

Muga Silk Production and Indian Knowledge System: A Cultural and Ecological Legacy of Assam

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Abstract

Muga silk of Assam plays a major role in the Indian textile industry. The textile sector is an important area of Assam's cultural, economic, and ecological landscape. Rooted in Indian Knowledge Systems (IKS), the indigenous practices involving silk rearing, preservation, natural dyeing, and weaving techniques have been passed down for generations. Muga being the first Geographical Indication (GI) registered product of Assam, and popularized for its rare golden color, durability, ability to repel up to 85% of UV rays, and eco-friendly in nature, makes it more valuable in the global textile industry and in the export market. It is not merely a textile product; as it represents India's indigenous knowledge systems (IKS), traditional ecological knowledge (TEK), and cultural heritage, making its study a significant part of indigenous and sustainable development discourse in India. The objective of this study is to comprehensively document and study the indigenous wisdom associated with Muga silk in Assam, India, while looking at the issues related to the sustainable development of the people.

Key Words: Indian Knowledge System, Indigenous Practices, Muga, Textile Heritage, Traditional Ecological Knowledge

1. Introduction

The production of Muga silk is connected to Indian Knowledge Systems (IKS), encompassing indigenous rearing techniques, particularly in relation to the procedures of seed collection, selection, preservation, natural dyeing methods, and traditional weaving practices along with the ways of improvement. The traditional knowledge and methodologies associated with Muga rearing, particularly focusing on the ancestral wisdom employed in larval care, host plant management, and disease prevention—practices sustained without modern scientific apparatus. Given that Muga farming is an outdoor activity, it remains vulnerable to climatic changes, pest infestations, and environmental pollutants from industries, agrochemicals, and vehicular emissions for which Indian indigenous techniques are used for mitigating these challenges. Thus, this paper critically highlights Muga silk through the lens of decolonization within the broader framework of global

indigenous studies, and sustainability. It also engages with the discourse of indigeneity, ecological stewardship, and knowledge sovereignty.

2. Methodology:

This study employs a qualitative and interdisciplinary research methodology, combining historical analysis and ethnographic inquiry to explore the relationships among Muga silk, the Swadeshi movement, and the Indian Knowledge System (IKS). A trans-disciplinary approach integrating Indian resources such as Kalika Purana, Harsha Charita and Western methodologies such as Ellen Messer's (2000) work on indigenous ecological knowledge in textile production, Heather Orr and Matthew Lopper's (2014) studies on Mayan textile production and indigenous craftsmanship remain a tool for a holistic study of Muga silk while ensuring that the indigenous perspectives remain central to this study. Thus, by combining IKS, postcolonial studies, TEK, Anthropogenic critiques, and global indigenous frameworks, this research will try to establish an ethical and sustainable model for studying Muga silk and similar indigenous textile traditions worldwide. As such, applying decolonial and indigenous perspectives to Muga silk study, this paper establish the dominant Indian indigenous knowledge structures, foreground sustainable alternatives to exploitative textile production, by reaffirming Assam's indigenous communities in global economic and ecological discourse.

2.1 Doctrinal and Archival Research

The methodology is a combination of conceptual as well as non-doctrinal approaches for the research topic. The doctrinal approach involves referring to Indian literature focusing mainly on books, journals, and unpublished materials and also sourcing materials online. Archival research and primary sources—including speeches, literature, colonial records, and early 20th-century newspapers—will be examined to trace how Muga silk was positioned as a symbol of indigenous resistance and self-reliance during the Swadeshi movement.

2.2 Fieldwork and Interviews

Fieldwork in Muga-producing region of Assam mainly Lakhimpur and Kamrup districts have been included in the study. Interviews include weavers, sericulture experts, and local knowledge bearers. As part of the research methodology, field surveys were conducted in Sualkuchi, few neighbouring areas of Kamrup and also in Dhakuakhana (Lakhimpur). The expert interviews highlight challenges faced by Muga rearers to carry out the cultural legacy and future prospects of this unique fabric. Almost 35 people were interviewed, consisting of knowledge holders, artisans, and community elders who helped to document the oral transmission of Muga techniques. The research methodology

is based on the Gandhian approach of community development which is solely rooted on *Swadeshi* Movement founded by Mahatma Gandhi in order to make India independent.

2.3 Auto-ethnography and Participant Observation

This study employs auto-ethnography as both method and representation, positioning my personal experiences as a basis for the meaning-making process. Auto-ethnography, as defined by Ellis and Bochner (2000), merges autobiography and ethnography to explore how personal narratives interconnect with larger cultural, political, and social contexts. This approach challenges the gap between the researcher and the subject by emphasising emotion and first-person storytelling as valid forms of knowledge. Participant observation of rearing, weaving and community practices is conducted to document the transmission of indigenous knowledge and eco-cultural practices embedded in Muga production.

Semi-structured interviews with Muga silk farmers, weavers, traders, and policy makers were conducted consisting of 100 farmers and 50 related people. Focus Group Discussions (FGDs) were completed by engaging with Muga rearers, women weavers and silk entrepreneurs to understand livelihood challenges and empowerment aspects. Along with those industry experts, government officials, and scholars were also consulted, specializing in textiles and sericulture.

3. Historical and Cultural Significance.

The origins of Muga silk traced back to ancient times, with significant development during the Ahom dynasty (1228–1828 A.D.) The Ahom rulers patronized Muga silk, integrating it into royal attire and ceremonial exchanges, thereby elevating its status within Assamese society (Das 2021). The deep-rooted cultural association of Muga silk with Assamese identity enriches its rich heritage based on traditional Knowledge in Muga silk production which is deeply related to the indigenous knowledge systems of India. Muga sericulture supports 30,000 Assamese households, providing livelihoods and nurturing Assamese community resilience.

Local communities possess the knowledge of Muga silkworm's life cycle, silk reeling and production methods, raw material management and optimal rearing practices. Pre-rearing, rearing, and post-rearing traditional practices which are involved with Muga consists of selection of appropriate rearing sites, timing of the rearing cycles with seasonal changes, and employing indigenous methods for cocoon harvesting and reeling. All these methods have been passed down through generations. This exemplifies the community's ecological knowledge and adaptive strategies too. Following paragraph shows how Muga silk production is thus significantly considered as a

sustainable practice rooted in ecological balance in the specific climatic conditions of Assam, which gives Muga a GI tag, and their rearing promotes the conservation] of host plant species, contributing to biodiversity preservation.

4. Generating Traditional Knowledge through the Production of Muga

4.1 Muga Cultivation and Indignity

Muga silk cultivation in Assam is based on Traditional Knowledge System (TKS). Findings of this study highlight the ecological wisdom, community practices, and indigenous agricultural systems rooted in centuries of observation, experimentation, and adaptation.

4.1.1 Ecological Synchronization and Multi – Voltin Reproduction:

For successful Muga silkworm rearing, a good planning is being done well in advance. Starting from the selection of rearing plot, pruning of food plants, defoliation, disinfection, proper planning and host plant management become an important activity for silkworm rearing which leads to successful cocoon harvest. The climate in the North-eastern part of India is ideal for Muga culture, and depending on the availability of food plants, silk worm can be raised for five to six crops annually. The crop cycle of Muga silkworm comprises of six overlapping crops, namely Jethua (April-May), Aherua (June-July), Bhodia (August-September), Kotia (October-November), Jarua (December-January) and Chatua (February-March) as per the Assamese nomenclature of yearly calendar crops. As per the perspective of Dulal Choudhury, retired government officer who has been dealing with Muga for last 60 yrs, the naming of the six crop cycles using Assamese terms (Jethua, Aherua, etc.) shows the connection of sericulture with cultural life and seasonal cognition(Choudhury:2025). Thus, traditional knowledge recognizes the multi-Voltin nature of Muga silkworms, allowing multiple rearing cycles a year, coordinated with the local seasonal calendar synchronized with natural climatic patterns, which showcase ecological literacy among the local communities and information transmission.

4.1.2 Selection of Ideal Rearing Environment: Semi-Domesticated Sericulture and Outdoor Rearing

Indigenous wisdom determines that eastern and southern slopes with elevated terrain are ideal for rearing due to better sunlight exposure and water drainage. The Muga silkworm is treated as a semi-domesticated insect, highlighting the symbiotic relationship between human management and wild insect behaviour. Rearing outdoors on Som (*Persea bombycina*) and Soalu (*Litsea monopetala*) reflects a non-invasive, low-intervention rearing model aligned with nature. There is a preference for

medium-sized host plants with optimum branch density—reflecting experiential knowledge of tree–worm compatibility. Rearing of Muga silkworm is being conducted outdoors, it is exposed to high fluctuating temperatures (28-37°C) coupled with high humidity (85-95%), especially during summer which is unfavourable and harmful to congenial development besides attack of pests, predators, and diseases, which affects the production of cocoons.

4.1.3 Host Plant Management Technique and Agro-forestry

Two host plants namely Som and Soalu are popular for Muga farming. Farmers systematically maintain 3x3m spacing and low pruning in order to get healthy leaf regrowth. Seasonal light pruning and defoliation are strategically timed based on summer and winter cycles, ensuring leaf availability and worm survival—showing a nuanced agroforestry technique. Regular application of FYM (farmyard manure) and balanced NPK fertilizers, help in maintaining the soil health of the Muga farm.

4.1.4 Pest Control and Field Disinfection

Communities have developed pre-rearing, field disinfection protocols, using low concentrations of pesticides such as Demicron, Rogor, and Indosulphan. Though modern chemicals are used, the timing and dosage are traditional knowledge and decisions passed orally. The choice of timing (e.g., 30–45 days before brushing) aligns with traditional forecasting and experiential knowledge of the community.

4.1.5 Rearing and Life Cycle Management

The community has deep biological knowledge of the larval stages, instars, and metamorphosis processes, which is essential for determining the optimal timing of cocoon harvest. There is a clear understanding of instar-specific rearing techniques, such as using dwarf plants during early larval stages, ensuring worm safety and growth. Tall trees make it difficult to hang the Chaloni (movable handmade bamboo net) on the tree during the transfer of worms from one tree to another after the completion of leaves.

4.1.6 Climatic Adaptation and Risk Management

Farmers are aware of temperature and humidity thresholds (22–26°C, 75–80%) and design their rearing cycles accordingly. They incorporate natural shading techniques (e.g., tall border plants) to protect larvae from sun and fluctuating temperatures—a form of climate-responsive farming. Traditional cycles incorporate pre-seed and seed crops, shows generational continuity and maintenance of silkworm genetic quality. This truly ensures self-sustainability of the industry and

reduces dependence on external seed supply.

4.1.7 Community-Centric Economic Model

Muga silk rearing is a supplementary livelihood for many rural families, especially women, who are custodians of indigenous silkworm rearing practices. The industry reflects a decentralized, community-driven model of economic sustainability that interweaves gender, ecology, and tradition. Jugal Kalita, an entrepreneur from Sualkuchi has been engaged with Muga production, marketing talks about the community centric economic model based on the prevailing Muga farming. Marvella, an organization based on Seri tourism has been engaging a village through Sericulture and Seritourism keeping both of them intact. Every year, they attract many tourists, including foreigners who joins to see the whole process of Muga farming, production and weaving (Bharali, 2025). Thus, Muga can be considered as a community centric economic model.

4.2 Process of Reeling of Muga Silk

Once Muga cocoon is produced, the process for reeling Muga silk starts. Cocoon cooking, deflossing, reeling, and Bhir reeling—are the examples of Indigenous Knowledge Systems (IKS) in several ways. These practices are not merely technical processes but are rich with cultural, experiential, and community-based knowledge that has been transmitted across generations in Assam. In the following paragraphs, an analytical breakdown of how IKS is embedded in each stage of the Reeling process has been given below:

4.2.1 Cocoon Boiling: Indigenous Observation and Insight

The cooking method varies across units and practitioners of Muga farming, demonstrating the tacit knowledge—based on experience, observation, and intuition—is central to the process. This is where we find IKS evident where, oral transmission and hands-on training outweigh formal documentation. We observe that Sodium carbonate is used to extract the silk from the cocoon, but, the exact concentration, temperature, and duration are adjusted based on the reeler's judgment of cocoon softness and quality, showing adaptive learning from lived experiences and in a tentative detail. The use of a ladle to ensure even cooking reflects a traditional, non-mechanized, low-tech approach deeply embedded in rural life.

4.2.2 Deflossing: Skill-Based Tradition

The outer filament layers are removed manually through tactile methods—using nails and fingers—demonstrate an embedded community knowledge system of Assam. Reelers, often women, rely on senses of touch and visual cues, not instruments, to determine readiness. The instruction during the

deflossing such as to start from the lateral side rather than the anterior or posterior shows a nuanced understanding of cocoon structure. The reeler's speed and efficiency (3 to 3.5 cocoons per minute) reflect the depth of specialized skill and hand-memory rooted in local tradition of Assam.

4.2.3 Reeling Technology: Indigenous Engineering

The practice of combining multiple filaments from different cocoons to make a single thread suitable for warp and weft shows practical innovation based on trial, error, and community knowledge sharing and experience. The distinction between Bhir reeling and motorized twisting prove the coexistence of traditional and modern practices, with Bhir methods being more deeply rooted in IKS (Giridhar and Neog,2014). Similarly, selection of cocoon numbers (e.g., 8–10 for warp and 12–14 for weft) reflects a deeper understanding of silk quality and properties and weaving requirements passed down through community practices.

4.2.4 Bhir Reeling: A skill based Indian Technology

Bhir Mugalata is another classic example based on indigenous innovation, developed without formal engineering input but through local knowledge. It uses readily available materials (bamboo bobbins, hand-operated flywheel) and is operated manually, preserving low-capital craftsmanship. The method of false twist insertion through palm friction is a uniquely indigenous technique that substitutes mechanical twisting with bodily movement, showing bio-cultural adaptation.

4.2.5 Socio-Cultural Symbolism of Muga Technology

The Muga silk tradition is not just economic—it is cultural, and spiritual. Muga silk is worn in traditional attire and rituals, showcasing the interweaving of material culture with identity. Thus, the endurance of weaving amidst industrialization in other regions highlights the resilience of indigenous practices. The preparatory processes of Muga silk reeling reflect Indigenous Knowledge System, which can be characterized by experiential learning and oral transmission, community-based skill development, resourcefulness and low-tech innovation, cultural continuity and identity expression, ecological and economic adaptability (Das 2021).

Thus, by looking at the realities of sericulture in lived, local perspectives, these practices highlight how indigenous wisdom sustains livelihoods, preserves culture, and adapts to evolving challenges—making it a part of Assam's both tangible and intangible heritage. From cocoon cooking and deflossing to traditional Bhir reeling—each step demonstrates a deep-seated reliance on experiential knowledge, manual skill, and cultural continuity that has been refined and passed down through generations that illustrate the ingenuity and sustainability of IKS, even in the face of modernization.

In preserving and valuing these knowledge systems, Assam not only safeguards its cultural legacy but also nurtures an eco-friendly, employment-rich craft that continues to contribute to both local economies and global appreciation of Muga silk.

4.3 Packaging of Muga Raw Silk:

Muga raw silk produced is coiled on a bamboo bobbin (as in the case BHIR technique) during reeling. Post-reeling operation involves the activities of re-reeling, hank-making, or bookmaking. The packaging process of Muga raw silk—particularly after the reeling stage—is a rich site of Indigenous Knowledge Systems (IKS). It involves techniques and materials that are sustainable, community-driven, and skill-intensive. Use of natural and indigenous materials such as the use of bamboo, a naturally available, biodegradable material, reflects indigenous eco-friendly practices. Bamboo is lightweight and cost-effective, ideal for rural silk-reeling units in Assam. In the BHIR (Basin Hand Reeling) technique, Muga raw silk is wound on bamboo bobbins. In comparison, MRTM (Multi-end Reeling cum Twisting Machine) uses plastic bobbins, which are less sustainable and indicate the shift from traditional to mechanized methods. Thus, the local craftsmanship in making reeling , re-reeling tools with a simple iron or wooden frame, operated manually by blacksmiths or carpenters, showing how local artisans contribute to the silk value chain show apprenticeship, experiential learning typical of IKS but not formal education. Muga raw silk produced is coiled on a bamboo bobbin (as in the case BHIR technique) during reeling. Post-reeling operation involves the activities of re-reeling, hank-making, or bookmaking. The packaging process of Muga raw silk—particularly after the reeling stage—is a rich site of Indigenous Knowledge Systems (IKS). Packaging techniques and materials that is sustainable, community-driven, and skill-intensive. Use of natural and indigenous materials such as the use of bamboo, which is a naturally available biodegradable, cost-effective material, shows indigenous eco-friendly, sustainable practice in Assam. In the BHIR (Basin Hand Reeling) technique, Muga raw silk is wound on bamboo bobbins. In comparison, MRTM (Multi-end Reeling cum Twisting Machine) uses plastic bobbins, which are less sustainable and indicate the shift from traditional to mechanized methods (Giridhar and Neog, 2014).

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prevent tangling. This pattern is not arbitrary however it's a result of generational knowledge that ensures smoother handling in the next stages like dyeing or weaving. Like traditional rice sowing patterns or Rangoli designs, these thread arrangement techniques combine functionality with aesthetic sense, a hallmark of IKS. After that, the post-reeling activities such as skeining or hank making, twisting hanks, and book-making are often represented in a gendered knowledge system, where women are key custodians of silk-handling techniques. Female engagement in textile, and nature-based crafts like Muga silk reflects eco-feminist values, where care for nature and community is deeply linked with women's work.

These practices are traditional but they are resilient, adaptive, and economically viable, especially in the context of rural livelihoods and indigenous economies. Muga silk's post-reeling processes, serve as a vital example of how indigenous methods can coexist and even enhance modern production frameworks when recognized and supported. It shows how environmental & ecological knowledge in sustainable rearing practices in Muga silk cultivation follows a complete organic and eco-friendly technique, avoiding synthetic pesticides and chemical fertilizers. The host plant (Som and Sualu) is grown in a way that maintains forest biodiversity, reflecting ancient Indian agricultural wisdom. Aligning with the Panchabhuta (Five Elements) in the life cycle of the Muga silkworm (*Antheraea assamensis*), is connected to the seasonal rhythms, Ritu Chakra, ensuring natural harmony. Muga farmers using lunar cycles to determine the best time for egg hatching, showcases traditional astronomical knowledge. Use of Ayurveda & indigenous healing methods to fight against natural diseases like Neem, Tulsi, and Ashwagandha to protect silkworms from infections, organic washes using cow urine (Gomutra) and turmeric to disinfect rearing spaces, following ancient Indian bio pesticide practices showcase the use of Indian knowledge. Use of Vedic mantras & rituals in many Assamese households, during the rearing process, believed to create a positive vibrational effect on silkworms. Ritualistic offerings (Prasad or Naivedya) to deities like Lakshmi and Vasundhara are performed for a good silk harvest. Indigenous Livelihood Model in Muga silk production follows the Guru-Shishya Parampara, where knowledge is passed down through generations of weavers and rearers. The system promotes self-reliance (Swadeshi), aligning with Mahatma Gandhi's vision of local industries sustaining rural India. Thus, Muga silk is exclusively woven in Assam, representing a Geographical Indication (GI) craft that has been preserved for centuries, showcasing the sacred connection to Assamese heritage.

5. Conclusion

Environmental vulnerabilities have been affecting the silkworm rearing cycles. Increased pest infestations are affecting the production, market in fluctuations with volatile pricing of raw silk and lack of price regulation causing challenges in Muga market. Lack of recognition and remuneration for labour in farming, post-reeling and weaving, inadequate documentation of region-specific knowledge systems. Muga silk promotes Indian Knowledge System, which is a harmonious blend of tradition, ecology, and culture. By recognizing such traditional practices, we not only honor cultural heritage but also glean insights into sustainable living and community-based resource management.

Encouraging the revival of biodegradable materials like bamboo in rearing, reeling, post-reeling stages instead of synthetic alternatives will help in continuing with sustainability. This could be supported through subsidies or inclusion of sustainability certification programs by promoting numerous sustainable practices. Recognizing and supporting the eco-feminist dimension of Muga production, we can see the nature and women's tacit skills playing a crucial role. This can be done by forming women-led cooperatives, offering microloans, and showcasing their work through textile exhibitions. Community-led innovation and design, thinking of traditional artisans are engaged in improving and adapting packaging tools and designs without compromising ecological or cultural values. Educating markets including both national and international, the cultural significance and sustainable roots of Muga silk production through story labels, QR codes, and branding strategies highlights the fact that IKS values can be re-enforced.

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