems faced by the mugarearers are lack of self-awareness or interest on adoption of technology, lack of glamour, lack

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Cite as: Saikia, Dipankar, Dababrata Saikia, Pulak Rabha, Monimala Saikia, and Debajit Borah. 2024. "Challenges Confronted by the Muga (*Antheraea Assamensis* Helfer) Farmers in Adoption of the Scientific Practices in Sonitpur District of Assam, India". *Journal of Advances in Biology & Biotechnology* 27 (7):363-71. <https://doi.org/10.9734/jabb/2024/v27i7997>.

of own land, adverse climatic condition, non-availability of storage facilities for cocoons, lack of adequate knowledge regarding cultivation practices of host plants and rearing practices of muga, non-availability of regulated cocoon market, non-availability of own vehicle and delay in getting loan.

Keywords: Sericulture; muga farmers; rearing; adoption; problems.

1. INTRODUCTION

Sericulture industry plays a vital role in the economic aspect of Assam. With the richest tradition of silkworm rearing, the state contributes almost 80.84 per cent of muga silk and 74.66 per cent of eri silk production in India and shares about 15.63 per cent of total silk production of the country [1]. Sonitpur, a prominent district of Assam is renowned for its silk production. The congenial climatic condition and suitable soil texture bestow it an optimum biosphere enriched with large numbers of species of host food plants for different sericigenous insets like Muga (*Antheraea assamensis* Helfer), Eri (*Samia richini* Donovan), Mulberry (*Bombyx mori* Linnaeus) etc, which are conventionally reared up in this district since time immemorial[2-4]. Due to its well flourished natural vegetation, it has remarkable entity of various rare species of wild silk moth such as *Attacus atlas* (Kotrormuga), *Actiaseleni* (Moon moth) etc in its potent bio-diversity. It is one of the district of Assam that is bordering with Arunachal Pradesh and it has rich biodiversity. Nameri national park lies in the district and presence of the primary food plants i.e som (*Persea bombycina*) and sualo (*Litsea monopetala*) indicates its ecological health and genetic diversity.

Muga culture encompasses a range of interlinked activities, including food plant cultivation, silkworm rearing, reeling of cocoons to unwind silk filaments, yarn making and processing, weaving, and production of fabric. Proper adoption of improved sericultural technologies by the sericulture farmers is very important for getting higher production. The potential of sericulture remains unexplored due to problems in conventional production practices [5]. Well-educated farmers having good knowledge on the improved sericulture technologies have adopted the recent technologies [6]. Within the broader sericulture industry, there are several types of silk, namely mulberry, eri, muga, and tasar silk. In this district, the focus is primarily on muga and eri cultures. Currently, there are approximately 211 sericulture villages and 8,672 families engaged in this sector. The area dedicated to

muga food plant cultivation spans 2,368.17 hectares, resulting in an annual production of 1.97 metric tons of muga raw silk [7]. The sericulture adoption is positively and significantly related to demographic features including age, number of dependents, education level, and experience in sericulture as well as technical and economic characteristics including the type of coronary ownership, profitability of sericulture given its shorter rearing period compared to other agricultural activities, willingness to rehabilitate coronary, and willingness to attend sericulture and other relevant courses. Also, it confirmed that supportive policies can play an effective role in the adoption of sericulture [8].

Rearing of silkworms and the production of Muga silk is a distinguished aspect of the district's rich agro-cultural heritage. This has established sericulture as a primary and widespread livelihood, crucial in preventing the migration of farm workers and laborers to urban areas. Adoption of scientific technologies among the seri farmers has significant impact on growth and development of sericulture as well as economic benefit of the farmer [9]. 'Sustainable rural livelihoods' was getting impetus in the context of development not only in rural development but also common perspectives like sericulture and allied sectors [10]. Despite its significance, the Muga silk sector, integral to the district's cultural and economic fabric, is currently facing several challenges that threaten its sustainability. Therefore, a study was conducted to identify the problems faced by Muga silkworm farmers in adopting scientific muga rearing practices.

2. MATERIALS AND METHODS

The present investigation was conducted during the year 2020–2021 purposively in the Sonitpur district of Assam, with a sample size of 120 respondents. A multistage sampling design was employed to select the respondents for this study. Sonitpur district has a total nos. of 7 block in which 3 were chosen purposively. Under the Tezpur subdivision Naduar and Balipara blocks, and under Dhekiajuli subdivision Borchala block were selected due to their higher population of

mugarearers. From each selected development block two villages were chosen namely Niz-Borchala and Borjhar from Borchala Development Block, Dharikati and Chariduar from Balipara Development Block, and Hatinga and Tupia Gaon from Naduar Development Block, for the investigation. With the study objectives in mind, Statistical techniques such as simple frequencies and percentage were calculated.

3. RESULTS AND DISCUSSION

3.1 Personal Problems

Table 1 highlights the primary personal challenges encountered by mugarearers, with "lack of self-awareness or interest in the adoption of new technology" ranked as the foremost issue. This could be attributed to the perceived high costs associated with adopting new technologies and lack of adequate training. Consequently, providing subsidies to the rearers, developing low-cost technologies, and conducting awareness campaigns are recommended to incentivize the adoption of scientific practices among the rearers.

Secondly, "lack of own capital" was identified as a significant challenge by many respondents, likely stemming from their financial constraints, which hindered their ability to afford the necessary rearing equipments and resources for silkworm rearing and other sericulture activities.

Moreover, "low level of education" was ranked third, suggesting a need for targeted training programs tailored to the specific needs of the rearers to enhance their understanding and skills in sericulture practices. Additionally, "lack of self-confidence" was identified as a barrier, indicating the importance of confidence-building measures and support mechanisms to empower rearers in their endeavors.

Lastly, "large size of family" was ranked last among the personal challenges. Addressing this issue may involve providing assistance or resources to alleviate the financial burden on the rearers with large families, enabling them to focus more on their sericulture activities.

In conclusion, targeted interventions such as subsidies, low-cost technologies, need-based training, and confidence-building measures are essential to address the personal challenges faced by the mugarearers, thereby fostering their

adoption of scientific sericulture practices and improving their livelihoods.

3.2 Social Problems

According to Table 2, the primary challenges reported by the respondents include "lack of glamour," which was ranked first by the majority. This perception may stem from the extensive time commitment required for muga rearing, particularly the need for continuous supervision over a prolonged period, thereby restricting farmers' ability to participate in social or cultural events. Consequently, muga rearing may be perceived as less attractive and undervalued compared to white-collar professions.

Secondly, "no recognition and appreciation by society" was ranked second, indicating lack of acknowledgment and esteem for the mugarearers within the community. This lack of recognition may be attributed to the socio-economic status and educational levels of many mugarearers, leading to a general lack of respect and appreciation from society.

Furthermore, "scarcity of labour during rearing" ranked third, likely due to difficulties in securing adequate labour for muga rearing activities, particularly during peak periods. Additionally, "high labour wages" ranked fourth, reflecting the challenges associated with labour costs, which may further strain the profitability of muga rearing ventures.

Lastly, "lack of support and appreciation from family members and other farmers" was ranked fifth, highlighting the importance of familial and communal support in muga rearing endeavors. The lack of support from family members and fellow farmers may contribute to feelings of isolation and disheartenment among the mugarearers.

3.3 Land Utilization Problems

The data presented in Table 3 sheds light on the land utilization challenges encountered by muga farmers during muga culture. The foremost issue reported by the respondents was "lack of own land," which was ranked first. Lack of own land of the muga farmer is the major problem in Goalpara district of Assam[11]. This challenge can be attributed to the prevalence of small landholdings among farmers, many of whom fall into the category of small and marginal farmers based on their operational land holdings.

Consequently, the limited availability of land hampers their ability to engage effectively in muga culture.

Ranked second was "people are not interested in leasing their land for cultivation." This challenge arises from the reluctance of landowners to lease their land for muga culture, which poses a significant barrier for farmers who are themselves small and marginal landholders and rely on leasing land from others for cultivation.

"Lack of knowledge on proper utilization of land" emerged as the third-ranked challenge among the mugarearers. This issue suggests a gap in farmers' understanding of optimal land utilization practices for various agricultural and sericultural activities. Addressing this challenge would require educational initiatives aimed at enhancing farmers' knowledge and skills in land utilization techniques.

3.4 Pre-Cocoon Technology Problems

Table 4 highlights the pre-cocoon technology problems encountered by mugarearers, with

"lack of technology to mitigate adverse climatic conditions" ranked as the primary issue. This challenge arises because muga silkworm rearing is conducted in outdoor conditions, making it highly susceptible to the fluctuations in weather and climatic conditions.

Ranked second was "lack of technology to mitigate the impact of environmental pollution," underscoring the sensitivity of the muga silkworms to environmental pollution, particularly from nearby tea gardens and pesticide usage in agricultural areas. This poses a significant threat to muga culture and requires innovative solutions to mitigate the adverse effects of pollution.

"Insufficient funds for buying seeds" emerged as the third-ranked challenge, reflecting the financial constraints faced by many muga farmers, making it difficult for them to afford seeds for muga culture. Additionally, "incidence of disease and pests in silkworms" and "incidence of disease in host plants" were ranked fourth and fifth, respectively, highlighting the susceptibility of muga silkworms to disease and pest infestations due to its outdoor nature.

Table 1. Rank-wise distribution of personal problems faced by the respondents (n=120)

Sl. No.	Personal problems	Frequency	Percentage (%)	Rank
1.	Low level of education	84	70.00	III
2.	Large size of family	45	37.50	V
3.	Lack of self confidence	64	53.33	IV
4.	Lack of own capital	90	75.00	II
5.	Lack of self-awareness or interest on adoption of technology	105	87.50	I

Table 2. Rank wise distribution of social problems faced by the respondents(n=120)

Sl. No.	Social problems	Frequency	Percentage (%)	Rank
1.	Scarcity of labour during rearing	83	69.17	III
2.	High labour wages	64	55.33	IV
3.	Lack of support and appreciation from the family members and other farmers	55	45.83	V
4.	No recognition and appreciation by the society	93	77.50	II
5.	Lack of glamour	95	79.17	I

Table 3. Rank wise distribution of land utilization problems faced by the respondents (n=120)

Sl. No.	Land utilization problems	Frequency	Percentage (%)	Rank
1.	Lack of own land	87	72.50	I
2.	Lack of knowledge on proper utilization of land	71	59.17	III
3.	People are not interested to lease their land for cultivation	73	60.83	II

Table 4. Rank wise distribution of pre-cocoon technology problems faced by the respondents (n=120)

Sl. No.	Pre-cocoon technology problems	Frequency	Percentage (%)	Rank
1.	Unavailability of seed in time	79	65.83	VI
2.	Insufficient money for buying seeds	91	75.83	III
3.	Lack of infrastructure for dfls production	68	56.67	VIII
4.	Lack of technology to mitigate adverse climatic condition	108	90.00	I
5.	Lack of technology to mitigate the impact of environmental pollution	103	85.83	II
6.	Incidence of disease and pests in silkworms	89	74.17	IV
7.	Incidence of disease in host plants	82	68.33	V
8.	Lack of knowledge about training and pruning of host plant	76	63.33	VII

Further down the list, challenges such as "unavailability of seeds in time," "lack of knowledge about training and pruning of host plants," and "lack of infrastructure for dfls production" were ranked lower. These challenges may stem from lack of awareness and information among the mugarearers, compounded by low levels of education.

3.5 Post-Cocoon Technology Problems

Table 5 clearly indicates that the primary post-cocoon technology problem faced by mugarearers is the "non-availability of storage facilities for cocoons," which was ranked first. This issue arises because many mugarearers lack proper storage facilities that meet the specific requirements of storing muga cocoons, which need to be stored in a single layer and require ample space and infrastructure.

Ranked second was the "non-availability of improved reeling machine." This challenge reflects the economic constraints faced by many farmers who are unable to afford costly reeling machines, which are essential for processing muga cocoons.

Additionally, the problem of "lack of availability of proper place for post-cocoon operation" was ranked third, indicating a shortage of suitable locations for conducting post-cocoon operations such as reeling and other processing activities. This issue is closely related to the lack of infrastructure and resources available to the mugarearers.

Finally, the problem of "lack of facilities for stifling cocoons" was ranked fourth among the post-cocoon technology problems. This challenge further underscores the financial constraints

faced by the mugarearers, as the lack of appropriate facilities for stifling cocoons hampers the quality of the final silk product.

3.6 Technical Problems

According to Table 6, a significant challenge reported by the mugarearers is the "lack of adequate knowledge regarding cultivation practices of host plants and rearing practices of muga," which ranked first. This issue likely stems from the longstanding establishment of muga host plant gardens, leading to lack of exposure to modern cultivation practices and rearing techniques. To address this, extension agencies should prioritize providing comprehensive training and modern technology to enhance productivity and returns from muga silk production.

Ranked second was the issue of "no regular contact between muga farmers and extension personnel." This challenge may arise from the busy schedules of rearers, preventing them from meeting extension personnel regularly. Additionally, infrequent visits by extension personnel to villages for training and input support may contribute to this lack of regular contact.

The problem of "less exposure to training programs" was ranked third among the technical problems. This highlights the need for area-specific and need-based training programs to support scientific muga silkworm rearing and enhance income generation. Possible reasons for this issue include inconvenient timing of trainings, limited availability of training programs, and inadequate communication with rearers regarding training opportunities.

"Lack of awareness about government schemes" was ranked fourth among technical problems faced by the mugarearers, likely stemming from low levels of education among rearers. Addressing this challenge requires efforts to increase awareness and understanding of government schemes among the mugarearers, potentially through targeted outreach and education initiatives.

3.7 Marketing Problems

From Table 7, it is evident that the foremost challenge faced by the mugarearers is the "non-availability of regulated cocoon market," which was ranked first. This indicates a significant gap in the market infrastructure for muga cocoon trading, which can lead to inefficiencies and exploitation of rearers by middlemen.

Ranked second was the issue of "lack of proper marketing system in cocoons, raw silk, and final products." This highlights the need for a comprehensive marketing system that covers all stages of muga silk production, from cocoons to final products, to ensure fair pricing and market access for rearers.

"Involvement of middlemen" emerged as the third-ranked challenge among marketing problems faced by the mugarearers. This suggests that the presence of middlemen in the

market chain contributes to inefficiencies and may result in lower returns for the rearers.

The problem of "Fluctuation of cocoon price" was ranked fourth, indicating the volatility in prices faced by the mugarearers, which can impact their income stability. This underscores the importance of establishing stable pricing mechanisms to provide rearers with predictable income streams.

"Lack of knowledge about proper techniques of marketing" was ranked fifth, highlighting the need for education and training programs to equip the rearers with the skills and knowledge required to navigate the market effectively.

Lastly, the problem of "Non-availability of a suitable market nearby the village" was ranked last among the marketing problems faced by the mugarearers. This suggests lack of accessibility to markets, which can further exacerbate the challenges faced by the rearers in selling their produce.

3.8 Transportation Problems

As depicted in Table 8, the primary challenge reported by the mugarearers is the "non-availability of own vehicle," which was ranked first. This issue arises from the limited financial resources of rearers, making it difficult for them to afford the purchase of a vehicle for transportation purposes.

Table 5. Rank wise distribution of post-cocoon technology problems faced by the respondents (n=120)

Sl. No.	Post cocoon technology problems	Frequency	Percentage (%)	Rank
1.	Lack of facilities for stifling cocoons	37	30.83	IV
2.	Non availability of improved reeling machine	79	65.83	II
3.	Non availability of storage facilities for cocoons	91	75.83	I
4.	Lack of availability of proper place for post cocoon operation	68	56.67	III

Table 6. Rank wise distribution of technical problems faced by the respondents(n=120)

Sl. No.	Technical problems	Frequency	Percentage (%)	Rank
1.	No regular contact between muga farmers and extension personnel	83	69.17	II
2.	Less exposure to training programmes	78	65.00	III
3.	Lack of adequate knowledge regarding cultivation practices of host plants and rearing practices of muga	96	80.00	I
4.	Lack of awareness about government schemes	67	55.83	IV

Table 7. Rank wise distribution of marketing problems faced by the respondents (n=120)

Sl. No.	Marketing problems	Frequency	Percentage (%)	Rank
1.	Non availability of regulated cocoon market	103	85.83	I
2.	Fluctuation of cocoon price	87	72.50	IV
3.	Lack of knowledge about proper techniques of marketing	84	70.00	V
4.	Involvement of middle man	89	74.17	III
5.	Non availability of suitable market nearby village	68	56.67	VI
6.	Lack of proper marketing system in cocoons, raw silk and final products	97	80.83	II

Table 8. Rank wise distribution of transportation problems faced by the respondents (n=120)

Sl. No.	Transportation problems	Frequency	Percentage (%)	Rank
1.	Poor road condition	64	53.33	III
2.	Non-availability of own vehicle	95	79.17	I
3.	Unaffordable cost of hiring vehicle	73	60.83	II

Table 9. Rank wise distribution of other problems (related to institutional and economic problems) faced by the respondents (n=120)

Sl. No.	Other problems	Frequency	Percentage (%)	Rank
1.	Non availability of need based information on time	68	56.67	III
2.	Non-availability of banking facilities in nearby areas	61	50.83	IV
3.	Complex procedure of getting a loan	84	70.00	II
4.	Delay in getting loan	87	72.50	I

Ranked second was the problem of the "unaffordable cost of hiring a vehicle." This challenge further underscores the financial constraints faced by the rearers, as the cost of hiring a vehicle for transportation purposes is often prohibitively high relative to their income levels.

Additionally, the "poor condition and connectivity of roads" emerged as another significant problem. The inadequate road infrastructure and connectivity in the study area hinder the transportation of muga cocoons and other materials, exacerbating the challenges faced by the rearers in accessing markets and essential services.

3.9 Other Problems (Related to Institutional and Economic Problems)

According to Table 9, the primary challenge highlighted by the majority of the mugarearers is the "delay in getting a loan," which was ranked first. This delay may stem from bureaucratic

processes or inefficiencies in the loan approval system. To address this issue, officials should work towards streamlining the loan application and approval process, while also providing clear and timely communication to applicants about the status of their loan applications.

Ranked second was the problem of the "complex procedure of getting a loan." This suggests that the loan application process may be overly complicated or difficult for rural individuals to navigate, particularly those with limited education or awareness of banking procedures. Efforts should be made to simplify the loan application process and provide assistance to the rearers in completing the necessary paperwork.

Among the institutional and economic challenges faced by the mugarearers, "non-availability of need-based information on time" was ranked third. This highlights the importance of timely and relevant information dissemination to rearers, particularly regarding loan opportunities, sericulture practices, and market trends.

Extension agencies and government institutions should prioritize providing timely and need-based information to empower the rearers to make informed decisions.

The findings of the current investigation underscore several significant challenges faced by the respondents, including lack of awareness on technology adoption, lack of glamour, lack of own land, lack of technology to mitigate adverse climatic conditions, non-availability of storage facilities for cocoons, lack of adequate knowledge regarding cultivation practices of host plants and rearing practices of muga silkworm, non-availability of regulated cocoon market, non-availability of own vehicle, and delay in getting loans.

These results align with previous research findings. Similar challenges faced by farmers, including the unavailability of timely labour and the high wage demands of labourers [12]. Marketing difficulties, such as the need to transport cocoons to other regions for fair prices and fluctuations in cocoon prices, were also noted. Additionally, it was identified constraints in sericulture technology adoption in Maharashtra, including water shortage, labour shortages, insufficient capital, high fertilizer costs, and lack of knowledge about disinfectants and rearing house hygiene [13].

Women involved in eri culture in Assam faces problems like leaf crisis during winter months, disease and pest attacks, lack of knowledge and skill in quality maintenance of raw silk, inadequate rearing houses, irrigation facilities, and marketing opportunities [14].

These findings collectively emphasize the multifaceted challenges encountered by stakeholders in muga culture, highlighting the need for targeted interventions to address these issues and promote sustainable development in the sector.

4. CONCLUSION

The investigation revealed that majority of the rearers had low level of education. Therefore, need based training like farmers skill training in both pre- cocoon and post cocoon sector, technology orientation programme, technology awareness and demonstration programme on various aspect related to the newly developed technologies developed by Central Muga Eri Research and Training Centre, Central Silk

Board, Lahdoigarh, Jorhat need to be conducted for the educated and unemployed young aged group. It will act as a catalyst in motivating other youths for active participation in muga culture as well as in sericulture and handloom sector and thereby development of entrepreneurial opportunities in the district.

From the findings it was observed that majority of the farmers had a medium level of extension contact, therefore extension agencies should arrange educational tour and exposure visits to the place of successful rearers in the nearby areas and interaction meetings could motivate the mugarearers for higher production of muga silk in the district.

For lack of capital and high cost of inputs and machinery, fluctuation in product price, lack of proper storage facilities, non-availability of vehicles, poor road connectivity, etc. govt. should make adequate arrangements to supply inputs to farmers at cheapest rates by giving subsidies. Also, there is a need to strengthen the transport facilities, so that, transportation of silk goods made easy without any transportation loss of silk goods. On the other hand financial institutes and government should come forward to provide a loan facility without any hassle and complication to encourage the mugarearers.

The government should take proper initiatives to establish a storage facility and processing unit in the district and also strengthen the marketing infrastructure for the mugarearers. The financial institutes and government should come forward to provide loan facility to encourage the mugarearers by simplifying the complex procedure of getting a loan in time.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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The peer review history for this paper can be accessed here:

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