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Invited Paper

Silk - a Global Textile

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Abstract: Silk, the mystical fiber of unmatched elegance, has attracted humanity across the globe since ancient times. Even today, silk holds its place as a symbol of luxury and high fashion, earning its title as the "Queen of Textiles.". Silk can also be regarded as a global textile, as it addresses significant global concerns and aspirations while rooted in the rich history of sericulture. With a legacy spanning over 4,500 years, sericulture has shaped beautified and sustained human civilization. Today, it is prominent in the global socio-economic landscape due to its multifaceted advantages. Because of the socioeconomic importance and rural economy, the industry is rightly accepted as the industry of the rural poor. The world produces five types of silks and mulberry is the major type occupying 70% share. China and India contribute 95% of the global production and India is the major consumer and importer of mulberry silk. Despite its socioeconomic importance, the world's raw silk production is showing a declining trend, especially in China. The main reasons attributed are fast urbanization, loss of interest among youth and stiff competition by synthetic fibers. Another important aspect to be considered is information on the global silk demand-supply position. In the absence of authentic information, many countries are not coming forward to venture into silk production. Silk is a rich proteinaceous biomaterial that can be used in the cosmetic, pharmaceutical, and food industries. Keeping all the above there is a need for establishing a global body for the promotion of the silk industry as a global avocation

Keywords: silk, mulberry, textile, fiber

1 Introduction

Silk, the mystical fibre of unmatched elegance, has captivated humanity across the globe since ancient times. In China, it was a highly lucrative trade commodity. Ancient Persian traders (modern-day Iran) ventured through perilous routes—marked by treacherous mountain ranges, challenging passes, arid deserts, and dense forests—to procure exquisite, richly coloured, and finely textured silk from Chinese merchants. Alongside silk, other goods such as amber, glass, spices, and tea were also traded. However, silk quickly became a cornerstone of the Chinese economy, giving the trade route its iconic name: the "Silk Route." Even today, silk holds its place as a symbol of luxury and high fashion, earning its title as the "Queen of Textiles.". Silk can also be regarded as a global textile, as it addresses significant global concerns and aspirations while rooted in the rich history of sericulture. With a legacy spanning over 4,500 years, sericulture has shaped and beautified human civilization and sustained it. Today, it is prominent in the global socio-economic landscape due to its multifaceted advantages. These contributions can be categorized as follows:

A. Sericulture and Global Issues

1. Environmental Safety – Promotes eco-friendly practices.
2. Employment Security – Provides stable jobs, particularly in rural areas.
3. Carbon Credit – Contributes to carbon sequestration and climate initiatives.
4. Ecosystem Services – Enhances biodiversity and supports sustainable agriculture.
5. Above all fulfils 7 of SDG of UNO

B. Sericulture and Society

1. Food and Nutrition Security – Plays a role in ensuring sustenance for communities.
2. Employment Generation – Offers gainful employment, particularly for rural populations.
3. Gender Inclusivity – Empowers women by being a human-friendly industry.
4. Wealth Distribution – Generates high income for producers, redistributing wealth as silk is a premium product.
5. Rural Retention – Helps curb rural-to-urban migration by offering local opportunities.
6. Multiple Benefits – Delivers diverse advantages for humankind.

7. Foreign Exchange Earnings – Boosts national economies through international trade.

This highlights the enduring relevance of sericulture as a sustainable and socio-economically vital industry.

Historical Perspective

The earliest records of cultivated silk production date back to approximately 2640 BC, when the Chinese Empress Si Ling-chi is credited with patronizing the silk industry. For centuries, the Chinese guarded the art of silk production as a closely held national secret. Queen Hoshomin later introduced sericulture as a commercial venture in China solidifying its importance. Over time, sericulture spread to Korea, Japan, and eventually Europe. Sericulture was introduced to India around 400 years ago and has since flourished as an exemplary agro-industry. Its adaptability and economic value highlight its immense potential for sustainability, particularly in the context of climate change and for the economic upliftment of small and marginal farmers.

Global Silk Scenario

Currently, five types of natural silks are produced worldwide, with **mulberry silk** dominating production and accounting for over 90% (Figure 1). The type of silk produced in each region is largely determined by the availability of specific food plants for silkworms (Table 1).

Key Highlights

- **China and India**: The two leading producers of mulberry silk.
- **India's Unique Position**: India is the only country producing all commercially exploited natural silks and holds a global monopoly in the production of Muga silk, which is endemic to the country.
- **Shift in Production**: There has been a notable shift in silk production from temperate regions to subtropical regions. Countries like Japan, South Korea, and the USSR have ceased silk production due to high industrialization, rising costs, and declining interest among younger generations. Sericulture continues to play a vital role in global economies and holds significant promise for sustainability in a changing climate

Figure 1: Mulberry Silk

Table 1. Commercially exploited serpiginous insects of the world and their food plants

Common Name	Scientific Name	Origin	Primary Food Plant(s)
Mulberry Silkworm	*Bombyx mori*	China	*Morus indica, M. alba, M.multicaulis, M.bombycis*
Tropical Tasar Silkworm	*Antheraea mylitta*	India	*Terminalia tomentosa T. arjuna, Shorea robusta*
Oak Tasar Silkworm	*Antheraea proylei*	India	*Quercus incana, Q. serrata, Q. himalayana, Q.leucotricophora, Q. semicarpifolia, Q. grifithi*
Oak Tasar Silkworm	*Antheraea frithi*	India	*Q. dealbata*
Oak Tasar Silkworm	*Antheraea compta*	India	*Q. dealbata*
Oak Tasar Silkworm	*Antheraea pernyi*	China	*Q. dentata*
Oak Tasar Silkworm	*Antheraea yamamai*	Japan	*Q. acutissima*
Muga Silkworm	*Antheraea assama*	India	*Litsea polyantha, L. Machilus bombycina*
Eri Silkworm	*Philosamia ricini*	India	*Ricinus communis, Manihot utilisma, Evodia fragrance*

Source:wwwcsb.gov.in

Global Silk Production and Trade

Silk production spans over 30 countries, with **Asia** serving as the global powerhouse, contributing approximately 98% of the world's total silk output. **China** and **India** dominate this industry, jointly accounting for more than 95% of global production. While silk represents only about 0.5% of the global textile trade, its cultural and economic significance remains immense.

Key Highlights

1. **China**
   - The largest producer of silk, contributing 63% of global output.
   - The largest exporter, accounting for over 80% of global silk exports.

- Home consumption of silk is relatively low, at 20%.

2. **India**
   - The second-largest global producer and the largest consumer and importer of raw silk (41,500 MT and 2,650 MT, respectively).
   - India's contribution to global silk production has risen to 40%, but its share in the world's "Silk Trade" remains at around 5%.
   - Silk production in India is increasingly managed by large consortiums that focus on exports.
3. **Other Countries**
   - **Uzbekistan** contributes 2.23% to global silk production.
   - Countries like **Brazil, Thailand, Vietnam, North Korea, and Iran** collectively account for a mere 2.72%.
   - **Japan** boasts the highest per-capita silk consumption.

Table 2. Global silk production trend (Source: https://inserco.org)

#	Country	2016	2023	+/-
1	China	1,58,400	50,000	- 1,08,400
2	India	30,348	38,913	+ 8,565
3	Uzbekistan	1,256	2,037	+ 781
4	Vietnam	523	1,448	+ 925
5	Brazil	650	330	- 320
6	Thailand	712	291	- 421
7	Iran	125	276	+ 151
8	Tajikistan	0	227	+ 227
9	Others (16 countries)	98	464	+ 366
10	Total	192112	91221	-100891

Trends in Production

- Over the past decade, there has been a **global decline in raw silk production** by 39,065 MT (30%), primarily due to a sharp reduction in Chinese output.
- In contrast, **India's silk production has increased steadily** by 11,532 MT (63%) over the same period.

Both Uzbekistan and Vietnam are showing an upward trend in silk production.

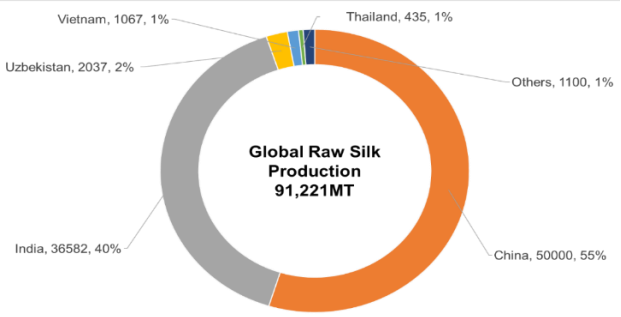

Figure 2: World Raw silk production (Source: https://inserco.org)

Global Silk Trade Scenario

Despite these developments, reliable data on global demand and supply trends is lacking. The silk trade dynamics are influenced by several factors, including shifts in production patterns, rising industrialization, and consumer preferences. Reliable information or data to accurately assess global demand and supply for silk remains unavailable. However, production trends reveal notable patterns. Despite a sharp decline in Chinese silk production, the overall global production ratio has remained relatively stable due to slow but steady growth in Indian output.

Over the past decade, global raw silk production has decreased by 39,065 MT, a 47.5% reduction. In contrast, **India** has seen consistent growth in raw silk production, with an increase of 11,532 MT, representing a 63% rise during the same period. Similarly, there is an upward trend in production in **Uzbekistan** and **Vietnam**, further contributing to the evolving dynamics of the global silk industry. This steady growth in certain regions indicates potential for regional diversification and resilience within the global silk trade

A detailed comparison of the mulberry sericulture industries in China and India, the two largest raw silk producers, is provided in Table 3.and over the last 10 years there has been an increase of 11532 MT (63.00%) Similarly there is an increasing trend both in Uzbekistan and Vietnam

The data highlights a significant decline in global silk production, particularly in China, where production has dropped to less than half of its earlier levels. This decline is primarily attributed to acute labor shortages, waning interest among the younger generation, and stiff competition from synthetic fibers.

A comparison between the world's two largest silk-producing countries—**China** and **India**—is summarized in Table 3.

Key Differences Between China and India

1. **Types of Silk**:
   - **China**: Produces only bivoltine silk, which is known for its superior quality (grade 3A and above).

- **India**: Primarily produces multivoltine silk, with most of it falling in the 2A and below grade range.

2. **Production and Consumption**:
   - **China**: Exports the majority of its silk, with domestic consumption accounting for just 20%.
   - **India**: A major consumer of silk domestically, it also imports high-quality silk from China to meet demand.
3. **Silk Rearing and Crops**:
   - **China**: Limited to 2–3 silkworm crops per year due to climatic conditions.
   - **India**: Benefits from climatic advantages, allowing silkworms to be reared year-round and yielding 5–6 crops annually.

Despite these differences, production and productivity levels in both countries remain comparable. Notably, while Chinese silk production is on a sharp decline, India's output is steadily increasing. This upward trend positions India as a strong contender to become the global leader in raw silk production.

As can be seen from the above data global silk production is declining sharply, especially in China and the production has come down to less than half, The reasons for the same has been attributed to acute labour shortage and loss of interest in younger generation besides, the tough competition from the other synthetic fibres

Table 3. Comparison between sericulture in China and India

Parameters	**China (2022)**	**India (2023-24)**	
Area under mulberry (ha)	4.10 lakh	2.63 lakh	
Leaf Yield (MT/ha/yr)	30-35	50-60	
Races reared	Bivoltine: 100%	Cross breed (CB): 72%	Bivoltine (BV): 28%
Egg production (crore dfls)	44.5	32.00	
Supply system	Majority chawki reared	CB: Supplied by eggs & Chawki 90%	BV: Mostly 85% Chawki reared
Rearing pattern	Batch wise	Throughout the year	
dfls brushed/ha/yr	1075	2250	2000
Cocoon Production (MT)	311500	152900	62700
Cocoon yield (kg/100 dfls) (2boxes)	70	60	65
Leaf cocoon ratio(kg)	20	22	25
Cocoon yield (kg)/ha	760	1350	1300
Cocoon weight (g)	1.9 – 2.0	CB: 1.5 –1.7	BV: 1.7-1.8
Shell percentage	21-24	CB: 17-19	BV: 20-21
Filament Length (m)	>1000	CB<800	BV >950
Renditta	6	CB: 7.6	BV: 6.50
Grade of silk as per ISA standards	Up to 6A	Up to 2A	Up to 4A
Cocoon price during March 2024 (Rs/kg)	600-650	CB: 400	BV: 500
Raw silk productivity (kg/ha/yr)	**122**	110	
Raw silk price during March 2024 (Rs/kg)	**5300**	4400	
Demand and supply position	90% Export	Mostly domestic (10% deficit)	
Mulberry raw silk production (MT)	50,000	29892 (CB:20217, BV:9675)	

Global Challenges in Sericulture

- Urbanization and Industrialization: Rapid urbanization and industrial growth in traditional sericulture regions, coupled with deforestation (especially in the Vanya silk sector), have reduced the potential area for food plants cultivation
- Manpower Issues: Declining interest among the younger generation and a shortage of manpower are major challenges.
- Competition and Counterfeiting: Stiff competition from synthetic fibres and the prevalence of adulterated or fake silk products.
- Climate Change and Environmental Vagaries: Effects of climate change, including drought, depleting water tables, and low soil organic carbon, along with climate aberrations and vagaries.
- Breeds and Technological Gaps: Insufficient availability of improved silkworm breeds across all varieties and inadequate maintenance/multiplication planning of silkworm races.
- Economic Challenges: Stagnation in silk exports, increasing input costs, and a growing preference for blended or synthetic products over pure silk.
- Underutilization of Resources: Poor utilization of sericulture products and by-products for value-added applications such as medical, aerospace, cosmetics, and food industries, particularly in India.
- Low Production Base: Limited production and low productivity in temperate/northern zones, with fewer crops per year.
- Lack of Corporate Involvement: Absence of large-scale corporate sector involvement in end-to-end sericulture operations, especially in India

Way Forward for Sericulture Development

- Global demand-supply Data and Planning: Conduct periodic surveys to assess domestic and international demand-supply dynamics to guide production planning.
- Mapping and Expansion: Use GPS/GIS tools to remap potential sericulture clusters in major production hubs and identify new suitable areas.
- Technological Advancements: Develop and refine cutting-edge technologies for all stages of the sericulture production chain- from farm to fabric.
- Climate Resilience: Introduce sericulture-based integrated farming and agroforestry models to enhance climate resilience and earn carbon credits.
- Improved Silkworm Breeds: Focus on developing silkworm races and hybrids resistant to biotic and abiotic stresses.
- Mechanization and Youth Engagement: Emphasize mechanization and reduce drudgery to attract younger generations to sericulture.
- Product Diversification: Diversify silk products to cater to changing market demands, including niche domestic and international markets.
- Value-Added Products: Maximize by-product utilization at every stage of production to develop value-added goods for multiple industries.
- Capacity Building: Provide large-scale training on new technologies and management practices to stakeholders, especially youth.
- Integrated Production Models: Implement economic/business models for cluster-based production hubs with end-to-end operations linking all stages of the sericulture production chain.
- Regulatory Reforms: Introduce industry-friendly reforms to attract corporate investors and boost sector growth.
- Global Coordination: Strengthen international coordination mechanisms for silk production and trade.
- Technology and Knowledge Exchange: Promote the exchange of genetic material, expertise, and cutting-edge technologies across borders.
- Silk Promotion: Position silk as a global textile, emphasizing its unique qualities to compete with synthetic fibres and other textiles.

The sericulture industry holds immense potential to contribute significantly to sustainable development, rural livelihoods, and global trade. By addressing challenges with a well-rounded approach—leveraging technological innovations, improving production efficiencies, and fostering international collaborations—the sector can thrive in a competitive global market. Prioritizing climate resilience, youth engagement, and value addition will ensure its long-term viability while enhancing its appeal to modern stakeholders. With coordinated efforts among policymakers, researchers, and industry participants, sericulture can be positioned as a dynamic, eco-friendly industry, meeting both traditional and contemporary demands.

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