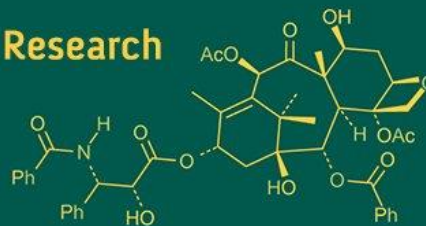


International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693

ISSN Online: 2617-4707

NAAS Rating (2026): 5.29

IJABR 2026; SP-10(4): 227-229

www.biochemjournal.com

Received: 17-02-2026

Accepted: 20-03-2026

M Poojith Kumar Reddy

M.Sc. Student, Department of Sericulture, College of Temperate Sericulture, Sher-e-Kashmir University of Agricultural Sciences and Technology, Srinagar, Jammu and Kashmir, India

Srikanth P

M.Sc. Student, Department of Sericulture, College of Temperate Sericulture, Sher-e-Kashmir University of Agricultural Sciences and Technology, Srinagar, Jammu and Kashmir, India

Thamizharasu T

Ph.D. Scholar, Department of Sericulture, College of Temperate Sericulture, Sher-e-Kashmir University of Agricultural Sciences and Technology, Shalimar, Srinagar, Jammu and Kashmir, India

S Nivya

M.Sc. Student, Department of Sericulture, College of Temperate Sericulture, Sher-e-Kashmir University of Agricultural Sciences and Technology, Srinagar, Jammu and Kashmir, India

Ganesh K

M.Sc. Student, Department of Entomology, Sher-e-Kashmir University of Agricultural Sciences and Technology, Shalimar, Srinagar, Jammu and Kashmir, India

Likhit Kumar R

M.Sc. Student, Department of Sericulture, College of Temperate Sericulture, Sher-e-Kashmir University of Agricultural Sciences and Technology, Srinagar, Jammu and Kashmir, India

Nishrita Khangia

M.Sc. Student, Department of Sericulture, College of Temperate Sericulture, Sher-e-Kashmir University of Agricultural Sciences and Technology, Srinagar, Jammu and Kashmir, India

Pinki

M.Sc. Student, Department of Entomology, Sher-e-Kashmir University of Agricultural Sciences and Technology, Shalimar, Srinagar, Jammu and Kashmir, India

Corresponding Author:**M Poojith Kumar Reddy**

M.Sc. Student, Department of Sericulture, College of Temperate Sericulture, Sher-e-Kashmir University of Agricultural Sciences and Technology, Srinagar, Jammu and Kashmir, India

Sericulture in transition: Global challenges, technological innovations and pathways to sustainable silk production: A review

M Poojith Kumar Reddy, Srikanth P, Thamizharasu T, S Nivya, Ganesh K, Likhit Kumar R, Nishrita Khangia and Pinki

DOI: <https://www.doi.org/10.33545/26174693.2026.v10.i4Sc.8090>

Abstract

Sericulture, the practice of rearing silkworms for silk production, is one of the oldest agro-based industries in the world. Historical evidence traces its origins to China nearly 5,000 years ago, where silk was considered a luxury commodity and became central to trade along the Silk Road (Zhao, 2012). Over centuries, sericulture spread to India, Japan and other Asian countries, embedding itself deeply into cultural traditions and rural livelihoods (Nagaraju, 2002). Today, India and China together account for more than 90% of global silk production, highlighting the continued dominance of Asia in this sector (Goldsmith *et al.*, 2005). Sericulture is often described as a “cottage industry with global reach.” It provides employment to millions of rural households, particularly women, who are engaged in mulberry cultivation, silkworm rearing and silk processing (Reddy & Uma, 2017). In India, the Central Silk Board estimates that sericulture supports over 9 million people, contributing significantly to rural development and poverty alleviation. Beyond domestic markets, silk remains a valuable export commodity, with India’s silk exports valued at hundreds of millions of dollars annually (Kumar *et al.*, 2019). The industry is unique in its ability to generate income at multiple stages from farming mulberry to reeling silk making it a powerful tool for inclusive growth.

Keywords: Sericulture, silk production, rural livelihoods, mulberry cultivation, silkworm rearing

Introduction

Biological Basis

The foundation of sericulture lies in the biology of the domesticated silkworm *Bombyx mori*. This insect has been selectively bred for centuries to maximize silk yield and quality (Nagaraju, 2002) [7]. The silkworm’s life cycle, egg, larva, pupa and adult, is closely tied to mulberry leaf availability, as larvae feed exclusively on mulberry leaves. The silk gland of the larva produces fibroin and sericin proteins, which together form the cocoon. Each cocoon can yield up to 1,000 meters of silk filament, making *Bombyx mori* one of the most efficient biological silk producers (Goldsmith *et al.*, 2005) [3].

Transition from Traditional to Modern Practices

Traditional sericulture relied heavily on manual techniques and local knowledge. Farmers cultivated mulberry in small plots, reared silkworms in household conditions and processed silk using simple tools. While these practices sustained rural livelihoods, they often resulted in inconsistent yields and vulnerability to diseases. Modern sericulture has introduced scientific methods, including improved mulberry varieties, controlled rearing environments and disease-resistant silkworm strains (Nagaraju, 2002) [7]. Biotechnology has further advanced the field, enabling molecular diagnostics for silkworm diseases and genetic engineering of silk proteins for specialized applications (Zhao, 2012) [14].

Challenges in Sericulture

Despite its economic and cultural importance, sericulture faces several challenges. Diseases such as pebrine (*Nosema bombycis*), flacherie, grasserie and muscardine can devastate silkworm populations, leading to significant economic losses (Kumar *et al.*, 2019) [6]. Climate change adds another layer of complexity, as rising temperatures and erratic rainfall

affect mulberry leaf quality and silkworm physiology (Reddy & Uma, 2017) ^[8]. Market fluctuations, competition from synthetic fibers and limited access to modern technologies also hinder the growth of the industry.

Mulberry Cultivation and Leaf Management

Mulberry (*Morus* spp.) is the cornerstone of sericulture, as the domesticated silkworm *Bombyx mori* feeds exclusively on its leaves. The nutritional quality of mulberry directly influences silkworm growth, cocoon yield and silk quality (Nagaraju, 2002) ^[7]. High-protein leaves enhance larval development and cocoon weight, while deficiencies in nitrogen or moisture reduce productivity (Kumar *et al.*, 2019) ^[6]. Different mulberry varieties have been developed to suit agro-climatic zones. In India, V1, S36 and G4 are widely cultivated, with V1 producing up to 35 tons of leaves per hectare annually under optimal conditions (Reddy & Uma, 2017) ^[8]. Mulberry thrives in well-drained loamy soils with pH 6.2-6.8 and requires balanced fertilization with nitrogen, phosphorus and potassium to maintain leaf protein content (Sarkar *et al.*, 2015) ^[9]. Irrigation is critical in tropical climates, while temperate regions rely more on rainfall.

Leaf Harvesting and Storage

Leaves must be harvested at the right stage of maturity: tender leaves for early instars, mature leaves for later instars (Reddy & Uma, 2017) ^[8]. Improper harvesting reduces nutritional value and silkworm performance. Storage is challenging, as leaves lose moisture rapidly. Techniques such as cool storage or wrapping in moist cloths extend freshness (Kumar *et al.*, 2019) ^[6].

Pests and Diseases

Mulberry is vulnerable to pests like thrips, leaf rollers and mealybugs and diseases such as powdery mildew and leaf spot (Sarkar *et al.*, 2015) ^[9]. Integrated pest management, including resistant varieties and biological control, is increasingly adopted (Reddy & Uma, 2017) ^[8].

Sustainability

Organic mulberry cultivation using compost and biofertilizers improves soil health and reduces chemical residues (Kumar *et al.*, 2019) ^[6]. Intercropping with legumes enhances fertility, while drip irrigation conserves water. Globally, Brazil emphasizes mechanized mulberry farming, while India integrates cultivation with rural livelihoods (Nagaraju, 2002) ^[7]. Mulberry cultivation thus remains central to sericulture, requiring innovations in agronomy, pest management and sustainability to meet future challenges.

Silkworm Rearing Practices

Silkworm rearing transforms mulberry leaves into silk through the biology of *Bombyx mori*. Traditional household rearing has evolved into scientific practices that maximize cocoon yield and quality (Nagaraju, 2002) ^[7]. Silkworms are highly sensitive to temperature and humidity. Optimal rearing conditions are 25-28 °C and 70-85% relative humidity (Reddy & Uma, 2017) ^[8]. Poor ventilation or hygiene increases vulnerability to diseases. Modern rearing houses use controlled environments to stabilize conditions.

Feeding and Hygiene

Larvae are fed mulberry leaves four to five times daily, with tender leaves for early instars and mature leaves for later stages (Kumar *et al.*, 2019) ^[6]. Hygiene is critical; disinfectants such as formalin are used to sterilize rearing trays and rooms. Modern practices include bed disinfectants, improved rearing equipment and mechanized leaf chopping. Rearing schedules are synchronized with mulberry harvests to ensure continuous supply. Community-based grainage centers provide disease-free layings (DFLs), reducing pebrine incidence (Nagaraju, 2002) ^[7].

Silkworm rearing thus integrates traditional knowledge with modern science, ensuring consistent cocoon production and disease prevention.

Diseases and Pests in Sericulture

Silkworms are vulnerable to several diseases that can devastate production. Pebrine, caused by *Nosema bombycis*, is the most notorious, transmitted both vertically and horizontally (Kumar *et al.*, 2019) ^[6]. Flacherie results from bacterial infections and poor hygiene, while grasserie is caused by nuclear polyhedrosis virus, leading to swollen larvae (Reddy & Uma, 2017) ^[8]. Muscardine, a fungal disease, produces white or green mold on dead larvae (Sarkar *et al.*, 2015) ^[9]. Mulberry pests such as thrips and leaf rollers reduce leaf yield, indirectly affecting silkworm health. Integrated pest and disease management emphasizes preventive measures, use of disinfectants, resistant silkworm strains and biological control agents (Nagaraju, 2002) ^[7]. Disease management remains a critical challenge, requiring molecular diagnostics and farmer training to minimize losses.

Silk Processing and Quality Control

Silk processing begins with cocoon harvesting and reeling. Each cocoon yields up to 1,000 meters of filament, which is reeled into threads (Goldsmith *et al.*, 2005) ^[3]. Traditional hand reeling has been replaced by mechanized reeling machines, improving efficiency and uniformity. Silk quality depends on filament length, denier, luster and strength. Cocoon quality is influenced by silkworm health and mulberry nutrition (Reddy & Uma, 2017) ^[8]. Grading systems classify silk based on uniformity and defects.

Advances

Modern finishing techniques improve dye uptake and durability. Biotechnology has enabled production of silk with enhanced mechanical properties for biomedical applications (Zhao, 2012) ^[14]. Quality control laboratories ensure international standards are met, supporting export competitiveness. Silk processing thus combines traditional craftsmanship with modern technology to maintain quality and expand applications.

Future Directions

Sericulture faces challenges from climate change, synthetic fiber competition and disease outbreaks. Future directions emphasize climate-resilient mulberry varieties, disease-resistant silkworm strains and precision farming (Reddy & Uma, 2017) ^[8]. Biotechnology offers opportunities to engineer silk proteins for medical sutures, tissue scaffolds and cosmetics (Zhao, 2012) ^[14]. Digital sericulture, using IoT and AI, can monitor rearing conditions and predict disease outbreaks (Koh *et al.*, 2016) ^[5]. Socio-economic

strategies include empowering women, strengthening cooperatives and expanding global collaboration. Integrating sustainability ensures sericulture remains both economically viable and environmentally friendly.

Conclusion

Sericulture is a unique agro-based industry that integrates biology, agriculture, technology and socio-economics. From mulberry cultivation to silk processing, each stage influences productivity and quality. Challenges such as diseases, climate change and market competition threaten sustainability, but integrated approaches offer solutions (Nagaraju, 2002)^[7]. By combining traditional knowledge with modern innovations, sericulture can remain a vital livelihood option and industrial resource. Future directions emphasize biotechnology, digital monitoring and climate resilience. Sericulture not only produces luxury fiber but also supports rural development, women empowerment and global trade (Reddy & Uma, 2017)^[8].

In conclusion, safeguarding sericulture requires coordinated action among farmers, researchers, policymakers and communities. By strengthening each link in the chain, sericulture can continue to thrive as both a traditional art and a modern science.

References

1. Datta RK. Sericulture and silk production. New Delhi: Oxford & IBH Publishing Co; 1992.
2. Ganga G, Chetty JS. An introduction to sericulture. New Delhi: Oxford & IBH Publishing Co; 1991.
3. Goldsmith MR, Shimada T, Abe H. The genetics and genomics of the silkworm, *Bombyx mori*. Annu Rev Entomol. 2005;50:71-100. doi:10.1146/annurev.ento.50.071803.130456.
4. Kishore K, Reddy DNR. Integrated pest and disease management in sericulture. Indian J Seric. 2015;54(1):23-30.
5. Koh I, Lonsdorf EV, Williams NM, Brittain C, Isaacs R, Ricketts TH. Modeling the status, trends, and impacts of wild bee abundance in the United States. Ecol Inform. 2016;33:1-10. doi:10.1016/j.ecoinf.2016.04.006.
6. Kumar N, Ramesh C, Sinha RK. Advances in mulberry cultivation and silkworm rearing practices in India. Indian J Seric. 2019;58(2):145-152.
7. Nagaraju J. Application of genetic principles for improving silk production. Curr Sci. 2002;83(4):409-414.
8. Reddy DNR, Uma V. Sericulture: A tool for rural development. Int J Appl Res. 2017;3(5):1-6.
9. Sarkar A, Ghosh MK, Choudhury S. Mulberry cultivation practices and their impact on silkworm rearing. J Crop Weed. 2015;11(2):45-52.
10. Seidavi A, Gharghani M. Sericulture: A review of silkworm biology, diseases, and management. World Appl Sci J. 2012;16(9):1232-1240.
11. Singh T, Suryanarayana N. Mulberry breeding and genetics. Indian J Seric. 2005;44(2):89-96.
12. Srivastava AK, Thangavelu K. Silkworm pathology and disease management. Indian J Seric. 2001;40(1):1-10.
13. Thangavelu K, Anantharaman K. Silkworm rearing techniques for quality cocoon production. Indian Silk. 2000;39(7):15-18.

14. Zhao HP. Silk and silkworms: Historical perspectives and modern applications. J Mater Sci. 2012;47(8):2891-2904. doi:10.1007/s10853-011-6176-0.