



वस्त्र मंत्रालय  
MINISTRY OF  
TEXTILES



## National Seminar

# Seri Genetic Resources Conservation: Challenges, Innovations and Future Pathways

6 March, 2026

## Book of Abstracts (e-version)



**CSB-Central Sericultural Germplasm Resources Centre**  
Central Silk Board, Ministry Of Textiles, Govt. Of India  
P.B. No.44, Thally Road, Hosur-635 109



**National Seminar**

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Challenges, Innovations and Future Pathways**

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**Organized by  
CSB-Central Sericultural Germplasm Resources Centre  
(CSGRC), Hosur  
Central Silk Board, Ministry of Textiles, Govt. of India**

**Seri Genetic Resources Conservation: Challenges,  
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## **Message**

It gives me a great pleasure to note that CSB–Central Sericultural Germplasm Resources Centre (CSGRC), Hosur, is organizing the National Seminar on “Seri Genetic Resources Conservation: Challenges, Innovations and Future Pathways” on 06<sup>th</sup> March 2026.

The conservation and sustainable use of seri-genetic resources play a pivotal role in resilient sericulture. Being the custodian of invaluable germplasm collection of both mulberry and silkworms, CSGRC safeguards its biodiversity, supports breeding, and drives innovations that enhance productivity and sustainability.

The theme of this seminar is timely, as it addresses the genetic erosion, climate variability, and pest-related challenges through genomic tools, biotechnological advances, bio-prospecting, and AI-driven conservation strategies. Such multidisciplinary dialogue bridges traditional knowledge with modern technology, fostering solutions that are both economically viable and ecologically responsible.

I am confident that this platform will inspire collaboration among researchers, academicians, industry leaders, and young scholars, shaping future policies and strengthening the conservation approaches and hence India can become the global leader in sericulture. I commend the organizing team for their efforts and wish all the success for the seminar.

  
(P. Sivakumar, IFS)

**Dr. S. Manthira Moorthy**  
Director (Technical)  
Central Silk Board  
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### Message

I extend my warm greetings and best wishes for the National Seminar on Seri Genetic Resources Conservation, organized by the Central Sericultural Germplasm Resources Centre (CSGRC), Hosur.

Seri-genetic resources are the backbone of the silk sector, vital for crop improvement, resilience, and diversification. Conserving mulberry germplasm, non-mulberry host plants, and silkworm stocks is essential to sustain breeding and adapt to changing climates. Challenges such as genetic erosion and habitat loss highlight the need for strong *in situ* and *ex situ* conservation supported by modern tools. Advances in genomics, omics-assisted selection, and digital germplasm documentation are accelerating the development of stress-tolerant, high-yielding traits while ensuring long-term preservation. Biotechnological innovations and biomolecule bioprospecting are opening new opportunities beyond textiles, including biomedical and bioeconomic applications. Automation and AI are further enhancing precision and efficiency in germplasm management. Conservation must align with utilization. Stronger integration between repositories, breeding programmes, and stakeholders will ensure diversity translates into tangible gains and sustainable growth.

I am confident this seminar will foster meaningful discourse and collaboration. I congratulate the organizers and wish the event great success.

  
(S. Manthira Moorthy)

**Dr. N. Dhahira Beevi**

Director  
CSB-CSGRC  
Central Silk Board  
Hosur-635 109



**Message**

It gives me immense pleasure to welcome all delegates, scientists, researchers, and students to the National Seminar on “*Seri Genetic Resources Conservation: Challenges, Innovations and Future Pathways*”.

As a national repository of mulberry germplasm and silkworm genetic stocks, CSGRC plays a vital role in safeguarding valuable genetic diversity that underpins breeding programmes, crop improvement initiatives, and long-term sustainability of the silk sector. In the face of climate variability, emerging pests and diseases, and increasing production demands, strengthening genetic resource management has become more critical than ever. At CSGRC, systematic efforts are being undertaken for integration of molecular tools, digital documentation systems, and standardized conservation protocols to enhance the scientific rigor of our repository management.

This seminar offers a vital platform to discuss modern conservation strategies and the role of genomic and biotechnological interventions in sericulture. The focus on bioprospecting and non-textile applications of seri by-products highlights opportunities to expand sericulture into emerging bio-based industries. I am confident that the deliberations during this seminar will foster collaborative research, promote innovative conservation strategies, and strengthen linkages among germplasm centres, breeding institutions, and industry stakeholders. I wish the seminar great success and meaningful scientific outcomes.

  
(N. Dhahira Beevi)

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**Lead papers**

## **LP01: Plant Genetic Resources Conservation: Approaches and Biotech Innovations in Conservation for Future Food and Nutrition Security**

Gowthami R<sup>1\*</sup>, Pranusha P<sup>1</sup>, Parameswari B<sup>1</sup>, Saravanan L<sup>1</sup>, and Celia Chalam V<sup>2</sup>

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### **Abstract**

Plant genetic resources (PGR) constitute the biological foundation of global agricultural systems and are essential for ensuring food and nutritional security. This rich diversity constitutes a vast genetic reservoir of adaptive traits including resistance to biotic and abiotic stresses that are critical for future crop improvement. Despite its inherent value, this genetic wealth is facing unprecedented threats due to anthropogenic pressures, habitat degradation, overharvesting of resources, impacts of climate change, and genetic erosion, which has created an urgent imperative for systematic and robust conservation action. *In situ* conservation is the primary method for protecting species diversity and evolutionary potential in natural habitats, but it is increasingly threatened by habitat loss and climate change. Complementary *ex situ* conservation, specifically through seed genebanks, therefore offers a vital and effective alternative for species exhibiting orthodox seed storage behaviour. However, this approach fails for many species, including those with recalcitrant (desiccation-sensitive) seeds, vegetatively propagated crops, threatened species and orthodox-seeded species with inherently short storage lifespans. For these "difficult-to- conserve" species, field genebanks provide a practical alternative by maintaining living collections, though this method is resource-intensive and exposes germplasm to environmental hazards, pests, and diseases. Biotechnological techniques such as *in vitro* and cryogenic conservation address these challenges. *In vitro* methods enable space-efficient storage and rapid multiplication under slow-growth conditions, while cryopreservation in liquid nitrogen (-196 °C) halts metabolism for indefinite, genetically stable preservation. Biotechnological integration over the past three decades has revolutionized PGR management, enhancing processes from collection to utilization ensuring safe conservation of PGRs worldwide.

**Keywords:** Plant genetic resources; genebanks; in-situ conservation

## **LP02: CONSERVATION ASPECTS OF MULBERRY HOST PLANT GERMPLASM**

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### **Abstract**

Mulberry (*Morus* spp.) germplasm conservation is fundamental to sustaining sericulture, as mulberry serves as the exclusive host plant of the silkworm *Bombyx mori*. Modern agricultural intensification and the widespread adoption of genetically uniform, high-yielding varieties have narrowed the genetic base, accelerating erosion and increasing vulnerability to pests, diseases, and climatic stresses. India, recognized as a centre of mulberry diversity, has assumed a strategic role in safeguarding seri-genetic resources through coordinated national efforts. Ex situ repositories such as the Central Sericultural Research and Training Institute (CSRTI), Berhampore, which maintains 354 accessions, and the Central Sericultural Germplasm Resources Centre (CSGRC), Hosur, which conserves 1,317 accessions from 29 countries, provide a robust foundation for crop improvement. These collections encompass indigenous landraces, exotic introductions, elite clones, and tetraploids, ensuring broad genetic variability for breeding programmes.

Conservation strategies integrate in situ approaches, including protection of wild species in biosphere reserves and culturally revered sacred groves, with ex situ methods such as field gene banks, on-farm conservation, in vitro repositories, and cryopreservation. Field gene banks remain central to long-term conservation, while in vitro and cryogenic techniques offer secure, space-efficient backups for elite and rare genotypes. Molecular tools, genomic characterization, and AI-based systems further enhance accuracy in accession management, reduce risks of genetic contamination, and facilitate efficient utilization. Collectively, these measures safeguard genetic integrity, ensure accessibility of germplasm, and provide diverse parental material for developing improved mulberry varieties with higher leaf yield, nutritional quality, adaptability, and resilience.

By combining traditional practices with modern biotechnological interventions, India's conservation framework strengthens the resilience of the sericulture sector. These efforts not only secure the genetic base of

mulberry but also support sustainable silk production, contributing to biodiversity conservation and long-term economic stability in sericulture-dependent regions.

**Keywords:** mulberry germplasm; sericulture; *in-situ* conservation; cryopreservation, biodiversity

### **LP03: Conservation of Tropical Tasar Silkworm and it's Host Plants**

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#### **Abstract**

The tropical tasar silkworm *Antheraea mylitta* represents one of the most genetically diverse silk-producing insects, comprising numerous ecologically adapted populations known as ecoraces. These ecoraces form the biological foundation of forest-based tasar sericulture in India and support the livelihoods of tribal and forest-dependent communities. However, rapid habitat degradation, climate variability, overexploitation of cocoons, and genetic erosion caused by replacement with cultivated stocks have resulted in the decline of several wild ecoraces. Conservation of these genetic resources is therefore essential for sustaining biodiversity and ensuring long-term stability of tasar sericulture. Tasar sericulture is a forest-based livelihood system dependent on the quality and availability of host plants supporting the tropical tasar silkworm (*Antheraea mylitta*). Among various host species, *Terminalia arjuna* and *Terminalia tomentosa* constitute the primary nutritional base determining silkworm growth, cocoon yield, and silk quality. Increasing climatic variability, degradation of forest ecosystems, and limited availability of genetically superior planting material pose serious challenges to sustainable tasar production.

This paper reviews major threats affecting tropical tasar ecoraces and discusses integrated conservation strategies emphasizing in situ habitat protection supported by eco-compatible grainage, natural regeneration techniques, and participatory management. Field-operational conservation models developed for major ecoraces such as Raily, Modal, Laria, and Sarihan demonstrate that location-specific interventions can restore populations while preserving genetic integrity. Complementary ex situ conservation and cryogenic preservation approaches are also highlighted. The study underscores that conservation of tasar ecoraces is not merely an agricultural concern but an applied biodiversity strategy linking forest ecology, rural livelihoods, and genetic resource management under changing climatic conditions. This paper also synthesizes research undertaken at CSB-CTRIT, Ranchi, focusing on host plant germplasm conservation, characterization, and genetic improvement. Approaches including germplasm exploration, morphological and biochemical

characterization, vegetative propagation, and breeding strategies are discussed. The paper highlights progress in identifying elite accessions with improved leaf yield and drought tolerance and outlines future strategies integrating molecular tools, climate-resilient breeding, and community-based conservation. Strengthening host plant resources is essential for improving tasar productivity, enhancing farmer livelihoods, and ensuring ecological sustainability.

**Keywords:** Tasar sericulture, silkworm ecoraces, host plants, conservation and genetic improvement

## **LP04: Conservation and Genetic Improvement of Eri and Muga Resources: Status, Constraints, and Future Pathways**

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### **Abstract**

India occupies a singular and globally exclusive position in the production of Vanya silks, particularly Muga silk (*Antheraea assamensis*) and Eri silk (*Samia ricini*), which are deeply embedded in the ecological, cultural, and livelihood fabric of the North Eastern Region (NER). Unlike mulberry silk, Vanya silks are forest-linked bioresources dependent on perennial host plants and region-specific silkworm ecoraces. Their sustainability is intrinsically linked to the conservation of genetic diversity at two biological levels: (i) silkworm germplasm and (ii) host plant genetic resources. However, rapid habitat erosion, climate variability, narrow genetic base, propagation constraints in perennial hosts, and limited molecular characterization threaten long-term resilience. This paper critically reviews the present status of Eri and Muga genetic resources, identifies structural and biological constraints, and proposes an integrated conservation and genetic improvement framework combining classical breeding, biotechnological tools, participatory conservation, and institutional strengthening.

**Keywords:** Muga; Eri; silkworm germplasm; host plant;

# Theme 1

## Conservation Strategies for Sustainable Utilization of Seri-Genetic Resources



## **T1O1: Tasar Host Plant Conservation, Characterization, and Genetic Improvement: Present Status and Future Strategies**

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### **Abstract**

The Tasar silk industry in India is experiencing dynamic transformation in response to shifting market requirements, climate variability, and increasing emphasis on sustainable sericulture practices. *Terminalia arjuna* and *Terminalia tomentosa*, the principal host plants of the tropical Tasar silkworm (*Antheraea mylitta*), play a pivotal role in sustaining cocoon quality and overall productivity. This paper provides a comprehensive synthesis of germplasm-based research initiatives undertaken at CSB-Central Tasar Research and Training Institute (CTRТИ), Ranchi, focusing on the genetic improvement and conservation of these economically important host species. The research framework includes germplasm exploration and characterization, clonal multiplication, in vitro regeneration, evaluation of tolerance to biotic and abiotic stresses, biochemical profiling, and breeding for enhanced yield and quality traits. The outcomes of these efforts hold significant potential for strengthening plant breeding programs, supporting conservation strategies, and improving commercial utilization of Tasar host plants. The paper further outlines targeted breeding strategies aimed at enhancing drought tolerance, disease resistance, leaf productivity, and nutritional quality, integrating both conventional and modern breeding approaches, and offers recommendations to guide future host-plant improvement programs.

**Keywords:** Tasar culture, *Terminalia* sp, Morphological characterization

## **T1O2: Safeguarding the Indigenous Silk Heritage: Conservation of Muga and Eri Seri Genetic Resources in North-East India-A Review**

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### **Abstract**

Muga and eri silkworms represent the living heritage of sericulture in the North-Eastern region of India, deeply embedded in the culture, ecology, and livelihoods of indigenous communities. Despite their ecological and economic significance, the seri genetic resources associated with these silkworms are increasingly vulnerable to environmental change, shrinking host plant habitats, and the gradual erosion of traditional conservation practices. This review qualitatively examines the conservation status of muga and eri seri genetic resources by drawing upon existing literature, field experiences, and community-based knowledge systems. It explores how traditional practices, institutional efforts, and recent scientific interventions interact to influence conservation outcomes. The review further reflects on emerging challenges and opportunities, highlighting the need for participatory, location-specific, and future-ready conservation approaches. By focusing on muga and eri silkworms, the paper underscores the importance of safeguarding seri genetic resources not only as biological assets but also as carriers of cultural identity and sustainable livelihoods in North-East India.

**Keywords:** Muga and Eri silkworm, Host plant, Genetic conservation, North-East India

### **T103: Ericulture as a Catalyst for Forest Conservation: Leveraging Biodiversity for Sustainable Rural Livelihoods**

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#### **Abstract**

Current estimates place global species diversity at approximately 1.75 million described species out of a potential 12 to 100 million, with insects representing the largest group at 950,000 described species. Despite its immense value, this biodiversity is increasingly threatened by anthropogenic interventions, including land-use changes, habitat fragmentation, nutrient enrichment, and environmental pollutants. These stressors reduce biological diversity across all levels—genetic, species, and community—and disrupt essential functional roles. According to the Food and Agriculture Organization (FAO), approximately 13 million hectares of forest are lost annually to land conversion.

The non-mulberry (Vanya) silk industry is uniquely vulnerable to this crisis as it relies heavily on forest ecosystem productivity. Vanya silkworm germplasm consists of various idiotypes and wild counterparts characterized by strong endemism; consequently, their metapopulation structures are highly sensitive to deforestation, habitat fragmentation, and climate change. North East India serves as a critical hotspot for seri-biodiversity, hosting diverse forest-based food plants and sericigenous insects that support sustainable rural livelihoods and poverty alleviation. As the world's second-largest silk producer, India contributes about 43% to global raw silk production, providing employment to 9.7 million people, primarily women.

This paper evaluates the status of wild silkworm germplasm and associated food plants in Northeast India. Furthermore, the study documents the prospects for the commercial exploitation of perennial forest trees, specifically *Borpat* (*Ailanthus grandis*) and *Borkesseru* (*Ailanthus excelsa*), within the Eri silk sector. Finally, we propose realistic intervention frameworks and strategic approaches for both the short-term and long-term conservation and sustainable commercial utilization of Vanya silk bio-resources.

**Keywords:** Vanya silk, conservation, Eri silkworm, forest ecosystems, bio-resources, Northeast India.

#### **T104: Polyploidy shapes functional traits in mulberry: an implication for tree plant conservation and utilization**

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#### **Abstract**

Mulberry (*Morus* spp.), a widely distributed woody plants in both natural and managed landscapes, exhibits exceptional cytogenetic diversity, with chromosome numbers ranging from  $2n = 14$  to  $2n = 308$ . Such extensive ploidy variation offers a rare opportunity to understand how polyploidy expansion shapes functional traits critical for forest conservation, tree improvement, and climate-resilient biomass production.

We studied the influence of different cytotypes (2x, 3x, 4x, 6x, and 22x) on morpho-anatomical and biomass-related traits, emphasizing parameters linked to cell division, cell size, resource-use efficiency, and leaf productivity. Principal Component Analysis (PCA) indicates that tetraploids express the most favorable combination of traits balanced growth, higher leaf mass per area (LMA), and optimal stomatal characteristics suggesting enhanced adaptive performance under variable environmental conditions. In contrast, higher polyploids (hexaploid to 22-ploid) exhibit trait downsizing and rate-limited growth attributes, reflecting biophysical boundaries imposed by genome enlargement.

These patterns imply a trade-off: while moderate polyploidy promotes structural robustness and improved physiological potential, excessive ploidy may compromise growth efficiency. This work underscores the importance of cytotype benchmarking for (i) conserving genetically diverse mulberry germplasm, (ii) selecting climate-resilient planting material for agroforestry and reforestation programs, and (iii) optimizing resource-efficient tree varieties for sustainable landscape management. By linking cytogenetic variation with functional trait performance, the study provides a novel framework for integrating polyploidy biology into forest conservation strategies and climate-adaptive tree management.

**Keywords:** Polyploidy, Cytotype, Functional Traits, *Morus* spp., PCA.

## **T105: Evaluation of high yielding and low temperature stress tolerant mulberry genotypes for yield characters and through bioassay studies**

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### **Abstract**

Silkworm *Bombyx mori* L. is an economically important insect used for silk production being a monophagous insect feeds solely on mulberry leaves (*Morus* spp.). Mulberry leaves with superior quality and higher yield are the essential requirements for quality cocoon production. Evaluation of high yielding mulberry varieties is mainly based on indirect selection for yield and growth characters. The present study comprising two high yielding low temperature stress tolerant mulberry genotypes *viz.*, C-2060 and C-2065 along with two check varieties S-146 and C-2038 were planted and maintained in Randomized block design at Regional Sericultural Research Station, Central Silk Board, Miran Sahib, Jammu. All the mulberry genotypes were evaluated for various growth, leaf yield and quality parameters during Spring season 2024 under sub-tropical conditions of Jammu. Analysis of variance for growth and yield contributing characters showed highly significant differences among the genotypes. Among the genotypes, leaf yield per plant was highest in C-2065 (0.703 kg) followed by C-2060 (0.617 kg) and out performed as compared to both check varieties. Similarly, C-2065 recorded highest number of primary shoots per plant (21), length of longest shoot (101 cm), number of leaves per meter of shoot length (17), weight of ten fresh leaves (35.40 g) and leaf moisture content (73.22%) followed by C-2060 and out performed as compared to both check varieties S-146 and C-2038. Further, all the genotypes were also evaluated for rearing performance through bioassay using FC1xFC2 silkworm hybrid during Spring season 2024. Bioassay experiment was conducted in completely randomized design (CRD) with three replications. All the mulberry genotypes exhibited significant difference in all the rearing parameters recorded. Among the genotypes, C-2065 mulberry genotype performed better by recording maximum mature larval weight (60.00 g /10 larva), single cocoon weight (2.07 g), shell weight (0.42 g), shell ratio (20.45%) and ERR (97.33%) followed by C-2060 as compared to the check

varieties S-146 and C-2038. Based on this evaluation study, C-2065 mulberry genotype has emerged as best performing genotype with respect to different growth, yield and quality characters and also in bioassay studies as compared to check varieties, which may be commercially exploited for production of higher leaf yield and better quality mulberry leaves under sub-tropical conditions of Northern India.

**Key words:** mulberry, silkworm (*Bombyx mori* L.), leaf yield, bioassay, sub-tropical.

## **T106: Plant Tissue Culture–Based Strategies for Mulberry Genetic Resource Conservation and Improvement**

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### **Abstract**

Mulberry (*Morus* spp.) represents a vital genetic resource for sericulture, serving as the sole food source for the silkworm (*Bombyx mori*). Conservation and genetic improvement of mulberry germplasm with enhanced growth, disease resistance, and superior nutritional quality are critical for sustainable sericulture. In this context, plant tissue culture–based strategies offer effective tools for the conservation, rapid multiplication, and genetic enhancement of mulberry genetic resources. At CSR&TI, Pampore, systematic biotechnological interventions were undertaken under three CSB-coded projects (PIB-3571, PIE03012SI, and PIC03014SI) to strengthen mulberry genetic resource conservation and improvement. Through somatic hybridization technology, three promising somatic hybrid combinations were developed, namely SH1 (PPR1 - Ichinose), SH2 (PPR1 - Chinese White), and SH3 (PPR1 - PPR1). The regenerated somatic hybrids were successfully hardened and transferred to field conditions at CSR&TI, Pampore, during 2021. The evolved somatic hybrids are being evaluated under Preliminary Yield Trials (PYT) from 2022 to 2025 for key agronomic and quality attributes, including sprouting behavior, rooting ability, leaf yield, leaf quality, and leaf palatability, assessed through silkworm bioassay studies. Parallely, efficient micropropagation protocols were standardized for the rapid multiplication and conservation of elite mulberry genotypes adapted to temperate regions, namely PPR-1, Goshorami, Chinese White, and Ichinose. Genetic fidelity of *in vitro*-raised plantlets was confirmed using molecular marker-based analyses, ensuring true-to-type propagation of ruling mulberry varieties. Further advancements achieved through *in vitro* culture approaches included somatic embryogenesis from leaf, node, and seed explants, direct organogenesis from petiole explants, *in vitro* seed germination, and chemical mutagen-based *in vitro* mutagenesis. Collectively, these plant tissue culture–based interventions significantly

contributed to the conservation and utilization of mulberry genetic resources, development of somatic hybrids, and standardization of *in vitro* protocols, thereby offering sustainable pathways for future mulberry improvement and sericulture development.

**Keywords:** Genetic Fidelity, *In vitro* Mutagenesis, Mulberry, Somatic Embryogenesis, Somatic Hybridization.

## **T1P1: Genetic Divergence and Strategic Conservation of Temperate Silkworm (*Bombyx mori* L.) Germplasm in Kashmir Valley**

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### **Abstract**

The conservation of genetic diversity is fundamental to the resilience and productivity of temperate sericulture. The CSB-Central Sericultural Research & Training Institute (CSRTI), Pampore, serves as a critical national repository, maintaining a specialized collection of 111 bivoltine silkworm genotypes. This study presents a comprehensive evaluation of these resources, focusing on key economically important traits including fecundity, larval duration, cocoon yield, shell weight, shell ratio, and pupal weight. To uncover meaningful patterns and natural groupings within the biological dataset, a multi-pronged statistical approach was employed. This included dimensionality reduction via Principal Component Analysis (PCA) and Ward's Hierarchical Clustering. The PCA effectively visualized the dispersion of races in multivariate space, with the first two principal components explaining 75.9 % of the total variance. The systematic biometric profiling provides a high-resolution roadmap for targeted breeding programs, ensuring the selection of elite genetic resources to enhance the productivity and sustainability of temperate sericulture in North India.

**Keywords:** *Bombyx mori*, Germplasm Conservation, PCA, Ward's Clustering, K-means, Bivoltine, Phenotypic Variance, CSRTI Pampore.

## **T1P2: Conservation Strategies for Sustainable Utilization of Muga (*Antheraea assamensis*) Genetic Resources with Special Reference to Cooler Zones and Nucleus Stock Maintenance**

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### **Abstract**

Muga silk, produced by the endemic silkworm *Antheraea assamensis*, represents a unique genetic and cultural resource of India but faces increasing threats from climate change, habitat shrinkage, and inbreeding depression. As a mono-racial species with narrow ecological amplitude, muga is highly sensitive to environmental stress, resulting in declining seed quality, reduced larval vigour, and unstable cocoon productivity in traditional rearing belts. The present study synthesizes recent conservation-oriented interventions undertaken by the Central Silk Board (CSB) and Muga Eri Silkworm Seed Organization (MESSO), with special emphasis on in situ conservation in cooler zones and systematic strengthening of P-4 nucleus stock. Empirical data from Kalimpong and allied cooler regions during 2023–2025 demonstrate a progressive increase in nucleus & basic seed production (from 5.3 kg to 18.5 kg), accompanied by higher fecundity, improved hatching percentage, superior cocoon traits, and reduced disease incidence. Comparative analysis between wild and conserved populations reveals that cooler-zone rearing facilitates re-expression of adaptive traits through Genotype × Environment (G×E) interaction, thereby mitigating inbreeding depression and enhancing physiological resilience. Ex situ conservation in forest and hill ecosystems further contributes to periodic genetic rejuvenation of nucleus stocks. The study highlights the critical role of host plant diversity and avoidance of monoculture in sustaining larval nutrition and ecological stability. Overall, the findings establish that integrated in situ–ex situ conservation combined with strategic P-4 stock maintenance in cooler zones provides a scientifically robust and economically viable pathway for long-term sustainability of muga sericulture under changing climatic scenarios.

**Keywords:** Muga silkworm, Genetic conservation, Cooler zones, P-4 stock, G×E interaction, Climate change, Monoculture, Sustainable sericulture

### **T1P3: Integrative Multi-Dimensional Assessment of Genotypic Stability for Sustaining Bivoltine Sericulture in Ecologically Sensitive Zones**

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#### **Abstract**

Escalating climate change in the North-West Sub-Himalayas poses a severe threat to the conservation and utilization of *Bombyx mori* genetic resources. Traditional germplasm characterization, historically anchored in static yield assessments, often fails to capture the phenotypic plasticity required to withstand the region's transient thermal-humidity stress. This study presents an integrative multi-dimensional stability assessment of Bivoltine Parental Breeding Stock (PBS) at RSRS Sahaspur, utilizing rearing data averaged over three years (2023–2025). Genotypic performance was evaluated across Spring and Autumn crop seasons using a composite framework comprising Evaluation Index (EI) modeling, Geometric Mean Productivity (GMP), Stress Susceptibility Index (SSI), and a derived Conservation Priority Index (CPI). While breeds like CSR2 dominated the favorable Spring season with a cocoon yield of 16.39 kg/10,000 larvae, they displayed significant sensitivity to autumnal stress, recording a positive SSI of 0.76. Conversely, the regionally adapted SH6 exhibited a rare negative SSI (-0.19), indicating superior homeostatic control where productivity marginally increased to 16.20 kg under stress conditions. This resilience was further validated by a top-ranking Conservation Priority Index (CPI) score of 66.99. Additionally, lines like PAM-DR-12 demonstrated high geometric stability, effectively bridging the yield gap. Based on these findings, we propose a "Risk-Adjusted Dual-Pathway Strategy" for the Doon Valley: prioritizing high-input breeds for the Spring commercial sector while mandating homeostatic genotypes for the Autumn stability sector. This integrative biometrical framework offers a robust roadmap for climate-smart breeding and germplasm deployment, ensuring long-term productivity, conservation value, and economic resilience of sericulture under escalating environmental uncertainty.

**Keywords:** *Bombyx mori*, climate resilience, phenotypic stability, stress susceptibility index, germplasm conservation

#### **T1P4: Effect of feeding diafenthiuron 50 % WP sprayed mulberry leaves on reproductive performance of *Bombyx mori* L.**

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#### **Abstract**

Mulberry is the sole food plant for silkworm, *Bombyx mori* L., and significantly influences their health and performance. However, it is susceptible to pests such as thrips and mites, causing crop losses and reduced leaf quality. Management of such pests is imperative for sustained productivity of quality silk, which necessitates the use of pesticides. However, pesticide residues on leaves can adversely affect silkworms, impairing their growth, productivity, cocoon quality and reproductive traits. This can be mitigated by following a safe waiting period. The present study evaluated the bio-efficacy of diafenthiuron 50 % WP against thrips and mites in mulberry and its impact on the grainage performance of *B. mori* during 2023-2024 at the Department of Sericulture, College of Agriculture, GKVK. Mulberry leaves harvested at 15 and 20 days after spray (DAS) were used to rear the parental lines of *B. mori*, and various grainage parameters were recorded. The larval batch fed with leaves harvested at 20 DAS resulted in superior grainage performance, as evidenced by higher pupation rate (97.96 %), increased pupal weight (1.24 g), higher fecundity (530.30 No.), greater weight of 100 eggs (57.73 mg), improved egg recovery (54.66 g/kg of cocoons) and hatching percentage (97.33 %) along with reduced egg retention in ovary (4.11 %), minimal dead (2.32 %) and unfertilized eggs (0.64 %). Among the breeds evaluated, the multivoltine pure breed PM showed consistently better grainage performance at both 15 and 20 DAS, indicating its robustness, while the bivoltine parental breeds (CSR2, FC1, and FC2) performed well at 20 DAS.

**Keywords:** mulberry pests; *Bombyx mori*; bio-efficacy;

## **T1P5: An Innovative approach for improving the mechanical properties of silk fiber by biofortification of Cu<sup>2+</sup> into silkworm *Bombyx mori* (Lepidoptera: Bombycidae)**

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### **ABSTRACT**

Silk fibers of Mulberry silkworm (*Bombyx mori* L.) are receiving significant attention for various functional textiles and biomaterials due to their outstanding mechanical properties, biocompatibility, and degradable characteristics. Currently, incredible efforts have been made to enhance or functionalized silk fibers or silkworm cocoons through various physical, chemical and biological processes. A direct feeding with biofortification of metal ions is a green and sustainable in-situ functionalization approach to modify silk fibers. In this study, copper (metal ion) was investigated to understand their impact on mechanical properties of silkworm. The mulberry leaves were bio-fortified with copper in the form of copper chloride with concentrations of 0.1%, 0.2%, 0.3%, and 0.5% and directly fed to silkworm. The maximum improvement was recorded in case of tensile strength and young's modulus of ~28.68 and ~14.28%, respectively, when the mulberry leaves were fortified by 0.1% of Cu<sup>2+</sup> ion concentration. Further, there was decrease in elongation and diameter of ~33.55 and ~16.68 %, respectively of fiber at 0.1% of Cu<sup>2+</sup> ion concentration. The overall improvement in case of tensile strength and young's modulus was noticed ~19.31 and ~12.72%, respectively as compared to control group. In this study, it has been observed that lower concentrations *i.e.*, 0.1 and 0.2% are more prominent as compared to higher concentration *i.e.*, 0.3 and 0.5% of Cu<sup>2+</sup> ions. These findings suggested that Cu<sup>2+</sup> ions could be a promising target to modify the mechanical properties of silk fibers and provides a green and effective approach to produce mechanically enhanced silk fibers with high strength on a large scale.

**Keywords:** Biofortification, Biomaterial, Copper Ions, Silkworm, Tensile Strength

## **T1P6: Effectiveness of foliar spray of calcium and magnesium on silkworm (*Bombyx mori* L.) rearing and grainage parameters**

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### **Abstract**

The present investigation on impact of foliar spray of calcium and magnesium on economic traits of *Bombyx mori* L. during summer in Kashmir was carried out at Temperate Sericulture Research Institute, Mirgund which is located at 3417 N latitude and 7517 E longitude at an elevation of 1587m above mean sea level. Calcium chloride and magnesium sulphate were used as foliar spray for supplementing calcium and magnesium. The experiment consisted of separate and combined foliar application of calcium and magnesium and one control. Goshoerami variety was taken as mulberry variety. Experiment was laid in CRD with three replications. Foliar Spray was done twice, first one month after June pruning and second 15 days after first spray. Calcium as well as magnesium was sprayed in 2 concentrations viz, 0.2% and 0.4%. The combined spray of calcium and magnesium was done at 4 concentrations viz, 0.2% Ca+0.2%Mg, 0.2% Ca+0.4%Mg, 0.4% Ca+0.2% Mg and 0.4%Ca+0.4%Mg. All treatments exhibited improvement in almost all parameters over control. Combined spray of 0.4%calcium and 0.2%magnesium (T8) resulted in significant increase in larval weight and pupation rate recording maximum values of 42.97 and 98%. Increased in these parameters over control was recorded to the extent of 18.00 and 15.54, percent respectively. Reduction in defective cocoon percentage was recorded to the extent of 86.88%, through combined spray of 0.4% Ca and 0.2%Mg. The study revealed that combined spray of calcium and magnesium (0.4%Ca+0.2%Mg) had significant influence on imperative rearing parameters during summer rearing, thus paving way for popularization of second commercial rearing through combined spray of calcium and magnesium as foliar spray.

**Keywords:** Foliar Spray, Cocoon, Nutrients, Rearing, Silkworm, Mulberry.

## T1P7: *Cricula trifenestrata* Helfer an Additional Wild-Silk Source for India: Exploring New Horizons of Vanya Silks

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### Abstract

*Cricula trifenestrata* Helfer (Saturniidae) is a widely distributed wild silk moth traditionally regarded as an agricultural pest in South and Southeast Asia. Nevertheless, it produces lustrous golden cocoons possessing notable biomaterial and commercial potential. In view of the growing interest in diversification of vanya silk resources, the present study evaluated the scope of *Cricula trifenestrata* as an additional wild silk source and examined the technical feasibility of blending its spun silk with Muga (*Antheraea assamensis*) and other natural silks. The investigation was based on empirical observations of life-history traits and detailed assessment of post-cocoon metrics. The study also emphasizes sustainable cultivation practices and pest-to-product strategies to integrate *Cricula* into rural livelihood systems while minimizing crop damage. The results revealed significant sexual dimorphism in cocoon characteristics. Female cocoon weight ( $2.68 \pm 0.13$  g) was significantly higher than that of males ( $1.50 \pm 0.12$  g) ( $t = 14.75$ ,  $p < 0.001$ ), whereas shell ratio did not differ significantly between sexes. Open-ended cocoons facilitated successful motorized spinning, yielding 350–420 m of filament per cocoon. Total staple fibre length was significantly greater in females ( $403 \pm 12.04$  m) compared to males ( $368 \pm 19.24$  m) ( $t = 3.45$ ,  $p < 0.01$ ). The average non-breakable filament length was 3.24 m in females and 3.02 m in males, indicating comparable reeling continuity. However, certain constraints were identified, including pigment loss during conventional degumming, the necessity of spun-yarn processing instead of conventional reeling, host plant management challenges, and the need for quality standardization. Post-cocoon performance metrics indicate that *Cricula* should be considered primarily as a spun-silk resource and as a promising blending material for mulberry and non-mulberry by-product

sectors. Its industrial utilization is therefore better suited for spun yarn-based products such as felts, knitted blends and artisanal woven fabrics rather than pure reeled-silk textiles. The study proposes practical blending strategies, standardized experimental protocols and socio-economic pilot models to facilitate the systematic integration of *Cricula* into India's vanya silk value chain.

**Keywords:** *Cricula trifenestrata*, vanya, spun, silk, blending, sustainability, sericulture.

## **T1P8: Influence of leaf morphology and biochemical constituents on thrips resistance in mulberry**

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### **Abstract**

An investigation on “Screening of Mulberry (*Morus*) Germplasm for Thrips Infestation” was undertaken during 2024–25 at UAS, Bengaluru, with a focus on identifying key morphological and biochemical traits associated with thrips resistance. Based on field screening of one hundred accessions for thrips infestation, contrasting moderately resistant (ME-86, ME-01, ME-52 and M-66) and highly susceptible (MI-79, MI-524, MI-517, MI-32 and MR-2) accessions were selected for morphological and biochemical trait analysis. Significant variability was observed in leaf morphological features that directly influenced thrips infestation. Moderately resistant accessions consistently exhibited narrow primary (1.30–1.45 cm), secondary (0.85–1.10 cm) and tertiary veinlet spacing (0.45–0.55 cm), which reduced interveinal area and restricted thrips movement. In contrast, susceptible accessions recorded substantially wider veinlet spacing (primary >2.0 cm, secondary >1.60 cm, tertiary >0.90 cm), providing a favourable surface for pest colonization. Trichome characteristics were also strongly associated with resistance. Moderately resistant accessions possessed high trichome density (95.4–99.2 hairs/cm<sup>2</sup>) and short trichomes (112.02–121.01 µm), forming an effective physical barrier against feeding. Highly susceptible accessions displayed lower trichome density (68.7–85.2 hairs/cm<sup>2</sup>) and longer trichomes (153.31–185.07 µm), resulting in reduced protection and enhanced vulnerability to thrips. Biochemical analysis further revealed distinct differences between moderately resistant and susceptible groups. Moderately resistant accessions maintained higher total chlorophyll content, indicating reduced physiological stress under infestation. Similarly, leaf moisture, protein, carbohydrate, nitrogen and potassium levels were better conserved in moderately resistant accessions, whereas susceptible accessions recorded greater reductions. Defensive compounds such as phenols and tannins were consistently higher in resistant accessions, contributing to biochemical resistance by deterring feeding and suppressing pest development. Based on this study it establishes that a combination of narrow veinlet spacing, dense short trichomes, and enhanced biochemical defence compounds play a crucial role in conferring thrips resistance in mulberry.

**Keywords:** Biochemical constituents, Chlorophyll content, Leaf nutrients, Mulberry, Phenols, Pest tolerance, Tannins, Thrips resistance, Trichome density, Veinlet spacing

## **T1P9: Integrating endophyte profiling with biophysical evaluation of mulberry varieties for sustainable sericulture**

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### **ABSTRACT**

Mulberry (*Morus* spp.) serves as the exclusive food source for the silkworm, *Bombyx mori* L., and its biophysical traits critically determine silkworm growth and cocoon productivity. In recent years, plant-associated endophytes have emerged as key modulators of host plant growth, physiology and nutritional quality. The present study examined the relationship between biophysical characteristics of eight mulberry varieties and their associated bacterial and fungal endophytes. Significant variation was observed among mulberry varieties with respect to total shoot length, number of shoots, leaf number, leaf area, leaf yield, shoot yield and leaf to shoot ratio. High-yielding varieties such as G4, G2 and V1 recorded superior shoot and leaf yields, while traditional varieties like Mysore Local and DD exhibited comparatively moderate growth parameters. Endophytic isolation revealed the predominance of four microbial genera, namely *Bacillus*, *Trichoderma*, *Aspergillus* and *Fusarium*, exhibiting distinct variety and tissue-specific colonization patterns. Varieties Sahana, S36 and V1, which showed balanced leaf yield and higher leaf-to-shoot ratios, were consistently associated with *Bacillus* spp. in both leaf and shoot tissues. This association suggests a positive linkage between bacterial endophyte colonization and improved leaf physiology. High biomass-producing varieties such as G2 and G4 harboured *Trichoderma* spp., known for their plant growth promoting and biocontrol attributes, indicating their role in enhancing shoot biomass and leaf area. Conversely, Mysore Local and DD, which exhibited moderate biophysical performance, were predominantly colonized by *Aspergillus* spp., reflecting a functional association with nutrient mobilization rather than aggressive growth promotion. Limited colonization by *Fusarium* spp. in AR12 and G4 was restricted to shoot tissues, suggesting an endophytic rather than pathogenic interaction. Beneficial endophytes such as *Bacillus* and *Trichoderma* appear to support superior growth and leaf quality, ultimately influencing silkworm performance and cocoon traits. These findings highlight the importance of integrating endophyte profiling with varietal selection in sustainable sericulture systems.

**Keywords:** Mulberry; endophytes; biophysical characters, bacterial and fungal diversity; *Bacillus*; *Trichoderma*; sustainable sericulture

## **T1P10: Conserving and utilizing silkworm germplasm for increased silk yield and environmental adaptation in subtropical region of Jammu and Kashmir**

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### **Abstract**

A crucial genetic resource for maintaining silk production, enhancing cocoon quality and bolstering sericulture's adaptability to shifting environmental conditions is silkworm germplasm. Because the domesticated silkworm, *Bombyx mori* L., is extremely sensitive to changes in the environment, it is crucial to conserve and use genetic resources scientifically in order to maintain stable production, especially in subtropical areas like Jammu and Kashmir where crop performance is greatly impacted by seasonal variability. The identification of strains with desired adaptive and economic features, such as disease resistance, environmental stress tolerance and increased silk yield potential, is made possible by the methodical conservation and evaluation of silkworm germplasm. Assessing germplasm under local agroclimatic conditions offers chances to find genetic resources that are adaptive and can help create breeding plans tailored to a particular area. These initiatives support the preservation of genetic diversity, which is the basis for sericulture's long-term genetic advancement and sustainability. The growing influence of climate variability on silkworm rearing makes it more crucial to integrate germplasm conservation and exploitation in subtropical ecosystems. Identification of germplasm with potential tolerance to biotic and abiotic challenges is made easier by characterization using morphological and biological data, which are bolstered by new analytical techniques. Better breed selection, increased cocoon yield and increased livelihood security for sericulture producers are all facilitated by the efficient use of these resources. For the long-term preservation of genetic resources, the study highlights the necessity of bolstering conservation measures through methodical documentation, assessment and use of contemporary techniques. Expanding the genetic base, encouraging the use of adapted germplasm and creating climate-resilient sericulture models appropriate for subtropical regions are some future views. Thus, the preservation and wise application of silkworm germplasm are essential to maintaining sustainable silk production and fostering the growth of farmer-oriented sericulture in Jammu and Kashmir.

**Keywords:** Silkworm germplasm, *Bombyx mori*, Germplasm conservation, Silk productivity, Environmental adaptation, Subtropical sericulture.

## **T1P11: Impact of monsoon dynamics on population stability and conservation of the Raily ecorace**

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### **Abstract**

The Raily ecorace of the tropical tasar silkworm, *Antheraea mylitta* D., is an important serigenetic resource endemic to the Bastar Plateau of Chhattisgarh. This ecorace is bivoltine, wild and polyphagous in nature. Despite its adaptive traits, population stability of the Raily ecorace remains highly sensitive to monsoon variability. The present study evaluates the impact of monsoon dynamics on population stability, decline and recovery of the Raily ecorace using silkworm excreta (litterfall) as an indirect, non-destructive indicator of larval population density and feeding activity.

An integrated field-based survey was conducted across four conservation sites between August 2025 and January 2026, incorporating climatic variables, stage-wise litterfall (frass) collection, and systematic observations of different life stages. In addition, rainfall patterns for 2024 and 2025 were analysed. During the monsoon period (June–November) of 2024, the region received a total of 1,355 mm of rainfall over 66 rainy days, which coincided with relatively stable population performance. In contrast, the same period in 2025 experienced a 19.4% increase in cumulative rainfall (1,617.5 mm) distributed across 79 rainy days, reflecting enhanced rainfall persistence and intensity.

Compared with 2024, cocoon production during the Chaiti generation declined markedly in 2025. Field surveys and stage-wise litterfall assessments indicated that prolonged and continuous rainfall in 2025 disrupted multiple life-cycle stages of the Raily ecorace. The reduced frequency of dry intervals constrained adult mate location and mating success, leading to suboptimal fertilization and low egg hatchability. Sustained leaf wetness further impaired oviposition by weakening egg adhesion and promoting egg loss through wash-off. Excessive moisture also interfered with larval feeding, increased larval mortality, and created unfavourable conditions for cocoon spinning. Collectively, these rainfall-

mediated stressors resulted in reduced larval abundance and cocoon yield during the Chaiti generation. With the gradual alleviation of rainfall from October onwards (corresponding to the Bhado generation), silkworm litterfall increased progressively, indicating recovery of larval feeding activity and rebuilding of the second-generation population. Field observations during December–January confirmed advancement from mid to late instars and subsequent cocoon formation, validating litterfall as a reliable early indicator of population recovery. Overall, the findings highlight the critical role of monsoon dynamics in regulating Raily ecorace population stability and underscore the need for conservation strategies tailored to local climatic conditions.

**Keywords:** Raily ecorace; *Antheraea mylitta*; tropical tasar silkworm; monsoon dynamics; conservation; litterfall (frass) and population stability

## **T1P12: Strengthening International Frameworks for Conservation, Exchange and Biosecurity of Seri-Genetic Resources in India**

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### **Abstract**

Seri-genetic resources, encompassing mulberry (*Morus* spp.) and silkworm (*Bombyx mori* L.) germplasm, constitute the biological foundation of sustainable sericulture and silk productivity. The conservation, characterization, and regulated exchange of these resources are critical for addressing genetic bottlenecks, broadening the gene pool, and enhancing resilience to climate variability, pests, and emerging production constraints. India, as a second leading silk-producing nation, has institutionalized systematic mechanisms for the conservation and safe utilization of serio-biodiversity through the Central Silk Board and its premier research institutes. Field gene banks and live repositories maintain diverse accessions, ensuring long-term conservation and facilitating their deployment in breeding programmes. Strategic plant introduction both primary and secondary has historically contributed to crop improvement; however, it necessitates rigorous pest-risk analysis (PRA) and quarantine safeguards to prevent transboundary spread of exotic pests and pathogens. India's regulatory framework for biosecurity aligns with the International Plant Protection Convention (IPPC) under the aegis of the Food and Agriculture Organization (FAO). National implementation through the Plant Quarantine (Regulation of Import into India) Order, 2003, and oversight by the Directorate of Plant Protection, Quarantine & Storage (DPPQS), Faridabad ensures that germplasm exchange adheres to International Standards for Phytosanitary Measures (ISPMs). Instruments such as Import Permits (PQ-09), Phytosanitary Certificates, Pest Risk Analysis, and Post Entry Quarantine (PEQ) are integral to mitigating risks associated with high-value propagative materials, including mulberry cuttings and silkworm breeds. The Indo-Uzbekistan Collaborative Research Project (AIB03006CI) between CSR&TI, Pampore and the Science Research Institute of Sericulture (SRIS), Tashkent, Uzbekistan exemplifies a structured international partnership for seri-genetic resource enhancement. The programme focuses on identifying superior mulberry varieties and silkworm hybrids adapted to temperate regions of India and

the continental climate of Uzbekistan. Through formal Material Transfer Agreements (MTAs), ministerial approvals, and regulatory clearances from ICAR-NBPGR and national authorities, the project ensures compliance with biosecurity and biodiversity regulations while facilitating germplasm exchange. Overall, effective conservation and exchange of seri-genetic resources require integrated institutional repositories, legal instruments, quarantine infrastructure, and collaborative research. Strengthening third-country quarantine options, digital accession documentation, and harmonized phytosanitary protocols can further enhance safe germplasm mobility. Robust governance combined with scientific breeding interventions remains essential for sustaining seri-biodiversity, promoting climate-resilient sericulture, and supporting rural livelihoods and global silk value chains.

**Keywords:** Import Permit; Material Transfer Agreement; Phytosanitary Certificate; Post-Entry Quarantine; Pest-Risk Analysis

### **T1P13: Development of Interspecific Hybrids in Muga Host Plants (*Litsea salicifolia* x *Litsea monopetala*) for Ideal Rearing**

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#### **Abstract**

The semi-domesticated, polyphagous Muga silkworm *Antheraea assamensis* Helfer feeds on nearly 36 host plant species. Among these, Som (*Persea bombycina*) and Soalu (*Litsea monopetala*) are recognized as primary host plants due to their superior leaf quality, which supports enhanced larval growth and cocoon productivity, followed by Dighloti (*Litsea salicifolia*) and Mejankari (*Litsea cubeba*) as secondary host plants. Although Som and Soalu provide high leaf yield and excellent palatability, they are fast-growing, tall, and gigantic trees. Their height and canopy architecture limit high-density plantation and complicate silkworm management and protection from natural enemies. In contrast, Dighloti is a small dwarf tree with spreading canopy, facilitating high-density plantation, easier maintenance, and improved larval health. To combine the desirable traits of high leaf yield and palatability (from Soalu) with dwarf growth habit, profuse branching, and superior biochemical leaf quality (from Dighloti), an interspecific hybridization programme was initiated in 2024 at the CSB-MESSO P-3 Unit, Kubolong, Nagaland. Dighloti (*L. salicifolia*) was used as the female parent, and Soalu (*L. monopetala*) as the male parent. The cross was successful, achieving 14% seed set. Fifteen F<sub>1</sub> hybrid seedlings were raised under nursery conditions and subsequently transplanted to the field. The hybrids exhibited considerable morphological diversity in leaf shape, size, and growth habit, indicating a highly heterogeneous population influenced by both parental genomes. Notably, 10 out of the 15 hybrids displayed intermediate leaf characteristics. Promising dwarf and high-foliage-yielding hybrids will be selected for further evaluation, clonal multiplication, and potential commercial exploitation to enhance sustainable Muga silkworm rearing.

**Keywords:** silkworm; muga; leaf yield; host plants;

## **T1P14: Development of Interspecific Hybrids of Eri Silkworm (*Samia* spp.) for Outdoor Rearing on Soalu Plantations**

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### **Abstract**

The Eri silkworm holds a unique position in the sericulture industry, as its pupa is consumed as food and its cocoons are used for spun silk, while its host plants serve multiple industrial purposes. Soalu (*Litsea monopetala*) trees are naturally abundant in northeastern India and are widely cultivated as a primary host plant for the Muga silkworm; however, they are often underutilized and hold potential for alternative silkworm rearing, such as Eri. The domesticated *Samia ricini* Donovan does not feed on Soalu and is poorly adapted to outdoor conditions, whereas the wild *Samia canningi* feeds on Soalu and is hardy under outdoor conditions but produces inferior cocoon traits. To combine these complementary advantages, interspecific hybridization was undertaken in 2024 at the CSB – MESSO P3 Unit, Kubolong, Nagaland. The cross of *S. canningi* (female) × *S. ricini* (male; C-2 breed) produced F<sub>1</sub> progeny that survived on Soalu under outdoor conditions and exhibited traits similar to the wild parent, including brown-colored cocoons. In contrast, the reciprocal cross survived only on Castor under indoor conditions and resembled *S. ricini*, indicating a strong maternal influence on host adaptation. The F<sub>2</sub> generation showed segregation in larval morphology (plain and marked with blue and yellow coloration) and cocoon colour (white and brick red). Through systematic selection up to the F<sub>5</sub> generation, stable lines were developed with cocoon traits comparable to domesticated *S. ricini*, even when reared outdoors on Soalu. These findings establish a practical breeding protocol for developing commercially viable Eri hybrids suitable for outdoor rearing, thereby enhancing the utilization of Soalu and strengthening sustainable sericulture practices in northeastern India.

## **T1P15: Artificial Diet Supplementation as a Sustainable Strategy for Expanding Vanya Silk Production in Host Plant-Limited Regions**

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### **Abstract**

Raising silkworms for the production of silk, or sericulture, has historically relied on the availability of particular host plants. Non-mulberry or “vanya” silkworms, like *Antheraea assamensis* (muga), *Samia ricini* (eri) and *Antheraea mylitta/A. proylei* (tasar) depend on local host plants like Som (*Persea bombycina*), Soalu, Arjun (*Terminalia* spp.), Castor (*Ricinus communis*), and Oak (*Quercus* spp.), while the mulberry silkworm (*Bombyx mori*) only consumes mulberry leaves. In many possible production sites, the limited geographic range and seasonal availability of these plants severely restrict the growth of vanya sericulture, lower the number of viable rearing cycles annually and eventually limit silk yield and farmer income. Artificial or synthetic feeds have become viable substitutes for natural foliage feeding in order to overcome these constraints. In order to mimic the nutritional makeup of natural host leaves, these diets are scientifically created mixtures that include leaf powders, protein sources, carbs, vitamins, minerals, gelling agents and preservatives. Even though artificial diet technology was first created for mulberry silkworms, new studies have effectively modified these formulations for vanya species, especially eri and tasar silkworms, allowing them to be raised indoors and under controlled conditions in areas that are not typically home to plants. Well-balanced artificial feeds have been shown in experiments to increase overall rearing efficiency, encourage uniform growth and increase larval survival. In contrast to traditional outdoor foliage feeding, experiments with tasar silkworms have demonstrated that artificial feeds like “Tasar Amrit” enable greater survival rates, consistent moulting and stable larval growth when primary host plants like Arjun or Oak are unavailable. In a similar vein, studies on eri silkworms show that diets that include castor leaf powder, soybean-based proteins, carbs and agar efficiently support early larval instars, lowering mortality and guaranteeing steady growth prior to later stages when the larvae are transferred to natural foliage. In addition to their

nutritional advantages, artificial diets allow for year-round indoor rearing, minimize pathogen contamination under controlled conditions, lessen reliance on vast host plant cultivation and save labour costs related to leaf collecting and transportation. These benefits enable several rearing cycles per year and make it easier for vanya sericulture to spread into new areas. Even though it's still difficult to completely replicate the chemistry and feeding cues of natural plants, research on nutrient optimization and palatability enhancement keeps improving diet formulations. All things considered, adding artificial nutrition supplements is a creative and sustainable way to boost silk yield, stabilize production and fortify non-mulberry sericulture systems.

**Keywords:**

Vanya sericulture, Artificial diet, *Antheraea mylitta*, *Samia ricini*, *Antheraea assamensis*, Nutritional optimization, Larval survival, Rearing efficiency.

## **T1P16: Evaluation of Bivoltine Silkworm (*Bombyx mori* L.) Genetic Resources for Rearing and Reeling Performance during Winter Season**

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### **Abstract**

Sericulture sustainability largely depends on the availability, conservation, and effective utilization of superior silkworm genetic resources. The present study with an objective to evaluate bivoltine silkworm germplasm accessions with important rearing and reeling traits to identify better performing and promising genetic resources during winter season. The key rearing & grainage parameters along with post cocoon parameters were used for evaluation. The data obtained were statistically analyzed. The results revealed that high fecundity in BBI-0286 (678 eggs), excellent hatching percentage in BBE-0166 (98.66%), and superior larval weight in BBE-0329 (46.67 g) were recorded. A shorter larval duration of 532 h, as observed in accessions CSR-5 and SY-6, is considered advantageous for efficient crop scheduling and management. Higher single cocoon weight in BBI-0274 (2.08 g), higher shell weight in BBI-0324 (0.44 g) and shell percentage of 24.67 in BBE-0264 found promising for cocoon parameters. Yield attributes showed superior performance (BBI-0368), with 9,930 cocoons per 10,000 larvae brushed, cocoon yield of 21.83 kg (BBI-0349), and a high pupation rate (98.0%) (BBI-0403), indicating the strong commercial suitability of these accessions. A corresponding performance are also recorded in the post cocoon parameters, higher average filament length of 1,191m and a NBFL of 977.55 m. Denier values of around 1.64 indicated fine silk quality. High reelability (95.33%) in BBE-0210 and low renditta (4.85) in BBE-0182 and BBE-0262 reflected efficient silk recovery. The study indicating the better performance of some of the bivoltine silkworm genetic resources during winter season found to be promising and can be utilized for crop improvement and breeding programmes.

**Keywords:** *Bombyx mori*, genetic resources, bivoltine, rearing traits, reeling traits, conservation

## **T1P17: Comparative Study on the Efficacy of Novel Insecticides Application against Mulberry (*Morus Sp.*) Major Pest**

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### **Abstract**

Mulberry (*Morus spp.*) is the primary and indispensable host plant of the silkworm, *Bombyx mori*, forming the backbone of sericulture. However, its productivity is substantially constrained by major sucking pests such as thrips (*Pseudodendrothrips mori*), whitefly (*Dialeuroporadecempuncta*), and tukra caused by the mealybug (*Maconellicoccus hirsutus*). These pests impair leaf quality and yield, ultimately affecting silkworm growth and cocoon production. The present investigation was undertaken to assess the comparative field performance of two insecticides, Imidacloprid 17.8% SL and Diafenthiuron 50% WP, each applied at three concentrations (0.015%, 0.03%, and 0.06%), against major mulberry pests under field conditions. Treatments were arranged in replicated plots containing healthy mulberry plants, and pest incidence was recorded before spraying and at 7 days after spraying (DAS). Both insecticides demonstrated dose-dependent suppression of pest populations. The highest concentration (0.06%) consistently resulted in maximum reduction of whitefly and thrips populations at 7 DAS. Tukra incidence also declined markedly at higher concentrations, although further reduction beyond 7 DAS was limited. Imidacloprid exhibited comparatively stronger immediate suppression of whitefly and thrips, while Diafenthiuron provided effective and sustained pest management with consideration for plant health and silkworm safety. Lower concentrations were comparatively less effective in reducing infestation levels. Overall, the findings indicate that both Imidacloprid and Diafenthiuron, particularly at 0.06%, can significantly minimize the incidence of key mulberry pests. Their judicious use may enhance leaf quality and support higher sericultural productivity. The study highlights the importance of optimized dosage in developing sustainable and integrated pest management strategies for mulberry cultivation.

**Key words:** Major pest, Insecticide, Imidacloprid, Diafenthiuron

## **T1P18: Development and Evaluation of High Temperature and Muscardine Tolerant Bivoltine Double Hybrids for Climate-Resilient Sericulture**

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### **Abstract**

Climate variability and increasing disease incidence pose significant constraints to bivoltine sericulture in India. Elevated temperature regimes and white muscardine disease caused by *Beauveria bassiana* adversely affect survival and key economic traits of *Bombyx mori* L. Developing stress-resilient bivoltine hybrids is therefore essential for stabilizing productivity under changing climatic conditions. In the present study, thermotolerant bivoltine foundation crosses derived from selected tolerant breeds were evaluated under independent stress conditions, i.e., high temperature ( $36 \pm 1^\circ\text{C}$  during fifth instar) and muscardine inoculation. Significant variation was observed among crosses for survival rate, cocoon weight, shell weight, shell ratio, filament length and cumulative survival index. B1  $\times$  B2 exhibited superior performance under thermal stress, while B1  $\times$  B4 showed relatively better tolerance under muscardine challenge. Based on stress performance, selected crosses were utilized to develop double cross hybrids, which were subsequently evaluated for economic and reeling parameters under stress environments. Double hybrids such as (B1  $\times$  B2)  $\times$  FC1 and (B1  $\times$  B4)  $\times$  FC1 demonstrated improved productivity traits along with enhanced stability under both thermal and disease stress conditions. The findings indicate that strategic development and deployment of high temperature and muscardine tolerant bivoltine double hybrids can reduce crop losses, improve performance stability and contribute to climate-resilient sericulture systems.

**Keywords:** *Bombyx mori*; Thermotolerance; White muscardine; *Beauveria bassiana*; Climate resilience; Stress tolerance; Sericulture breeding;

## **T1P19: Probiotics-Enhancing Immunity and Growth Performance of Silkworm, *Bombyx mori***

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### **Abstract**

Probiotics has opened new avenues for exploring the impact of introducing beneficial microbes into insect systems. Probiotics influence host health through a range of well-documented mechanisms that contribute to gastrointestinal integrity and immunological stability. These mechanisms primarily include strengthening of the intestinal epithelial barrier, enhanced adhesion to the mucosa lining and inhibition of pathogenic colonization. By competing for receptor sites and nutrients, probiotics effectively exclude harmful microbes and create an unfavourable environment for their survival. The gastrointestinal tract of silkworms harbours a diverse array of microbial communities that play a crucial role in digestion, immunity and overall physiological development. Besides its role of providing innate immunity, the gut microbiota also contributes to resistance against bacterial, fungal, viral, and microsporidian diseases. Advancements in next-generation sequencing (NGS) have greatly enhanced understanding of the presumed microbial communities within silkworm larvae. Among the molecular techniques available, sequencing of the 16S ribosomal DNA (rDNA) gene encoding the small ribosomal subunit in prokaryotes is most frequently employed for assessing microbial diversity. Probiotic supplementation has emerged as a promising strategy to enhance silkworm health, growth and silk productivity. The application of strain-specific probiotics has also been linked to improvements in cocoon quality, silk yield and disease resistance. Despite the promising benefits of probiotic supplementation in enhancing silkworm growth, immunity and silk yield, several critical challenges remain. One of the foremost issues is the lack of standardized protocols for probiotic strain selection, dosage and mode of administration. Future research must focus on metagenomic, transcriptomic and metabolomic analyses to unravel the precise molecular pathways influenced by probiotics in silkworm.

**Keywords:** Probiotics, Silkworm, Host health, Innate immunity, Next generation sequencing, Molecular Pathways.

## **T1P20: Seri-Genetic Resource Conservation in Vanya Host Plants: Current Status and Genomics-Driven Future Pathways**

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### **Abstract**

India's vanya sericulture sector, encompassing muga, eri, and oak tasar silks, is fundamentally underpinned by the genetic diversity and ecological adaptability of their host plants. Muga culture relies primarily on Som (*Persea bombycina*), Soalu (*Litsea monopetala*), and Dighloti (*Litsea salicifolia*); eri culture on castor (*Ricinus communis*), kesseru (*Heteropanax fragrans*), *Ailanthus* spp., and cassava (*Manihot esculenta*); while oak tasar depends on diverse oak species including *Quercus* spp. and *Lithocarpus dealbata*. Despite their strategic importance in sustaining rural livelihoods across the North-East and Himalayan regions, host plant improvement continues to depend largely on heterogeneous wild or farmer-selected populations, characterized by narrow and poorly characterized germplasm bases, limited formally released varieties, and minimal integration of genomics-enabled breeding tools.

Systematic exploration and ex situ conservation efforts have expanded through structured collections of Som and Soalu accessions, castor - cassava - kesseru - *Ailanthus* resources for eri, and prioritized oak germplasm in the North-Eastern and North-Western Himalayas. Documented phenotypic, biochemical, and cytological variability, including induced tetraploids in Som and promising perennial castor lines, along with ongoing hybridization programmes (e.g., *Litsea monopetala* × *L. salicifolia*) and nascent tissue culture initiatives for difficult taxa such as *Ailanthus grandis*, indicate tangible progress. However, major gaps persist in genome-wide diversity assessment, trait mapping, climate-resilience screening, propagation standardization, and integrated crop management, collectively constraining leaf biomass, nutritional quality, silkworm performance, and ecosystem sustainability.

This paper synthesizes the current status of vanya host plant genetic resources and proposes a forward-looking framework anchored in genomic and biotechnological interventions. Priority strategies include genome-wide

diversity analysis to develop core germplasm sets; marker-assisted and genomic selection for leaf quality, stress tolerance, and coppicing ability; polyploidy and mutation breeding in vegetatively propagated hosts; high-throughput phenotyping and host–silkworm bioassay platforms; CRISPR-ready tissue culture systems; and scalable micropropagation pipelines for elite clones. The establishment of a coordinated National Vanya Host Plant Germplasm Network integrating regional resource centres with interoperable phenomic–genomic databases, climate-smart evaluation nurseries, and farmer-participatory selection models is advocated to enable climate-resilient agroforestry-based deployment of superior host plant ideotypes.

**Keywords:** Seri-Genetic Resource, CRISPR Cas, Genomic database

## **T1P21: Performance of promising fruit yielding mulberry accessions under RSRS Kodathi**

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### **Abstract**

Mulberry (*Morus* spp.) the sole food plant for the mulberry silkworm *Bombyx mori* L. being cultivated worldwide for production of cocoons. Though the *Morus* spp is grown primarily for leaves of late, as apart of value addition the fruits produced by the plants are gaining importance for commercial purposes as a minor fruit. Mulberry fruits are being utilized for production of jam, jelly, marmalade and in wine making. CSGRC Hosur under Central Silk Board is the unique institute involved in the conservation of mulberry and silkworm germplasm it is also the National Active Germplasm Site (NAGS) for mulberry and silkworm is effectively conserving a collection of nearly 1317 mulberry accessions comprising 14 species of *Morus*. As a part of the evaluation seven potential fruit yielding accessions ME-0018, ME-0253, MI-0776, MI-0380, MI-0486, MI-0527 and MI-0472 were identified comprising one each of *Morus cathayana*, *M. latifolia*, *M. indica* and four species of *M. laevigata* were collected and established under 12' x 12' spacing as trees at RSRS Kodathi with the exclusive objective of evaluation of their potential as fruit yielders and also to assess their performance under four different fertilizer treatments. The performance of these accessions in over the seasons indicated that accession ME-0253 recorded highest average fruits/plant of 51 followed by ME-0018 (48 no.) and MI-0486 (42 no). The average weight of 10 fruits revealed accession MI-0380 with a higher weight of 34.4 gms. followed by MI-0427 (33.1gms) and MI-0572 (29.8 gms). Longest fruit length was observed in accession no. MI-0572 (9.5 cms), MI-0776 and MI-0427(8.5 cms). The studies also revealed that accessions ME-0018 is the early bearer in fruit setting and ripening (30 days after pruning). Similarly in accession MI-0486 the fruit setting and ripening is late (45 days after pruning) when compared to the other accessions. Accessions MI-0427, 0776 and MI-0380 are very much sweet in comparison with other accessions under evaluation. Biochemical analysis of the fruit samples was also done for total soluble solids, soluble proteins, fat %, soluble sugars, phenols, flavonoids, anthocyanins, anti-oxidants potential, carotenoids in support of the nutritive value of the mulberry fruits.

**Keywords:** Mulberry, Accession, Germplasm, Biochemical analysis.

## **T1P22: Influence of Silkworm Egg Preservation Centre for Efficient Conservation, Maintenance, and Utilization of Silkworm Genetic Resources**

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### **Abstract**

Conservation of silkworm genetic resources is of paramount importance for their effective utilization and wider exploitation in sericulture. The Central Sericultural Germplasm Resource Centre (CSGRC), Hosur conserves a total of 489 silkworm genetic resources, comprising 84 multivoltine, 383 bivoltine, and 23 mutant accessions. Preservation of these valuable genetic resources ensures their availability for breeding programs, research, and sustainable development of the silk industry. The Silkworm Egg Preservation Centre (SEPC) plays a pivotal role in this process by serving as a repository for long-term storage of silkworm eggs. SEPC utilizes the diapause trait of bivoltine silkworm eggs for long-term preservation and subsequent maintenance, termination, synchronization and post-diapause development, thereby ensuring controlled and uniform development of silkworm stocks. Eggs are preserved under controlled temperature and humidity, which prolong viability without affecting the genetic integrity of the accessions. The 383 bivoltine accessions are maintained in three batches that were consigned during different seasons and preserved according to specific schedules, while the 23 mutant accessions are maintained in two batches with specific preservation schedules. The 84 multivoltine accessions are maintained by rearing five times a year and preserved for specific duration. Through these systematic strategies, SEPC ensures continuous and efficient maintenance of silkworm genetic resources, acting as a strategic reserve to restore valuable strains when required. It also provides a genetic safety net, protecting against loss due to disease, environmental stress or other unforeseen events. By supporting year-round availability, strategic conservation and ready utilization of silkworm germplasm, SEPC significantly contributes to the sustainability, productivity, and advancement of silk industry.

**Keywords:** preservation, accessions, temperature, genetic resources.

## **T1P23: Evaluation of silkworm germplasm for economic characters under sub-tropical conditions of Northern India**

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### **Abstract**

Assessment of silkworm germplasm is of prime importance for appropriate use in the breeding programmes. Success of any breeding programme mainly depends on the selection of superior and promising parents. Identifying season specific silkworm breeds is essential as variation in climatic conditions affects the economic and cocoon parameters. The investigation was carried out to assess 55 silkworm breeds for economic characters under sub-tropical conditions at CSB-Regional Sericultural Research Station, Central Silk Board, Miran Sahib, Jammu during Spring season 2024. Analysis of variance for economic characters showed highly significant differences among the breeds. The maximum fecundity was recorded in SH6 (599) and minimum in JAM-124 (334); maximum hatching percentage was recorded in PamDR-12 (98.37%) and minimum in JAM-122 (92.98%); weight of ten matured larvae was highest in JAM-22 (45.33 g) and lowest in PamDR-12 (38.33 g); maximum cocoon yield per 10,000 larvae was recorded in JAM-121 (15.35 kg) and minimum in PamDR-7 (11.22 kg). Similarly, highest single cocoon weight was recorded in JAM-22 (1.65 g) and lowest in PamDR-12 (1.35 g); highest single shell weight was recorded in JAM-121 (0.30 g) and lowest in JAM-119 (0.23 g); maximum shell ratio percentage was recorded in CSR-26 (18.79 %) and minimum in RSJ-15 (16.00 %) whereas maximum pupation percentage was recorded in RSJ-1 (93.66 %) and minimum in JAM-127 (86.00 %). The overall average evaluation index values calculated by considering all the economic parameters ranged from 37.35 to 58.28. Among 55 silkworm breeds evaluated, a total of 29 breeds recorded >50 average EI values. The silkworm breeds *viz.*, CSR-26 (58.28), SH-6 (57.94), JAM-24 (57.33), JAM-121 (56.64), NB4D2 (56.42), RSJ-13 (55.64) and CSR-4 (55.57) recorded highest average EI values and these silkworm breeds can be utilized for further breeding programmes for development of superior hybrids under sub-tropical climatic conditions of Northern India.

**Key words:** Silkworm, evaluation, germplasm, cocoon, breeds

## **T1P24: Evaluation of mulberry fruit yielding accessions for growth and yield traits**

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### **Abstract**

Mulberry is a fast-growing deciduous plant found in wide variety of climatic and soil conditions which are widely distributed from temperate to subtropical regions. The mulberry leaves are economically viable due to its significant role in sericulture industry since ancient times. Due to the presence of valuable phytochemical constituents, mulberry as a whole plant has been utilized as a functional food since long time. For proper utilization, different value-added products like syrups, jams, jellies, wines and squashes are made. In overseas, these value-added products are commercially sold and easily available. In India, mulberry is regarded as “KalpaVruksha” since all parts of the plant are used for various purposes. In spite of its versatile uses, this plant is missing its identity due to lack of identified variety. In this context, the present research has been undertaken to evaluate and identify promising mulberry fruit yielding accessions. Majority of the accessions showed meaningful variability among the ten mulberry fruit yielding accessions. The highest coefficient of variation was 60% observed in number of branches followed by total shoot length (47%), internodal distance (41%), leaf fresh weight (40%) and stem weight (38%). The divergence analysis grouped 10 mulberry accessions into 3 clusters. Maximum accessions were grouped in cluster I (5 accns.) followed by cluster II (4 accns.) and cluster I (1 accn.). The diversity among the accessions measured by inter-cluster distance (D2) showed significant variation. The cluster group indicates that mulberry fruit yielding accessions were distributed in different clusters irrespective of geographical distribution.

**Key words:** Mulberry, Fruit yielding accessions, germplasm, evaluation, variability, growth and yield traits.

## **T1P25: Evaluation of mulberry germplasm for yield and quality related characters under sub-tropical conditions of Jammu region**

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### **Abstract**

Mulberry leaf yield is a complex character jointly contributed by a good number of component characters and is highly influenced by different genotypes. For developing a promising variety, suitable parent material needs to be identified from large number of germplasm accessions through continuous process of evaluation, which is a great challenge to plant breeders. Information on the nature and magnitude of genetic variability, heritability and contribution of different characters to yield would be highly important for initiation of mulberry breeding programme. The investigation was carried out to study the genetic variability, heritability, correlation and path coefficient analysis of yield and quality related characters in 18 mulberry genotypes at Regional Sericultural Research Station, Central Silk Board, Miran Sahib, Jammu during Spring season 2024. Analysis of variance for yield and quality related characters showed highly significant differences among the genotypes. Phenotypic coefficient of variation was found to be higher than the corresponding genotypic coefficient of variation for all the characters indicating the role of environment in the expression of characters. High heritability coupled with high genetic advance as per cent of mean was observed for number of leaves per meter, internodal distance, leaf area, diameter of shoot, total shoot length, weight of 10 fresh leaves, moisture retention capacity and leaf yield per plant indicating that variation in these traits was most likely due to additive gene effect. The directional selection would be effective to improve these characters. Correlation analysis revealed that leaf yield per plant was positive and significantly associated with number of new shoots per plant, longest shoot length, number of leaves per meter, diameter of shoot, total shoot length and weight of 10 fresh leaves. Further, number of new shoots per plant, number of leaves per meter, internodal distance, leaf area, total shoot length and weight of 10 fresh leaves had a high direct effect on the leaf yield per plant and these traits can be used for indirect selection. Therefore, number of new shoots per plant, longest shoot length, number of leaves per meter, leaf area, total shoot length and weight of 10 fresh leaves may be given more emphasis during selection in mulberry improvement programme.

**Keywords:** Mulberry, evaluation, germplasm, yield, quality

## **T1P26: Innovative *in situ* conservation strategies for strengthening natural enemy complex in the mulberry ecosystem**

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### **Abstract**

The sustainability of mulberry-based sericulture largely depends on effective ecological regulation of insect pests through conservation of indigenous natural enemies. While conventional biological control strategies emphasize habitat diversification and reduced chemical usage, recent advancements advocate innovative, field-adapted techniques to enhance *in situ* conservation efficiency. The present framework integrates proven conservation approaches with novel strategies such as the Chocolate Box Technique, Natural Enemies Field Reservoirs (NEFRs), and structured ecological engineering to reinforce biological pest suppression in mulberry ecosystems. The Chocolate Box Technique involves the strategic placement of compartmentalized micro-habitat units within fields that serve as controlled refuges for predators and parasitoids. These compartment systems maintain alternate hosts or prey in segregated niches, ensuring continuous survival, multiplication, and gradual dispersal of beneficial organisms into the main crop. This technique improves natural enemy retention, protects them from environmental stress, and minimizes exposure to pesticide residues. Complementing this approach, establishment of NEFRs within mulberry gardens provides pesticide-free refuge zones that sustain parasitoid populations through managed host availability. Habitat diversification through flowering strips, border crops, cover vegetation, and maintenance of semi-natural vegetation further enhances nectar resources, shelter, and overwintering sites for predators such as coccinellids, chrysopids, spiders, and parasitoids. Adoption of selective biopesticides, botanical formulations, and threshold-based spraying prevents disruption of beneficial fauna. Additionally, augmentative releases integrated with conservation modules accelerate establishment of natural enemies in newly infested areas. Farmer-led monitoring, participatory biodiversity mapping, and conservation literacy programs strengthen grassroots implementation. These integrated strategies collectively enhance arthropod biodiversity, improve pest–natural enemy balance, and reduce chemical dependency in mulberry cultivation. The proposed *in situ* conservation model promotes ecological resilience, environmental safety, and long-term sustainability of sericulture while contributing to the preservation of associated agro-biodiversity within the mulberry ecosystem.

**Keywords:** Ecological engineering, chocolate box technique, conservation,

## **T1P27: Conservation status of bivoltine mulberry silkworm germplasm for Sustaining high quality silk production in India**

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### **Abstract**

Sericulture advancement is largely based on the silkworm varietal improvement, and breeding of new silkworm breed in turn based on the material supply from rich silkworm germplasm resources. CSGRC is the national nodal centre which was established in the year 1991 by Central Silk Board, and recognized by National Bureau of Agricultural Insect Resources, Bangalore (ICAR) and conserving **406** bivoltine mulberry silkworm genetic resources which includes 23 mutant genetic stocks. The diverse geographical conditions of our country led to a significant collection of silkworm germplasm resources, including local, improved, and introduced varieties. Preliminary evaluation, characterization and conservation of 406 silkworm genetic resources was conducted and promising bivoltine silkworm accessions were identified for further utilisation in breeding programme. The success of silkworm hybrids in the field developed by the silkworm breeders depends on its combining ability and quite a good number of bivoltine breeds with high silk content and raw silk recovery which have played a key role in boosting bivoltine silk production in India recently.

Bivoltine Silkworm genetic resources were evaluated for abiotic stress conditions (High temperature and high humidity) at different agro climatic areas, All India Silkworm Germplasm Evaluation Programme and resulted in identification of suitable accessions region wise and seasonwise. Further, Post cocoon evaluation for fibroin and sericin content was also conducted. Projects on evaluation of exotic bivoltine was formulated to identify better parental genetic resources. The Centre has a vision to protect these seri-genetic resources for posterity and facilitate their utilization by stakeholders. Thus, The germplasm serves as the vital material base for the sustainable development of sericulture, supporting breeding of new, improved bivoltine silkworm hybrids for commercial exploitation.

**Keywords:** Bivoltine silkworm germplasm; Conservation; sustaining silk production;

**T1P28: Phenotypic and molecular variations in the thermo-tolerance of variants of the nistari race of silkworm, *Bombyx Mori***

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**Abstract**

Nistari, an indigenous silkworm race of West Bengal, is a highly resistant multivoltine race tolerant to high temperatures, fluctuating climatic conditions, and diseases. Owing to these advantages, it can be reared successfully throughout the year by farmers in West Bengal, although it produces inferior quality cocoons. Based on the place of rearing and morphological characteristics, Nistari is available in different forms such as Nistari (Marked), Nistari (Plain), Nistari (Chalsa), and Nistari (Debra). However, it is difficult to distinguish the original Nistari from other variants. To address this, a study was conducted to characterise the variants of the Nistari race with respect to thermo-tolerance using a combination of morphological and molecular methods. To assess differences in morpho-quantitative traits, the four Nistari lines were reared in two different seasons. Among them, Nistari (Debra) performed better in both pre- and post-cocoon parameters, with the highest average evaluation index of 58.74. To assess thermo-tolerance, the Nistari variants were also exposed to 36°C for 6 hours from the 5th instar, 3rd day, until spinning. Interestingly, Nistari (Marked) performed better, with the highest pupation rate of 92%, while Nistari (Debra) showed the lowest thermo-tolerance, with an 82% pupation rate. For molecular analysis, DNA from the Nistari variants was extracted and screened for markers linked to thermo-tolerance in silkworms. The results revealed a tolerant band in all four lines, but in a homozygous condition for Nistari (M) and Nistari (P), and in a heterozygous condition in Nistari (C) and Nistari (D). This heterozygous condition may be due to the introgression of a character from one of their productive parents used to improve productivity. This study enhances knowledge of the thermo-tolerance ability of the Nistari race variants, assisting silkworm breeders in selecting Nistari variants for developing new multivoltine silkworm breeds with thermo-tolerance.

**Keywords:** Multivoltine, Thermo-tolerance, Nistari, Morpho-quantitative,

## T1P29: Cryopreservation of Mulberry Genetic Resources for Long-term Conservation and Sustainable Utilization

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### Abstract

Mulberry (*Morus* spp.) is the sole food plant of the silkworm (*Bombyx mori* L.) and forms the biological foundation of the sericulture industry. The long-term conservation of mulberry germplasm is essential to sustain silk productivity, enhance adaptability to climate change, and preserve genetic diversity for future crop improvement programmes. Conventional field gene banks are vulnerable to climatic extremes, pest and disease outbreaks, land constraints, and genetic erosion. Cryopreservation, involving storage at ultra-low temperatures ( $-196\text{ }^{\circ}\text{C}$ ) in liquid nitrogen, provides a secure and cost-effective strategy for long-term genetic conservation by completely arresting metabolic activity and preserving genetic integrity. The present study focuses on standardization of cryopreservation protocols for mulberry germplasm including dormant buds, shoot tips, and *in vitro*-derived tissues. Techniques such as vitrification, encapsulation–dehydration, and droplet vitrification were optimized to enhance post-thaw survival and regeneration efficiency. Critical parameters including osmotic preconditioning, cryoprotectant exposure (PVS2/PVS3), dehydration levels, and rapid cooling–rearming cycles were systematically evaluated to minimize cellular damage and ice crystal formation. Post-cryogenic recovery was assessed through viability tests, regrowth performance, and molecular marker-based genetic fidelity analysis to ensure true-to-type conservation. Cryopreservation enhances long-term genetic security, facilitates safe germplasm exchange, and supports breeding programs targeting stress tolerance, yield improvement, and nutritional enhancement. **Keywords:** Cryopreservation; Germplasm conservation; Genetic fidelity; Liquid nitrogen; *Morus* spp.; Sustainable sericulture.

### **T1P30: Conservation and Digitization of mulberry silkworm genetic resources for sustainable utilization**

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#### **Abstract**

India possesses exceptional seri-biodiversity and a large pool of mulberry silkworm (*Bombyx mori*) genetic resources that supports sustainable sericulture development. Central Sericultural Germplasm Resources Centre, Hosur, functions as the national repository, conserving 489 silkworm accessions, including bivoltine, multivoltine and mutant stocks of both indigenous and exotic origin collected from multiple Indian states and 14 countries. These accessions are systematically characterized for voltinism, morphological traits, productivity and stress tolerance, reared in scheduled crop cycles, and supported by long-term egg-preservation strategies to reduce conservation cost, time and space while maintaining high viability. A notable resource within this collection is KS10, a diapause-inhibiting multivoltine line that enables acid-free seed production and combines bivoltine-like cocoon and raw-silk quality with multivoltine rearing ease, thereby broadening options for hybrid development, seed production and field utilization. To enhance accessibility and effective use of this biodiversity, CSGRC has moved beyond printed catalogues to a web-based Silkworm Germplasm Information System that integrates standardized descriptors, photo documentation, customized data retrieval, statistical summaries and an e-indenting module for germplasm supply. The database allows multi-parameter queries, efficient updating and linkage of characterization and evaluation data to unique national accession numbers, ensuring traceability and interoperability with wider silkworm genomic resources. This integrated programme of conservation and digitization strengthens long-term security of *ex situ* silkworm gene banks, supports rapid identification of trait-specific donors and climate-resilient parental lines, and facilitates sharing of mulberry silkworm genetic resources for breeding programmes. It also provides a scalable platform for future integration of genomic markers, high-throughput phenotyping, automation and AI-enabled decision support in seri-germplasm management, aligning with national priorities for sustainable growth of the silk industry.

**Keywords:** *Bombyx mori*; silkworm germplasm; digital database; Silkworm Germplasm Information System

### **T1P31: Structural and functional components of polyploid *Morus serrata* Roxb.: insight into tree plant biodiversity conservation**

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#### **Abstract**

Concerns regarding the declined superiority of higher polyploid over diploid and the higher extinction rate have been subjected recently. The present study aims to understand the structural (phenotypic) and functional (genome-wide repeat content, transcriptomic) aspects of polyploid *Morus serrata* Roxb. An integrated approach including evolutionary time scale analysis, cytology, genome-wide repeat content (repeatome), transcriptomics and phenomics has been deciphered. Flow cytometry, cytology, and phenotypic investigation suggest that *M. serrata* Roxb. is considerably influenced by increased genome size, as evidenced from polyploid-associated traits including leaf thickness, stomatal frequency, stomatal size, and chloroplast per stomata. However, correlation and principal component analysis (PCA) insight into the considerable decline in growth-yield/biomass traits. Genome-wide repeat content, the abundance and occupancy of different classes of transposable elements, and transcriptome data supporting active transposition of transposable elements (TEs). Overall, TEs contribute to the genome expansions, gene regulation, and increased cost of genome maintenance in polyploid *M. serrata* Roxb. Significantly enriched GO also suggests that *M. serrata* Roxb. invests significant resources to maintain an enlarged genome like other polyploid angiosperms. The study provided new insights into the conservational aspects of natural polyploidization and loss of growth superiority.

**Keywords:** *Morus* spp., polyploid, repeatome, transcriptome

### **T1P32: Assessment of Nutritional and Anti-nutritional Attributes of Mulberry Genetic Resources Suitable for Animal Feeding**

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#### **ABSTRACT**

The present study aimed to assess the nutritional and anti-nutritional composition of twenty-one mulberry genotypes for their potential as livestock fodder. The genotypes were evaluated for key nutritional parameters, including moisture content, crude protein, crude fiber, crude fat, carbohydrate, and ash, as well as anti-nutritional factors such as phenols, tannins, nitrates, saponins, and flavonoids. The crude protein content varied significantly ( $P \leq 0.05$ ), ranging from 7.79% in ME-0663 to 34.06% in ME-0220. Among the genotypes, MI-0663 exhibited the highest moisture content (77.53%), while ME-0001 recorded the lowest (64.72%). Crude fat content was highest in ME-0109 (8.50%) and lowest in MI-0034 (2.49%). Crude fiber ranged significantly from 7.55% (MI-0615) to 21.85% (MI-0536), whereas carbohydrate content varied between 14.39% and 21.62%. Polyphenol levels were below toxic thresholds, ranging from 0.72% (ME-0220) to 2.92% (ME-0025), and tannin content differed significantly ( $P \leq 0.05$ ) from 1.23% (ME-0220) to 3.32% (ME-0025). Nitrate content was highest in MI-0663 (0.165%) and lowest in MI-0017 (0.026%). Overall, the study indicated that these mulberry genotypes possess high protein content coupled with low levels of anti-nutritional factors, highlighting their potential as valuable fodder resources for livestock.

**Keywords:** Anti-nutritional factors, Fodder, Minerals, Mulberry, Nutritional factors

### **T1P33: Effect of Feeding Abamectin 1.9 % EC Sprayed Mulberry Leaves on Survival and Economic Traits of Silkworm, *Bombyx mori* L.**

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#### **Abstract**

Mulberry is the sole food plant for silkworm, *Bombyx mori* L., and significantly influence their health and performance. However, it is susceptible to pests such as thrips and mites, causing crop losses and reduced leaf quality. Management of such pests is imperative for sustained productivity of quality silk, which necessitates the use of pesticides. However, pesticide residues on leaves can adversely affect silkworms, impairing their growth, productivity and cocoon quality. This issue can be mitigated by following a safe waiting period. Therefore, the present study was conducted to assess the bioefficacy of abamectin 1.9 % EC against thrips and mites in mulberry and its impact on larval and cocoon parameters of silkworm, *Bombyx mori* L. Mulberry leaves harvested at 15 and 20 days after spray (DAS) were used to rear the parental lines of *B. mori*, and different parameters were recorded. Feeding silkworms with mulberry leaves harvested at 20 DAS from treated plots was found to be safer, as evidenced by zero larval mortality and improved rearing performance, including shorter larval duration (24.08 Days), higher larval weight (31.54 g/10 larvae) and effective rate of rearing (98.58 %). Significant improvements were also observed in cocoon traits such as higher cocoon and shell weight (1.59 & 0.325g), shell ratio (19.98 %), longest filament length (1038.49 m) and maximum filament weight (0.298 g). The results indicate that abamectin 1.9% EC can be effectively used to manage thrips and mites in mulberry with a safe waiting period of 20 DAS, without any adverse effect on silkworm growth.

**Keywords:** mulberry; *Bombyx mori*; bioefficacy; cocoon traits;

### **T1P34: Importance of Conservation of Mulberry Genetic Resources for Developing Mulberry Varieties for Eastern and North Eastern India**

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#### **Abstract**

Mulberry (*Morus* spp.) is the primary food plant of silkworm (*Bombyx mori*), making the conservation and sustainable utilization of its genetic resources vital for development of high yielding mulberry varieties. In the present study, 33 mulberry genetic resources of 4 different species viz., *M. indica*, *M. alba*, *M. latifolia* and *M. sinensis* were evaluated for morpho-physiological characteristics for its effective utilization in breeding. Analysis of 21 morpho-physiological traits revealed high significant genetic differences ( $p < 0.05$ ), indicating predominant additive gene action and a broad genetic base suitable for genetic improvement in mulberry. High phenotypic and genotypic coefficients of variation, along with high heritability for traits such as leaf weight (90.61%), shoot (69.02%) and leaf yield (53.31%) coupled with high genetic advance as a percentage of mean (GAM) for fresh leaf weight (93.22%), shoot yield (92.35%) and leaf yield (66.24%) indicating strong additive genetic control and highlight the feasibility of direct selection for crop improvement. Leaf yield per plant exhibited substantial variation, ranging from 210g to 4200g. Principal component analysis explained 68.34% of the total variance, while cluster analysis successfully grouped genotypes into four divergent clusters. In the Multi-trait Evaluation Index (MEI), CT-44, CT-11, RG-76 and C-2038 exhibited the superiority of the genotypes for leaf yield and yield attributing traits, making them valuable candidates for both *in-situ* conservation and serving as elite parental lines for strategic hybridization programmes for crop improvement. By integrating field phenotyping with multivariate statistics analysis, we can identify diverse genetic resources for speed breeding or rapid variety development in mulberry. These findings facilitate the targeted selection of genotypes with enhanced productivity supporting robust breeding strategies, which will pave the way for effective utilization of mulberry genetic resources to develop varieties for E & NE Serizones of India.

**Keywords:** Mulberry, Genetic Conservation, Diversity, Correlation, PCA, Cluster Analysis, Sustainable Utilization.

### **T1P35: Seasonal Performance and Stability of Eight Elite Mulberry Genotypes for Growth and Leaf Yield Traits**

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#### **Abstract**

An investigation was conducted at the Department of Sericulture, UAS, GKVK, Bengaluru during 2023-24 to evaluate the mean performance and stability of elite mulberry genotypes across winter, summer and rainy seasons. A stable and promising genotype was identified based on a Stability parameters, higher mean performance, regression coefficient ( $bi$ ) and deviation from regression ( $S^2di$ ), were estimated to assess genotype x environment interaction and adaptability. The results revealed that most genotypes exhibited low environmental sensitivity and adaptability to all seasons, making it possible to predict their performance across seasonal conditions. With respect to vegetative growth traits during winter, summer and rainy seasons, MI-0014 showed superiority in nearly all characters studied, including leaf yield per plant, number of branches per plant and shorted internodal distance across all three seasons. Based on G x E interaction and consistent performance in leaf yield and vegetative traits, genotypes MI-0014 and ME-0067 were identified as stable and promising genotypes suitable for cultivation throughout different seasonal conditions.

**Keywords:** mulberry; stability; GxE interaction; morphology;

### **T1P36: Iron oxide nanoparticles for sustainable pest management against *Spilosoma obliqua***

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#### **Abstract**

The research, conducted at the Regional Grain Research Station from January to November 2024, focused on the preparation of iron oxide nanoparticles (FeO NPs) and the evaluation of their insecticidal efficacy against *Spilosoma obliqua* larvae. The formation of FeO NPs through chemical co-precipitation was confirmed by FTIR spectroscopy, which showed a characteristic Fe–O stretching vibration around  $\sim 580\text{ cm}^{-1}$ , indicating successful nanoparticle synthesis. Stability in aqueous solution was attributed to the presence of –OH stretching vibrations ( $\sim 3200\text{--}3600\text{ cm}^{-1}$ ), suggesting hydroxyl functionalization. XRD analysis revealed a face-centered cubic (FCC) crystal structure with an average particle size of 15.8 nm. Furthermore, a zeta potential of  $-35.2\text{ mV}$  indicated excellent colloidal stability, minimizing particle aggregation.

In pesticide bioassays, FeO NPs demonstrated dose-dependent toxicity against *Spilosoma obliqua* larvae, with a 48 h  $\text{LC}_{50}$  value of 23.5 mg/L, highlighting their potential for long-term insecticidal activity. Cytotoxicity evaluation in L6 mouse myoblast cells using the MTT assay showed that cell viability remained above 85% at a concentration of 25  $\mu\text{g/mL}$ , indicating low toxicity at lower doses. However, viability declined to approximately 48% at 100  $\mu\text{g/mL}$ , demonstrating significant cytotoxic effects. The calculated  $\text{IC}_{50}$  value was 58.63  $\mu\text{g/mL}$ . These findings suggest that FeO NPs could be a sustainable component of integrated pest management in mulberry cultivation, provided further field trials validate their safety and efficacy.

**Keywords:** Bihar Hairy Caterpillar; Cytotoxicity; FTIR; Nanoparticle; XRD

**T1P37: Effect of Zinc Oxide Nanoparticle-Fortified Mulberry Leaves on Protein Profiles and Economic Traits of Bivoltine Silkworm Hybrid *Bombyx mori* (FC1XFC2)**

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**Abstract**

The silkworm *Bombyx mori* L. is a lepidopteran insect used as laboratory tool for various experiments. Being a domesticated insect, it has been reared mainly for the production of silk. The successful production of the silk not only governed by dynamic environmental factors but also affected by quality of mulberry leaf provided to silkworm. Hence, dietary nutrients are the most important factor which determine quality and quantity of silk production. An experiment was carried out to know the impact of mulberry leaf foliar spray with zinc oxide nanoparticle at varied concentrations viz., 1% ,1.5%, and 2% on protein contents as well as commercial parameters in the FC1XFC2 silkworm hybrid. The larvae reared on zinc oxide at 1.5% concentration registered higher protein contents in the haemolymph, fat body and silk gland over absolute and distilled water control. However, protein contents were relatively higher in the fat body when compared to haemolymph in all the treatments. Explicitly state that the 1.5% treatment yielded the best economic parameters such as larval weight, cocoon weight, shell weight, pupal weight, shell ratio, filament length, filament weight, denier, renditta and raw silk percentage.

**Keywords:** *Bombyx mori*; silk production; nanoparticle; zinc oxide;

**T1P38: Advancing Tasar sericulture through scientific seed multiplication: Contributions of BSMTC, Bilaspur**

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**Abstract**

The Central Silk Board through its Basic Seed Multiplication and Training Centre (BSMTC), Bilaspur, plays a crucial role in sustaining quality tasar seed production and distribution in Chhattisgarh. Analysis of five-year performance data (2021–22 to 2025–26) reveals consistent progress in Disease Free Layings (DFL) production, supply efficiency and field performance.

During the period under review, cocoon processing ranged from 11.45 to 13.12 lakh annually, resulting in DFL production between 3.10 and 3.40 lakh per year. The cocoon-to-DFL conversion ratio remained stable (3.57:1 to 3.97:1), reflecting effective grainage operations and scientific seed management. Importantly, DFL production exceeded annual targets consistently, achieving 126% to 181.95% of the planned figures. The highest performance was recorded in 2022–23, with 4.25 lakh DFLs produced against a target of 2.33 lakh. DFL supply also surpassed targets each year, achieving between 135% and 200.42%. Field results indicate cocoon yields ranging from 49.81 to 61.20 per DFL, demonstrating satisfactory seed quality and adaptability under field conditions.

The sustained overachievement highlights BSMTC Bilaspur's strategic role in ensuring timely availability of quality tasar seed, strengthening the seed value chain and enhancing livelihood opportunities, particularly among tribal farmers. The centre significantly contributes to productivity enhancement and expansion of tasar sericulture in the state.

**Keywords:** BSMTC, Bilaspur; Tasar Seed; cocoon-to-DFL ratio; tribal farmers;

### **T1P39: Performance dynamics and productivity analysis of tasar silk seed production at BSM&TC, Boirdadar, Chhatisgarh**

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#### **Abstract**

The Basic Seed Multiplication & Training Centre (BSM&TC), functioning under the Central Silk Board, has shown sustained and remarkable progress in scientific Tasar seed production in Boirdadar, Raigarh, Chhattisgarh, from the period of 2021-22 to 2025-26. The centre consistently met and exceeded its annual Disease-Free Laying (DFL) production targets, reflecting high operational efficiency and strong technical management in grainage operations. Achievement levels demonstrated significant resilience and growth, maintaining a performance above the 100% threshold in four out of the five years analyzed. Specifically, performance from 103.81% in 2021-22 (2,68,090 DFLs against a target of 2,58,240) to an exceptional peak of 142.00% in the 2024-25 period, where 3,29,380 DFLs were produced against a target of 2,31,702. Even in the most recent 2025-26 cycle, the centre recorded a solid 109.92% achievement, producing 2,60,720 DFLs.

The peak performance year of 2024-25, the brushing of only 29,095 DFLs yielded a substantial harvest of 14,48,100 cocoons, reaching a superior yield per DFL ratio of 49.77:1. This indicates that the scale of seed cocoon utilization corresponding to the achieved DFL output is substantial and managed with increasing precision. In 2025-26, the harvest of 11,97,440 cocoons supported a production of 2,60,720 DFLs, maintaining a steady supply chain to the field. These figures demonstrate the centre's expanding seed multiplication capacity and its ability to efficiently manage large volumes of quality cocoons through scientific grainage operations. Improvements in grainage operations, mother moth examination, disease-free seed maintenance, and scientific rearing practices have strengthened cocoon recovery rates and silk productivity. The data shows that the supply-to-production ratio remains exceptionally high; for instance, in 2024-25, of the 3,29,380 DFLs produced, 3,25,785 were successfully supplied to stakeholders, representing a near-total utilization of produced seeds. The

centre's sustained overachievement in DFL production highlights its vital role in boosting raw silk output, enhancing farmer income, and promoting socio-economic development in tribal communities of Chhattisgarh. By consistently delivering high-quality Tasar seeds (DFLs) to the rearers, BSM&TC Boirdadar ultimately strengthens Tasar sericulture productivity and contributes significantly to the national raw silk generation goals.

**Keywords:** Tasar; DFLs; BSM&TC; Cocoon; Raw silk; Seed Multiplication; Yield Ratio;

## **T1P40: Contribution of Central Silk Board–Basic Seed Multiplication and Training Centre Bastar in Strengthening Daba Ecorace Tasar and Seed Sector in Chhattisgarh**

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### **Abstract**

The Central Silk Board–Basic Seed Multiplication and Training Centre (BSMTC), Bastar, Chhattisgarh, established in 1980, has emerged as a pivotal institution in the conservation, multiplication, and genetic management of the Daba ecorace of Tropical Tasar silkworm (*Antheraea mylitta*). Within the framework of serigenetics and germplasm conservation, the Centre plays a crucial role in maintaining the genetic purity, vigor, and disease-free status of Daba seed stocks through systematic grainage operations, mother moth examination, and scientific seed multiplication protocols. From 2009–10 to 2025–26, the Centre has demonstrated sustained expansion in basic seed multiplication while safeguarding germplasm integrity. DFL production consistently exceeded annual targets, increasing from 108.9% achievement in 2009–10 (1,75,750 DFLs against 1,61,412 target) to a peak of 202.41% in 2016–17 (5,05,000 DFLs against 2,49,488 target). In 2025–26, production reached 4,08,695 DFLs against a target of 2,47,017, recording 165.45% achievement. This growth reflects not only enhanced infrastructure but also improved genetic line maintenance, effective disease surveillance, and scientific cocoon selection ensuring high-quality germplasm multiplication. The Centre significantly contributes to strengthening the Tasar seed chain in Chhattisgarh by ensuring timely supply of genetically stable and disease-free layings (DFLs), thereby reducing crop losses and enhancing cocoon productivity and raw silk yield. Standardized protocols in germplasm preservation, seed crop monitoring, and quality control have improved cocoon recovery and reeling performance, reinforcing the genetic base of Daba ecorace populations. Beyond production, BSMTC Bastar serves as a hub for capacity building in serigenetics and seed technology, imparting technical training to farmers, seed rearers, and departmental officials. Its focused

outreach in tribal-dominated regions has facilitated participatory conservation of Tasar genetic resources, livelihood enhancement, and increased involvement of tribal women in seed and cocoon production activities.

By integrating germplasm conservation, scientific seed multiplication, and grassroots technology transfer, CSB–BSMTC Bastar presents a sustainable and scalable model for strengthening tropical Tasar sericulture under the vision of genetic resource management and self-reliant silk production.

**Keywords:** Daba ecorace; Tasar; DFLs; CSB-BSMTC; Cocoon; Raw silk

## **T1P41: Impact of CSB-CTSSS in Tasar seed production after Covid-19**

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### **Abstract**

Tropical tasar seed production in India follows a four-tier multiplication from P4, P3, P2 to P1 and then to farmers for mass multiplication of tasar cocoons. Central Tasar Silkworm Seed Station (CSB-CTSSS) is the exclusive P3 tasar seed station in India supplying Nucleus seeds to 17 P2s/BSMTCs (CSB-Basic Seed Multiplication and Training Centre) located in 8 states of India. Ensuring nucleus seed production to the prescribed norms and standards is challenging owing to the open field rearing practises after the onset of monsoon in the uncertain climatic condition. CSB-CTSSS maintains three races *viz.*, Daba Trivoltine (DTV), Daba Bivoltine (DBV) and yellow larval colour selected BDR10, and supplies a minimal quantity of each nucleus DFLs on alternate years to different CSB-BSMTCs. This paper describes the contribution of CSB-CTSSS in the past five years (2021-2025) after Covid-19 towards tasar seed sector and their performance in the respective CSB-BSMTCs in different parts of the country.

**Keywords:** Tropical tasar; seed production; CSB-CTSSS; Covid-19;

## **T1P42: Comparative Evaluation for Conservation and Sustainable Utilization of Daba–BV and Daba–TV Seri-Genetic Resources of *Antheraea mylitta* under Semi-Arid Tropical Conditions**

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### **Abstract**

Conservation and sustainable utilization of seri-genetic resources require systematic evaluation of productivity stability, biological efficiency and climate responsiveness across ecoraces. The present study provides a five-year comparative assessment (2020–2025) of grainage productivity, biological efficiency and climate sensitivity of Daba–BV and Daba–TV ecoraces of *Antheraea mylitta* under semi-arid tropical conditions of Telangana, India, with emphasis on conservation-oriented seed security planning. Pooled grainage data were analyzed using descriptive statistics, one-way ANOVA and correlation–regression approaches to identify performance stability and key determinants of seed output. Daba–BV demonstrated consistently superior performance with a mean DFL output of 244,842, low rejection (1.03%) and efficient cocoon conversion (3.37 cocoon:DFL), with stable productivity across years (CV 17.6%), confirming operational reliability and suitability for sustained commercial utilization. In contrast, Daba–TV recorded a lower mean DFL output (49,928) and higher variability (CV 25.4%), indicating greater seasonal and climatic sensitivity. ANOVA revealed a highly significant race effect on DFL productivity ( $p < 0.001$ ), statistically establishing BV as superior in output potential. Correlation analysis indicated that female moth availability strongly determined BV productivity ( $r = 0.91$ ), whereas rejection percentage was the principal limiting factor in TV ( $r = -0.81$ ), reflecting stronger environmental and health-related constraints. The findings demonstrate complementary conservation value of both ecoraces: BV as a high-yield, biologically efficient race ensuring production sustainability, and TV as a climate-buffering genetic resource adaptable across multiple seasons. Strategic dual maintenance and planned deployment of BV and TV can enhance resilience, stabilize seed supply, and safeguard seri-genetic diversity under semi-arid climatic variability. The study provides quantitative benchmarks to guide conservation-driven tasar seed planning and long-term sustainable utilization of Daba seri-genetic resources.

**Keywords:** Daba–BV; Daba–TV; Seri-genetic conservation; Grainage stability; Climate-adaptive seed planning;

### **T1P43: Scaling Tasar Silk Production and Tribal Livelihoods: The Strategic Role of BSMTC Balaghat in Madhya Pradesh**

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#### **Abstract**

Tasar sericulture remains a vital forest-based industry for the tribal populations of Central India. The Basic Seed Multiplication and Training Centre (BSMTC), Balaghat, established in 1983 under the Central Silk Board, serves as the primary institutional catalyst for this sector in Madhya Pradesh. This study evaluates the contribution of BSMTC Balaghat in stabilizing the tasar silk value chain and enhancing the economic resilience of tribal communities through technical intervention and seed supply chain management.

Data indicates a significant upward trend in productivity, with DFL (Disease-Free Layings) production rising from 1.13 lakh in 2016-17 to 2.12 lakh in 2025-26. Beyond numerical growth, the center has successfully provided a consistent supply of high-quality eggs to farmers and state departments. Increased household income by reducing crop failure through the distribution of disease-free stock. Enabled tribal youth and women to adopt modern sericulture practices, effectively reducing seasonal migration. During the odds of covid-19 pandemic BSMTC Balaghat managed to survive the farmers and sustain the flow of tasar value chain in the state of MP and surroundings by producing and supplying the seeds. BSMTC Balaghat is instrumental in bridging the gap between scientific silk cultivation and grassroots implementation. By integrating advanced seed technology with tribal skill development, the center has established a sustainable model for rural poverty alleviation.

**Keywords:** Tasar Sericulture, BSMTC, Tribal Empowerment, Seed Multiplication, Madhya Pradesh, Disease-Free Layings (DFLs);

## Theme 2

**Intervention of genomic & biotechnological tools in characterization and evaluation of Seri-genetic resources**



## **T2O1: Decoding Epigenetic Plasticity in *Bombyx mori*: A Bioinformatics Framework for Climate-Resilient Germplasm Characterization**

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### **Abstract**

The domesticated silkworm, *Bombyx mori*, holds immense economic value, yet its inherent physiological vulnerability to environmental instability makes escalating climate change a critical threat to sericultural sustainability. While conventional germplasm characterization has successfully utilized static genomic markers like SNPs and SSRs to identify fixed traits, these tools inherently fail to capture phenotypic plasticity—the organism's dynamic capacity to modulate gene expression in response to transient environmental stress. To bridge this gap, we propose for a paradigm shift from purely genotype-centric frameworks to an epigenetically informed perspective that treats the epigenome as a critical reservoir of adaptive variation. We present an integrative bioinformatics framework that combines Whole Genome Bisulfite Sequencing (WGBS) and transcriptome profiling (RNA-seq) to decode the "epigenetic signatures" of resilience. The proposed analytical pipeline links differential methylation regions (DMRs), specifically within gene bodies, to the transcriptional regulation of key stress-response pathways. We anticipate that identifying these "epimarkers" will reveal latent adaptive potential in silkworm accessions that appear genetically identical but phenotypically distinct. Ultimately, incorporating these insights into "climate-smart" breeding and precision conservation strategies offers a promising pathway to secure genetic resources and sustain productivity under future environmental uncertainty.

**Keywords:** *Bombyx mori*, Epigenetic Plasticity, Bioinformatics, Climate Resilience, Conservation

## **T2O2: Comparative transcriptome analysis in popular bivoltine and multivoltine silkworm *Bombyx mori* L using high throughput RNA Sequencing**

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### **Abstract**

Characterization and evaluation of different silkworm races is important for understanding the genetic potential and for commercial exploitation. In general, bivoltine (temperate) silkworms are productive in nature and multivoltine (tropical) are the native races are tolerance to diseases and harsh environmental conditions. Understanding the functional complexities in these silkworm races not fully elucidated. In this study we explored the transcriptome analysis in different vital tissues such as midgut, silk gland, Testes & ovary of CSR-2 and Pure Mysore (PM) silkworms collected from germplasm using high-throughput paired-end RNA sequencing. Total Raw reads recorded ranging from 24.10 to 34.39 (million reads). The quality was assessed using Fastqc with an average read count of raw data >30million and ~95% of raw data are  $\geq$  Q30; or high-quality reads. On an average >95% of high-quality reads were recovered after filtration and the alignment with reference sequence data was found >95%. R module DSeq2 tool was used to analyze the Differential expression of genes (DEG) using transcript data of different tissues of PM & CSR-2 silkworm races. Total 15,407 genes upregulated and 15596 down regulated genes recorded. Functional annotation of significantly expressed genes was analyzed with Gene Ontology (GO) and clustered into 3 basic groups: Biological process (BP), Molecular function & Cellular components. Majority of Significantly top enriched genes are related to either carbohydrate metabolism (54 genes), regulation of translational process (33 genes) or neuropeptide signaling pathway (19 genes) in all the tissues analyzed.

**Keywords:** Transcriptome analysis, RNS Sequencing, *Bombyx mori*, Differential expression of genes (DEG), tissue specific

### **T2O3: Pan-genome informed GWAS identifies candidate loci underlying diapause regulation in *Bombyx mori*.**

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#### **Abstract**

Diapause is an adaptive developmental arrest that enables insects to survive adverse environmental conditions through coordinated metabolic suppression and enhanced stress tolerance. In the domesticated silkworm (*Bombyx mori*), embryonic diapause is regulated by diapause hormone (DH), a 24-amino-acid neuropeptide secreted from the suboesophageal ganglion that activates its receptor (DHR) to induce glycogen accumulation in developing ovaries. Voltinism in *B. mori*, classified as univoltine, bivoltine, or multivoltine, reflects distinct diapause phenotypes governed by environmental cues such as photoperiod and temperature. The facultative diapause exhibited by bivoltine strains provides a powerful framework to investigate the genetic architecture of this trait.

We performed a genome-wide association study (GWAS) using SNPs derived from a pan-genome dataset of 1,078 accessions. After removing data of wild relative of *Bombyx mori*, 1,004 individuals (978 bivoltine and 26 multivoltine) were analyzed across all 28 chromosomes. The analysis identified suggestive association signals primarily on chromosomes 1, 11, and 19. Annotation of genomic regions flanking the top-associated SNPs revealed 48 candidate genes, of which 11 are functionally linked to pathways relevant to diapause regulation. Network analysis highlighted enrichment of neuropeptide signaling, insulin/IGF signaling, fatty acid metabolism, G-protein-coupled receptor pathways, and circadian clock components, supporting a polygenic and interconnected regulatory framework.

Although the limited number of multivoltine accessions reduces statistical power and may affect effect size estimation, these results provide a genomic foundation for understanding diapause regulation and offer prioritized targets for future validation and functional studies.

**Keywords:** *Bombyx mori*, Diapause, GWAS, Pan-genome

## **T2P1: LC–MS/MS based Proteomic Characterization of Saliva from the Pink Mealybug (*Maconellicoccus hirsutus*)**

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### **Abstract**

The pink mealybug, *Maconellicoccus hirsutus*, is a major agricultural pest affecting a wide range of crops worldwide, including mulberry. It is a phloem-feeding insect that injects saliva into host plants, suppressing plant defense responses and causing tukra disease. Despite its economic importance, the salivary proteome of *M. hirsutus* remains poorly characterized. In this study, liquid chromatography–tandem mass spectrometry (LC-MS/MS) was employed to analyze the salivary proteins of *M. hirsutus*. A total of 55 insect-derived proteins were identified in the secreted saliva. Functional annotation indicated that these proteins are involved in key biological processes, including development, digestion, detoxification, immunity, energy metabolism, chitin metabolism, hormone regulation, and cytoskeletal maintenance. Comparative analysis with other arthropods revealed conserved functional categories such as ribosomal components, binding proteins, hydrolases, and redox-related enzymes, suggesting shared roles among herbivorous insect salivary proteins. Several proteins implicated in the modulation of plant immune responses were identified, and genes encoding odorant-binding protein, cathepsin B-like endopeptidase, legumain, and heat shock protein 70 were identified as potential RNA interference (RNAi) targets. These findings enhance our understanding of pink mealybug salivary function and support the development of targeted pest management strategies.

**Keywords:** Biotic stress, Mulberry, Pink Mealybug, LC-MS/MS, Tukra

## **T2P2: New Advancements and Opportunities in the Use of Nanotechnology to Advance Sustainable Sericulture**

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### **Abstract**

In order to increase production and sustainability, sericulture a traditional agro-based business with major socioeconomic significance is progressively adopting contemporary technological solutions. Among these, nanotechnology has become a promising area that offers creative answers to persistent problems in silkworm raising, disease control and improving the quality of silk. Novel physicochemical characteristics of nanomaterials, including metal and metal oxide nanoparticles, carbon-based nanostructures and polymeric nano-carriers allow for focused use in biological and agricultural systems, creating new avenues for the development of sericulture. According to recent research, silkworm nutrition can be improved by nano-enabled methods that promote gut microbial balance and physiological function while also improving nutrient absorption and feed efficiency. The use of nanomaterials has demonstrated promise in enhancing immunological responses, decreasing pathogen susceptibility and enhancing cocoon properties such as weight, shell ratio and filament quality. Furthermore, silk fibers can now be functionally modified thanks to nanotechnology, increasing its use in the industrial, textile and biomedical fields. Using nano-formulations to manage diseases and pests also helps to reduce the use of chemicals and encourage ecologically friendly behaviour. Even with these promising advancements, there are still a number of obstacles to overcome, such as issues with biosafety, environmental toxicity, economic viability, application method uniformity and regulatory approval for field-level implementation. To solve these problems, thorough analysis, interdisciplinary cooperation and the creation of precise safety regulations to guarantee responsible use are needed. All things considered, sericulture has a lot of potential to become a more robust, effective and sustainable industry thanks to nanotechnology. Nano-enabled innovations have the ability to improve the security of farming communities' livelihoods that depend on sericulture while fortifying silk production systems with more research, technological advancements and supportive regulatory frameworks.

**Keywords:** Nanotechnology, *Bombyx mori*, Sustainable production, Silk quality.

### T2P3: RNA-Seq Based Identification of Differentially Expressed Genes in Insecticide-Treated *Bombyx mori*

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#### Abstract

Insecticide exposure significantly affects the physiological and molecular integrity of *Bombyx mori*, potentially compromising silk production and overall health. In this study, comparative transcriptomic analysis was conducted between treated silkworms (Broflanilide 20% SC) (TSW) and control silkworms (CSW) to elucidate treatment-induced gene expression alterations. RNA sequencing followed by differential expression analysis ( $P < 0.05$ ;  $|\log_2 \text{fold change}| > 2$ ) identified 802 differentially expressed genes (DEGs), of which 797 were downregulated and 5 were upregulated, indicating extensive transcriptional suppression. The most prominently upregulated gene encoded a 26S proteasome regulatory subunit, suggesting activation of protein degradation and stress-response pathways, while other induced genes were linked to cellular signaling and vesicular transport. Notably, major silk biosynthesis genes, including fibroin heavy chain, fibroin light chain and silk protein P25, were strongly repressed, demonstrating severe impairment of silk gland function. Correlation heatmaps, boxplot normalization, hierarchical clustering, and volcano plot analyses confirmed clear transcriptional divergence and robust data quality. These findings highlight the importance of molecular biomarkers for early stress detection, promotion of stress-resilient strains, eco-friendly alternatives, conservation of genetic resources and regulatory evaluation of insecticide safety to ensure sustainable sericulture and long-term resilience of *B. mori* populations.

**Keywords:** *Bombyx mori*, Transcriptomics, Silkworm Proteins, DEG's

## **T2P4: Development of a DNA barcoding system for varietal differentiation and protection of authorized mulberry varieties**

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### **Abstract**

The taxonomy of the genus *Morus* is notably complex due to significant morphological plasticity, hybridization, and a long history of domestication, which often renders traditional phenotypic identification unreliable for germplasm management and Intellectual Property Rights (IPR) protection. We developed a comprehensive molecular identification system for mulberry by integrating multi-locus DNA barcoding with high-resolution allele profiling.

For our study, we obtained a core set of 150 accessions from CSGRC Hosur, 22 from CSRTI Mysore and 11 from CSRTI Berhampore. To achieve varietal differentiation in 33 authorized varieties, SSR markers were identified from the *Morus alba* genome assembly and genotyped to identify a set of unique combinations of alleles. A total of 41 SSR primers were screened, among which four (04) highly polymorphic and reproducible primers were selected to generate allele-specific fingerprints. These SSR profiles provided distinct molecular signatures for reliable discrimination and protection of commercially released cultivars. We also employed universally accepted plant barcode markers (*rbcL*, *matK*, *ITS1*, *ITS2*, and *trnH-psbA*) to ensure precise taxonomic classification of Hosur germplasm via phylogenetic analysis. The marker information will be eventually used to conducted detailed population genetic analysis of *Morus* germplasm.

**Keywords:** *Morus* spp., DNA barcoding, Allele profiling, SSR markers, Varietal protection, genotype

## T2P5: Integrating Genomics and Phenotypic Performance for Conservation and Utilization of Eri Silkworm Genetic Resources

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### Abstract

The North Eastern Region (NER) of India is globally recognized as a biodiversity hotspot and a major centre of sericulture, producing all five commercially important silks. The domesticated eri silkworm (*Samia ricini* Donovan) is widely distributed across the NER, where numerous ecoraces are maintained and traditionally named after their collection sites. Although 26 distinct ecoraces and six pure-line strains have been identified based on morphological and larval characters, comprehensive genomic characterization of available eri germplasm remains limited. In the present study, eri silkworm ecoraces and morphotypes were collected from different locations of North-East India and evaluated using an integrative framework combining phenotypic performance and genotyping-by-sequencing (GBS). Genomic DNA from 98 individuals representing diverse ecoraces, morphotypes, and both sexes was subjected to GBS. Phenotypic assessment revealed marked inter-ecorace variability, with the highest larval weight recorded in Borduar YP (5.99 g), followed by Udalgiri YP (5.88 g). Borduar GBP exhibited the highest shell ratio (13.29%), whereas Kokrajhar showed the lowest shell ratio (10.36%). After stringent quality filtering, a panel of 878 informative SNPs was retained for downstream analyses. Observed heterozygosity ranged from 0.094 to 0.333, with a mean of 0.237, indicating substantial genetic variation among accessions. Pairwise genetic dissimilarity and neighbor-joining clustering based on SNP genotypes revealed well-defined genetic groupings corresponding to major ecoraces and commercial breeds, with each major ecorace forming cohesive clades and exhibiting clear genetic divergence. The convergence of phenotypic superiority with adaptive genetic diversity highlights the potential of elite ecoraces as donor lines for trait introgression into domesticated stocks. Strengthening in situ gene sanctuaries in combination with phenotype-driven selection and genomic characterization is advocated for sustainable genetic improvement and conservation of eri silkworm genetic resources.

**Keywords:** Genomics, Phenotype, Ecoraces, Genotyping-by-Sequencing (GBS), *Samia ricini* Donovan

## T2P6: Digital Genebank and Molecular Characterization of host plant

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### Abstract

Sericulture is very important for the rural livelihoods and for the growth of economy, the rearing of these worms depends significantly on the genetic diversity of host plants, including Mulberry and Vanya species. The conservation and sustainable use of these plant genetic resources are very much important for increasing the silk production and productivity, mitigating climate change effects, and for enhancing resistance to pests and diseases.

Digital genebanks and molecular characterization are redefining the conservation and utilization of sericultural plant resources by integrating biological repositories with advanced genomic and informatics tools. sericulture of north east mainly centered on India's vanya silks (Muga, Eri, and Oak tasar) depends fundamentally on the genetic diversity and ecological adaptability of host plants. Muga culture relies on Som (*Persea bombycina*), Soalu (*Litsea monopetala*), and Dighloti (*Litsea salicifolia*); Eri culture utilizes castor (*Ricinus communis*), kesseru (*Heteropanax fragrans*), *Ailanthus* spp., and cassava (*Manihot esculenta*); while Oak tasar is sustained by diverse oak species including *Quercus* spp. and *Lithocarpus dealbata*. Despite their socio-economic importance in the North-East and Himalayan regions, these ericulture and Muga culture largely depend on heterogeneous and poorly characterized germplasm.

Digital genebanks provide structured platforms for integrating passport data, morphological descriptors, geo-referenced information, and molecular datasets into dynamic, searchable databases. The application of molecular tools—such as DNA barcoding, SSRs, SNP markers, and next-generation sequencing—enables precise assessment of genetic diversity, reducing the duplicates, identification of unique alleles, and understanding of the population structure. Such genomic insights support the selection of elite genotypes, broaden the genetic base for breeding and enhance resilience against climate variability, pests, and diseases.

By linking conservation with molecular characterization and bioinformatics, digital genebanks facilitate data-driven breeding and sustainable management strategies, ensuring long-term conservation and strategic utilization of sericultural plant genetic resources.

**Keywords:** Genebank, Host plant, Molecular characterization

## **T2P7: Marker-assisted identification of trait-specific silkworm genetic resources for climate resilient sericulture in India**

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### **Abstract**

Climate variability and rising environmental stressors threaten the sustainability of sericulture in India, highlighting the need for climate-resilient silkworm genetic resources (SWGRs). This study systematically identifies and characterizes trait-specific *Bombyx mori* germplasm conserved at CSGRC, focusing on tolerance to abiotic and biotic stresses. A diverse set of accessions were evaluated for tolerance to high temperature, and viral pathogens. Key parameters included survival rate, cocoon yield, and adaptability under stress conditions. Specific SSR markers were employed to assess genetic diversity and pinpoint alleles associated with thermotolerant and viral tolerance traits. Results indicated 6 SWGRs exhibiting superior thermotolerance in selected hotspots of India, and 22 *BmBDV*-resistant and 15 *BmNPV*-tolerant SWGRs available in the gene bank. By integrating phenotypic screening with molecular insights, the study provides a strategic framework for harnessing genetic diversity to mitigate climate risks. These findings emphasize the importance of conserving and utilizing silkworm germplasm to ensure sustainable sericulture, improve farmer livelihoods, and enhance silk productivity in the face of global climate change.

**Keywords:** *Bombyx mori*; germplasm evaluation; climate resilience; molecular markers;

## **T2P8: Molecular Characterization and Conservation of Drought-Tolerant Mulberry Genotypes for Climate-Resilient Sericulture**

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### **Abstract**

Drought stress remains one of the most critical constraints in mulberry cultivation. It significantly reduces the leaf yield and quality and leads to decline silk production. Since Mulberry (*Morus* spp.) serves as the exclusive host plant for the silkworm *Bombyx mori*, the development of climate-resilient mulberry varieties has become essential for sustaining silk productivity under increasing climatic variability. The progressive narrowing of the mulberry genetic base further heightens vulnerability to abiotic stresses, underscoring the urgent need for systematic identification and conservation of drought-tolerant genotypes.

This study synthesizes secondary data from peer-reviewed research articles, institutional reports, and programs of the Central Silk Board, focusing on the evaluation and molecular characterization of mulberry germplasm collected from diverse agro-climatic regions. Accessions were screened under moisture stress conditions using key physiological and yield-related parameters, including relative water content, chlorophyll stability index, leaf moisture retention capacity, and biomass productivity. Molecular marker analyses were employed to assess genetic diversity and identify allelic variations associated with drought tolerance. The integration of phenotypic screening with molecular profiling enabled the precise identification of elite stress-resilient genotypes.

Superior lines were prioritized for ex situ conservation in field gene banks and repository plantations, while promising genotypes were promoted for on-farm conservation to preserve adaptive performance under real cultivation conditions. The conserved germplasm was subsequently integrated into breeding programs aimed at developing region-specific, drought-resilient mulberry varieties. This integrated framework demonstrates that the strategic combination of molecular tools and structured conservation approaches not only safeguards valuable genetic resources but also accelerates the development of climate-resilient cultivars. Such efforts are vital for enhancing leaf productivity, stabilizing cocoon yield, and ensuring the long-term sustainability and resilience of the sericulture sector under changing climate scenarios.

**Keywords:** Mulberry germplasm; drought tolerance; molecular markers; genetic diversity; climate-resilient breeding; sustainable sericulture.

## **T2P9: Systematic Domestication of *Antheraea mylitta* Through Continuous Indoor Rearing Integrated with Genomic and Biotechnological Interventions**

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### **Abstract**

The tropical tasar silkworm, *Antheraea mylitta*, remains semi-domesticated and highly sensitive to environmental variability under conventional outdoor rearing systems. Continuous indoor rearing under regulated temperature and relative humidity conditions provides a structured opportunity to promote gradual adaptation toward controlled ecological environments. Successive rearing cycles combined with directional phenotypic selection based on larval survivability, effective rate of rearing (ERR%), cocoon weight, shell weight, and shell ratio may progressively enrich individuals exhibiting improved indoor performance, thereby initiating a domestication trajectory while maintaining seri-genetic variability.

Beyond phenotypic stabilization, a broader integrative analytical framework can be conceptualized to deepen understanding of adaptive responses under indoor conditions. Population genomic approaches may facilitate estimation of the inbreeding coefficient (F), effective population size (Ne), genetic diversity parameters, and linkage disequilibrium architecture using genome-wide SNP datasets. Selection signature mapping could enable identification of genomic regions potentially undergoing adaptive shifts under sustained indoor rearing. Comparative evaluation between indoor-surviving and indoor-sensitive larvae may further elucidate stress-associated physiological differentiation emerging under confinement-based conditions. Investigation of expression dynamics of key stress-response regulators including heat shock proteins (Hsp21, Hsp70), antioxidant defense genes (SOD, catalase, GST), and endocrine markers such as EcR and Broad-Complex, may provide insight into transcriptional modulation underlying resilience. Correlating molecular stress-response profiles with larval growth performance, cocoon traits, and survivability indices could reveal functional linkages between physiological robustness and productive efficiency.

This integrative conceptual framework connects systematic indoor selection with prospective genomic and molecular characterization, contributing to strengthened evaluation and scientific advancement of Vanya serigenetic resources through evidence-based domestication strategies.

**Keywords:** *Antheraea mylitta*, Indoor Rearing, Domestication, Seri-genetic Resources, Stress Physiology, Heat Shock Proteins, Antioxidant Defense System

## **T2P10: Integrated Multivariate, Genomic and NIR-Based Evaluation of Mulberry Germplasm for Development of Nutrient-Dense Artificial Diets for Silkworm (*Bombyx mori* L.)**

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### **Abstract**

Sustainable silkworm rearing is increasingly challenged by seasonal fluctuations in mulberry leaf availability, climatic variability, and labour constraints, highlighting the need for nutritionally consistent artificial diets. The success of such diets depends on the identification of suitable mulberry germplasm with balanced nutrient composition, functional safety, and processing compatibility. The present study integrates multivariate statistical analysis, genomic tools, biochemical profiling, and near-infrared reflectance spectroscopy (NIRS) to evaluate mulberry (*Morus* spp.) germplasm for use as standardized bio-ingredients in instar-specific artificial diets for silkworm (*Bombyx mori* L.). Diverse accessions from field gene bank were analysed for key nutritional parameters including crude protein, carbohydrates, fibre fractions, moisture, total phenols, and essential macro- and micronutrients. Genomic characterization using SSR and SNP-based markers assessed genetic diversity, population structure, and marker–trait associations linked to nutritional attributes. Multivariate analyses such as principal component analysis and hierarchical clustering identified nutritionally functional accession groups suitable for early and late larval instars. Early instars required higher moisture and moderate protein with lower fibre and phenolics, whereas late instars demanded elevated protein and mineral levels to support rapid growth and silk synthesis. NIRS calibration models were developed using multivariate regression and validated with independent datasets for rapid, non-destructive screening of large germplasm sets. The combined genomic–biotechnological framework enhances precision utilization of mulberry germplasm, supports molecular-assisted breeding, and strengthens resilience and sustainability in sericulture systems.

**Keywords:** Artificial silkworm diet; *Bombyx mori*; Mulberry germplasm; Multivariate analysis; NIRS; Precision nutrition

## **T2P11: Molecular basis of fruit ripening of *Morus macroura*: a unique aroma ( $\gamma$ -decalactone) and creamy flavour comprising fruit**

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### **Abstract**

Fruit ripening represents a highly coordinated developmental process that involves complex molecular networks governing color transformation, sugar accumulation, and textural changes. Decoding molecular basis of fruit ripening is key to improving fruit quality and post-harvest technology (PHT). Publicly available RNA-Seq reads of three stages (with three replicates) of fruit tissue (green, semi-ripe and ripe) of *Morus macroura* subjected to retrieved and analysed ~500 Gb data in previously optimized RNA-Seq workflow. Steps including read quality checks (FastQC), alignment (HISAT2), transcriptome assembly (StringTie), quantification (FeatureCounts), differential expression (DESeq2), and functional annotation (BlastKOALA, Cytoscape-ClueGO) were performed. Comparative analysis identified ripening-associated upregulated genes involved in sugar metabolism, cell-wall remodeling, anthocyanin synthesis, and ethylene/abscisic acid signalling, alongside downregulation of gene involved in photosynthesis and chlorophyll biosynthesis. Further, TF-mediated gene regulatory network (GRN) identified 11 TFs that are crucial for aroma ( $\gamma$ -decalactone) and creamy flavour. This streamlined, study empowers researchers to dissect ripening mechanisms and gene-metabolite interactions in mulberry. Present data-mining methodology can disclose the genetic underpinnings of hidden phenotypes that are difficult to identify using traditional approaches.

**Keywords:** mulberry, fruit ripening, RNA-Seq, GRN

# Theme 3

## Bioprospecting of Seri by-products and non-textile applications



### **T3O1: The Multifunctional Mulberry: Nutritional and Therapeutic Roles of Its Botanical Parts**

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#### **Abstract**

Mulberry (*Morus* spp.), a plant deeply rooted in Asian agriculture and tradition, is celebrated not only for its essential role in sericulture but also for its exceptional nutritional and therapeutic properties. Referred to as the 'Kalpa Vriksha' in India for its multipurpose benefits, mulberry's fruits, leaves, twigs, and root bark are rich in bioactive compounds that offer a wide range of health-promoting effects. These include anti-cancer, anti-diabetic, anti-inflammatory, antioxidant, antimicrobial, and cardiovascular benefits. Additionally, mulberry extracts demonstrate promising neuroprotective, hepatoprotective, and skin-enhancing properties, making them increasingly valuable in medicinal and cosmetic applications. This article explores the multifaceted potential of mulberry, highlighting its role as a functional food and natural remedy in modern health and wellness.

**Keywords:** mulberry; bioactive compounds; anti-oxidant; anti-inflammatory

## **T3O2: Silk Fibroin as a Promising Biomaterial for Modern Biomedical Applications**

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### **Abstract**

Silk fibroin, a natural protein polymer that primarily comes out of the *Bombyx mori* silkworm cocoons has received a lot of interest in biomedical research because of its good biocompatibility, biodegradability, mechanical properties, and low immunogenicity. The structural peculiarities of fibroin such as  $\beta$ -sheet structure and adjustable degradation rate render it a promising biomaterial in a wide range of clinical applications. Fibroin is processed into many different forms, including films, hydrogels, scaffolds, nanoparticles and nanofibers, which allows it to be used in tissue engineering, wound healing as well as drug delivery systems and regenerative medicine. Fibroin scaffold has been used in tissue engineering to support cell adhesion, proliferation, and differentiation in regulating skin, bone, cartilage, and nerve tissues. Its regulated drug release characteristics maximize the therapeutic effect in minimizing side effects. Furthermore, biomaterials made of fibroin have demonstrated high oxygen and moisture permeability and are thus applicable in high-order wound dressing. In fibroin, the new developments in bioengineering and nanotechnology have given it the added potential in the creation of biosensors and implantable medical devices. In spite of these benefits, there are still issues like large scale processing, standardization and long-term clinical validation. Altogether, silk fibroin is a flexible and promising biomaterial in the future of the biomedical practice.

**Keywords:** Silk fibroin, Biomaterials, Tissue engineering, Drug delivery, Biocompatibility

### **T3O3: Bioprospecting of Sericulture By-products as an Economic Incentive for On-Farm Conservation of Seri-Genetic Resources**

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#### **Abstract**

The replacement of indigenous mulberry varieties and silkworm races with high-yielding genotypes accelerates genetic erosion. Ex-situ germplasm conservation is essential but costly, institutional burden and may not capture adaptive nature of Seri-genetic resources. In this context, bioprospecting of Seri by-products offers an opportunity to link sustainable utilization with conservation under farmers field conditions. This study examines the bioprospecting potential of sericulture by-products as an income-enhancing pathway to support on-farm conservation of indigenous Seri-genetic resources. Sericulture generates a wide range of secondary by-products which are mostly underutilized found to possess high demand due to its significant biological properties finds applications in pharmaceutical and cosmetic industries. Indigenous mulberry landraces and traditional silkworm races, though often lower in primary silk yield, are resilient, low-input, and rich in unique biochemical and adaptive traits, making them particularly suitable for non-textile value addition.

This analysis is based on secondary information from research articles, institutional and Central Silk Board technical reports. The primary focus of the study is on the TSP and NER programs, which have a very large investment towards sericulture production; developing host plants; providing support to farmers, and transferring technology. In turn, these programs indirectly help with on-farm conservation because they provide an economic benefit for farmers to keep local silkworm races and host plants at low margin. This study emphasizes the need for minimum government assistance and technology to aid stakeholders in bioprospecting and adding value to by-products. By utilizing sustainable benefits from by-products, the responsibility of conserving the genetic resources of Sericulture will move from an institutional level to a farmer level, enhancing the conservation of these resources in the area where they are produced. The government should provide premium pricing for products from by-products and prioritize R&D, branding, and promotion to advance a 'Conservation-through-Utilization' policy.

**Keywords:** Mulberry, Silkworm, Genetic erosion, Seri By-product, On-Farm Conservation, Seri-genetic resources.

### **T3O4: Reimagining Sericulture Waste: Cocoon Artistry as a Model for Sustainable Livelihood and Rural Innovation**

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#### **Abstract**

Sericulture has long served as an environmentally sustainable rural enterprise in India, contributing to employment generation, cultural heritage and ecological balance. Despite its socio-economic importance, a considerable proportion of defective and non-reelable cocoons remains underutilized, resulting in economic loss and resource wastage. Addressing this gap, the Creative Cocoon - Cocoon Artistry Initiative conceptualized and implemented by me introduces an innovative approach that converts sericultural waste into value-added artistic and livelihood opportunities. The initiative promotes the transformation of discarded and defective cocoons into eco-friendly craft products through structured training, skill development and community participation. By integrating traditional craftsmanship with contemporary design approaches, the model encourages entrepreneurship among rural women and youth while reinforcing principles of sustainability and circular resource utilization. The initiative aligns with national priorities of self-reliance and women-led development by enabling participants to generate supplementary income through low-investment, home-based creative enterprises. Capacity-building workshops conducted across remote and border regions of Jammu and Kashmir have facilitated hands-on training in cocoon processing, natural colouration, design development and product creation. These interventions have not only enhanced technical skills but have also strengthened confidence, economic participation and social recognition among beneficiaries. Parallel environmental efforts, including mulberry plantation drives, further support ecological sustainability and reinforce the linkage between sericulture and environmental stewardship. The Cocoon Artistry model demonstrates how waste materials within traditional industries can be re-envisioned as creative economic resources. By bridging art, sustainability and livelihood generation, the initiative provides a replicable framework for rural development and micro-enterprise promotion. Future expansion aims to establish dedicated training centers, integrate cocoon-based crafts into vocational education systems and build collaborative networks for

marketing and institutional support. Beyond economic outcomes, the initiative represents a transformative social movement that redefines sericulture waste as a medium of innovation, cultural expression and empowerment. It highlights the potential of creative interventions in strengthening rural economies while contributing to a sustainable and inclusive development paradigm.

**Keywords:** Sericulture Waste Utilization, Cocoon Artistry, Sustainable Livelihoods, Women Empowerment, Circular Economy, Rural Entrepreneurship and Eco-friendly Crafts

### **T3O5: Sericin based bioactive interventions: evaluation of its pharmaceutical activities**

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#### **Abstract**

Sericin is a natural biopolymer, constitutes 25 - 30 % of cocoon which acts as an adhesive in joining two fibroin filaments in order to form silk yarn. This molecule is highly hydrophilic and consists of 18 amino acids including essentials. The demand for biocompatible and biodegradable materials shows the growing interest of sericin protein in non-textile applications in a field of science and medicine due to its biocompatibility, biodegradability and multifunctional bioactivities including antioxidant, antimicrobial, anti-inflammatory, and wound healing properties. With this background, the present study was conducted to study the antioxidant, antihyperglycemic and wound healing property of sericin. Sericin found to possess strong antioxidant activity. The IC<sub>50</sub> value of sericin for DPPH radical scavenging activity was found to be less (0.0741 mg) than standard ascorbic acid (0.213 mg). The results of antihyperglycemic activity of sericin in diabetic induced rats showed a significant decrease in Fasting Blood Glucose level compared to standard drug treatment. Similarly, the results of wound healing activity of sericin showed a wound reduction of 100 ± 0.00 per cent on 14<sup>th</sup> day. Wound contraction was significantly increased in wounds treated with sericin when compared to wounds treated with standard and untreated wounds which indicated that sericin showed more wound healing property than control. From the results of the study, it is evident that sericin had potential biological properties and it could be exploited not only in biomedical but also in food and cosmetic industries.

**Keywords:** sericin, antioxidant, antibacterial, antihyperglycemic, wound healing

### **T3O6: Bioengineered fluorescent sericin-chitosan sheets from *Antheraea mylitta* for accelerated wound healing**

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#### **Abstract**

An uninvestigated fluorescent Sericin-Chitosan-PVA (SCP) blend sheet was developed with sericin (1%), chitosan (1%), and PVA (5%) via solvent casting. The analytical characterization of the sheet via X-ray diffraction (XRD), thermogravimetric analysis (TGA), and Fourier transform infrared spectroscopy (FTIR) confirmed the lack of polymer-polymer incompatibility. Optical contact angle (OCA) measurements confirmed the hydrophobicity of the developed sheets. Field emission scanning electron microscopy (FESEM) confirmed the smooth, flat, and porous surface topography. Bioengineered fluorescent sheets showed increased antioxidant activity as measured by DPPH and hydrogen peroxide scavenging assays, suggesting that higher sericin concentration is an effective approach to enhance antioxidant properties. The sheets showed high mechanical strength, along with optimal contact angle and surface free energy, suggesting excellent biomaterial compatibility. In vivo wound healing studies in mice showed that all the fluorescent SCP sheets significantly promoted wound healing within 14 days, without any scar formation. These results suggest that SCP fluorescent sheets could be an effective biomaterial for wound dressing.

**Keywords:** Tasar silkworm, Sericin, chitosan, fluorescent sheet, wound healing

### **T3P1: Bioprospecting of Mulberry Fruits for its Nutraceutical Properties**

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#### **Abstract**

Mulberry (*Morus* sp.) is a multipurpose plant with high economical potential and is widely distributed in Asia, Europe, North America, South America, and Africa (Imran *et al.*, 2010). Mulberry is known as “KalpaVruksha” in India which means all parts of the plant are used for various purposes also its fruit is commonly named toot and shah took (King or superior mulberry). But in India, the mulberry plant is an economically important and predominantly used as a feed source for silkworm (*Bombyx mori* L.). As mulberry fruit contains an essential amino acid score of more than 100, mulberry fruit has been recommended as an excellent dietary product by World Health Organization (WHO). Despite having these immense nutraceutical and pharmacological properties, mulberry fruits are underutilized in India because of various reasons which include a lack of awareness of the richness of pharmaceutical value of fruit and also lack of research and developments to add its value. At present, isolation and characterization of the phytochemicals from mulberry fruits are imperative, as these fruits are consumed in many countries for dietary enhancement. With this background, the present research study has been carried out in which it has been found out that mulberry fruit extracts of G4 and MR2 variety has higher antibacterial activity against *Staphylococcus aureus*, *Streptococcus pneumonia*, *Staphylococcus epidermidis*. And also the fruit extracts has stronger antioxidant activities against DPPH radical (IC50 value - 60.28 µg/ml), FRAP (30.08 µg/ml) and ABTS (IC50 value - 27.83 µg/ml) radicals. Both G4 and MR2 mulberry fruit extracts were found to have 19 functional groups which are identified through FT-IR analysis and bioactive compounds through GC-MS analysis which is responsible for the antioxidant and antibacterial activities. Hence, utilization of mulberry fruits in pharmaceutical and nutraceutical industries will be of great importance.

**Keywords:** mulberry fruit, nutraceutical, antioxidant

## T3P2: The Magic of Mulberries: From Orchard to Everyday Life

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### Abstract

Mulberries, the sweet, juicy fruits from the *Morus* tree, stand out as nutrient powerhouses, loaded with vitamins C and K, iron, potassium, ample dietary fiber, and potent antioxidants such as anthocyanins and resveratrol. These berries not only tantalize the taste buds but also deliver profound health perks, from enhancing digestion and fortifying immunity to stabilizing blood sugar and promoting cardiovascular wellness. Among the most beloved mulberry offerings is mulberry juice, savored fresh for its pure essence or pasteurized for wider commercial reach. Its innate sweetness makes it a refreshing drink that aids metabolic health. Similarly, mulberry jam captivate with their intense, velvety richness, serving as delectable spreads on toast, scones, pastries, and indulgent desserts. For on-the-go snacking, dried crispy mulberries shine as a wholesome alternative to sugary treats. The drying process locks in vital nutrients while dramatically extending shelf life, allowing easy incorporation into trail mixes, granola bars, yogurt, or breakfast cereals—perfect for busy lifestyles. Mulberry squash, crafted by simmering berries with sugar and a splash of lemon juice, imparts a vibrant hue and balanced sweet-tart profile. It's a versatile addition to summer coolers, cocktails, pancakes, ice creams, or baked goods, elevating everyday recipes with natural flair. In fermented realms, mulberry wine enchants with its deep, fruity aroma and robust antioxidant load, gaining traction among wine enthusiasts. Don't overlook mulberry leaf tea or beverage, brewed from dried leaves for a soothing, caffeine-free experience. Packed with antioxidants, vitamins, and minerals, it excels in blood sugar management, cholesterol reduction, and immune enhancement—ideal for wellness routines. As global appetites shift toward natural, functional superfoods, mulberry products—whether fresh, preserved, or innovatively processed—command increasing attention. Their adaptability spans culinary delights, nutraceuticals, and even cosmetics like skin-brightening extracts, positioning them for substantial market growth amid health-conscious trends.

**Key words:** Mulberry Wine, Mulberry Juice, Mulberry Jam, Dried Crispy Mulberries, Mulberry Squash.

### **T3P3: Antimicrobial Properties of Sericin Extracts: A Systematic Review of *In Vitro* Evidence (2000–2025)**

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#### **Abstract**

Sericin, a water-soluble silk protein generated in large quantities as a by-product of the silk reeling industry, has recently attracted attention for its potential non-textile applications, particularly as a natural antimicrobial agent. Although numerous *in vitro* studies have reported antimicrobial activity of sericin extracts, the evidence remains fragmented and methodologically heterogeneous. The present systematic review synthesizes *in vitro* experimental evidence on the antimicrobial properties of sericin published between 2000 and 2025. A PRISMA-guided search was conducted in Scopus using predefined keywords related to sericin and antimicrobial activity. Peer-reviewed *in vitro* studies evaluating sericin as the primary test material were included, while *in vivo*, clinical, composite-material, and review studies were excluded. Data were extracted on extraction methods, test microorganisms, assay types, and antimicrobial outcomes. Most studies employed hot-water or alkaline extraction methods and evaluated antibacterial activity using agar diffusion and minimum inhibitory concentration assays. Sericin consistently exhibited moderate antimicrobial activity against Gram-positive bacteria, particularly *Staphylococcus aureus* and *Bacillus* species, while Gram-negative bacteria showed comparatively lower susceptibility. Antifungal activity was less frequently investigated and yielded inconsistent results. Considerable variability in extraction protocols, concentrations, and assay methodologies limited cross-study comparability. Overall, *in vitro* evidence indicates that sericin possesses measurable antimicrobial properties, supporting its potential for non-textile applications such as biomedical and cosmetic formulations. However, the translational value of current findings is constrained by methodological inconsistency and limited mechanistic validation. Future research should emphasize standardized extraction protocols, robust antimicrobial assays, and mechanistic studies to strengthen evidence for practical applications.

**Keywords:** sericin; anti-microbial; non-textile applications

### **T3P4: Mulberry Fruits- Cosmetic Value Bioprospecting Sericin for Wound Healing and Drug Delivery Systems**

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#### **Abstract**

Sericin is a globular silk protein that comes from silk reeling. It has attracted more scientific interest as a valuable biomaterial because of its excellent biocompatibility, biodegradability, and many useful biological activities. Researchers are looking into sericin to understand its physical and biological properties for biomedical uses, especially in wound healing and drug delivery systems. Sericin is rich in hydrophilic amino acids like serine, glycine, and aspartic acid. This composition gives it a great ability to retain moisture, as well as antioxidant and antimicrobial properties. It also promotes cell adhesion and growth, which are essential for repairing wounds effectively. In managing wounds, sericin-based films, hydrogels, sponges, and electrospun mats have shown faster epithelialization, improved collagen production, and lower inflammation. Moreover, the chemical groups in sericin allow for modification and crosslinking. This enables controlled drug encapsulation and steady release. Sericin-based drug delivery systems have promising results for targeted delivery of antibiotics, growth factors, and anticancer drugs. These platforms improve treatment effects while reducing overall toxicity. This review outlines the latest progress in extracting, modifying, and exploring sericin, stressing its important roles in wound healing and drug delivery. Using sericin in biomedical products represents a sustainable way to make good use of silk waste, showing great potential for practical applications in regenerative medicine and drug development.

**Keywords:** Sericin, Wound healing, Drug delivery

### **T3P5: Development and Evaluation of a Bioactive Skin Balm Utilizing Upcycled Sericin from *Bombyx mori* cocoons**

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#### **Abstract**

This study investigates the development and rigorous evaluation of a sustainable skin balm enriched with sericin, a multifunctional bioactive protein extracted from *Bombyx mori* cocoons. To address the growing demand for eco-conscious skincare, sericin was recovered using an optimized High-Pressure High-Temperature (HPHT) extraction method. This green processing technique ensured high yield and chemical integrity, preserving the protein's native biological properties without the need for harsh reagents. The recovered sericin was subsequently incorporated into a specialized lipid-wax matrix consisting of beeswax, almond oil, coconut oil, and lavender essential oil, chosen for their synergistic emollient and therapeutic benefits. A precise three-phase manufacturing protocol was developed to stabilize the hydrophilic sericin within the hydrophobic base, resulting in a homogenous, high-performance emulsion.

Comprehensive physicochemical characterization confirmed the balm's suitability for dermatological use, maintaining a skin-compatible pH of  $5.4 \pm 0.2$ . This acidity is vital for preserving the natural acid mantle and supporting epidermal barrier function. The formulation's viscosity was measured at  $82,000 \pm 3,500$  cP, ensuring a smooth, spreadable consistency that facilitates uniform coverage and effective occlusive moisture retention. Stability assessments, including accelerated thermal cycling and high-speed centrifugation, demonstrated robust physical and chemical integrity with no evidence of phase separation. Long-term monitoring projects a shelf life exceeding 24 months under standard conditions.

Safety evaluations through human skin irritation tests confirmed a zero-irritation profile, making it suitable for sensitive skin types. Furthermore, the balm exhibited moderate antimicrobial activity against common cutaneous pathogens, attributed to the membrane-disrupting properties of

the sericin fraction. Microscopic analysis verified a stable oil-in-water system that promotes rapid absorption without leaving a greasy residue. By valorising sericulture waste, this research validates the sericin-enriched balm as a viable, sustainable alternative to synthetic emollients, supporting circular economy goals and offering a scientifically grounded solution for barrier repair and dermatological health.

**Keywords:** Sericin, skin balm, HTHP extraction, sericulture waste valorisation, cosmeceuticals

### **T3P6: Development and quality assessment of flavour blended mulberry herbal tea**

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#### **Abstract**

Mulberry is a perennial woody plant belongs to family Moraceae and genus *Morus*. Apart from feed for silkworm, leaves are being used for many other purposes. The present research was conducted to develop and evaluate flavour blended mulberry herbal tea. The nutrient content, consumer acceptability and cost economics of the developed products were analysed. Mulberry herbal tea with different flavours was prepared by incorporating 4 g of mulberry leaf powder with varied 0.5 g, 1 g and 1.5 g each of ginger, lemongrass, *jeera*, *pudina*, cardamom, vanilla and cocoa powder. Sensory evaluation of mulberry herbal tea with different flavours revealed that adding 1 g of each *pudina*, *jeera* and ginger showed highest overall acceptability. Based on these findings, Flavour blended mulberry tea (FBMT) was developed using 4 g of mulberry leaf powder, blended with *pudina*, *jeera* and ginger at 0.4 g, 0.6 g and 0.8 g respectively. The results indicated that 0.6 g each of *pudina*, *jeera* and ginger showed highest overall acceptability. Nutritional composition of FBMT powder indicated 7.8 per cent of moisture content, 23 g of protein, 5.8 of pH, 1.66 per cent of titratable acidity, 8.10° Bx of total soluble solids, it also contained 1-Deoxynojirimycin (0.132 mg/g), tannins (2.34 mg TAE/g) and flavonoids (32.56 mg RE/g). Consumers showed higher acceptance for colour (93.33%), flavour (92.50%), taste and freshness (90.83%). Overall, the results indicate high consumer acceptance across all age groups, reflecting strong potential demand for mulberry herbal tea and satisfaction with its key product attributes.

**Key words:** Mulberry herbal tea, Sensory evaluation, Flavour blending, Nutrient composition, Consumer acceptability

### **T3P7: Developing and Testing Wildboar Repellent from Mulberry**

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#### **Abstract**

Human wildlife interaction is an escalating problem in Indian agriculture, with wild boar (*Sus scrofa*) causing severe crop losses due to its omnivorous diet, rapid reproduction and adaptability to varied habitats. In Tamil Nadu, especially near forest fringes of Mudumalai and Sathyamangalam, conventional deterrent methods have shown limited long-term success. This study explored mulberry (*Morus* spp.) as a potential plant-based repellent, inspired by reports of its non-preference by elephants. A survey of 63 mulberry farmers revealed V1 and MR2 as the most cultivated varieties, with wild boar reported as the leading crop pest (44.5% of cases), particularly in summer (70% of damage reports). Phytochemical profiling using GC–MS and HPLC identified diverse bioactive compounds like alkaloids, phenolics, terpenoids and fatty acids linked to herbivore deterrence. MR2, V1, and S36 varieties recorded the highest morin content, with MR2 showing 95.44% similarity to the morin standard. Field trials at the Government Large Scale Silk Farm, Madhahally, Thalavadi tested mulberry-based formulations for their repellent efficacy. All treatments provided complete protection at 1 and 3 days after application, while untreated controls suffered 28–36% loss. MR2, V1 and S36 maintained superior long-term performance, with MR2 recording only 11% damage at 15 days after treatment (DAT), compared to 73% in controls. Statistical analysis confirmed significant differences ( $p < 0.05$ ), with MR2 achieving the highest mean damage reduction (99.14%), followed by V1 (98.74%) and S36 (97.38%). The findings highlight mulberry-derived repellents particularly from MR2, V1, and S36 as promising, non-lethal and environmentally safe tools for wild boar management. This approach integrates crop protection with biodiversity conservation and offers scalable potential for reducing human–wildlife conflict in agro-forest landscapes.

**Keywords:** Human wildlife interaction, wild boar, mulberry, morin, alkaloids, plant-based repellent, GC–MS, HPLC, crop protection.

### **T3P8: Comprehensive Analysis of Physico-Chemical and Nutritional Characteristics of Mulberry Accessions Fruits**

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#### **Abstract**

The present investigation aimed to evaluate the physico-chemical and nutritional characteristics of fruits from fifteen mulberry (*Morus* spp.) accessions to identify superior genotypes for fresh consumption and value-addition. Significant variability was observed across all measured physico-chemical parameters, including moisture, pH, total soluble solids (TSS), titratable acidity (TA), ash, fibre, and reducing sugars. Moisture content ranged from 73.53% in MI-0555 (*M. indica*) to 82.60% in MI-0818 (*M. latifolia*), indicating substantial differences in fruit juiciness. Fruit pH varied between 3.80 (MI-0300) and 4.45 (MI-0632), with most accessions exhibiting mildly acidic profiles. TSS values showed considerable variation, with MI-0252 (*M. laevigata*) recording the highest level (14.30°Brix), whereas MI-0818 exhibited the lowest (8.20°Brix). Titratable acidity ranged from 0.72% in ME-0024 (*M. indica*) to 1.54% in MI-0300 (*M. alba*). Reducing sugar content was highest in MI-0252 (7.94%) and lowest in MI-0675 (5.04%). Ash content varied from 5.23% in ME-0006 to 6.73% in MI-0783, while fibre content was notably higher in MI-0632 (11.34%) and MI-0783 (10.72%), both belonging to *M. latifolia*. Nutritional profiling also revealed significant genotype-dependent differences. Carbohydrate content was highest in MI-0300 (21.43%), followed by MI-0489 (18.30%), while MI-0657 recorded the lowest value (10.43%). Protein content ranged from 1.10% in MI-0715 (*M. indica*) to 2.67% in MI-0632 (*M. latifolia*). Fat content was relatively low across accessions (0.21–0.92%), with MI-0783 exhibiting the highest level. Vitamin C content showed marked variability, ranging from 10.10 mg/100 g in MI-0715 to 19.77 mg/100 g in MI-0300 (*M. alba*). Overall, MI-0300, MI-0632, and MI-0783 emerged as promising accessions due to their favourable balance of physico-chemical and nutritional properties. These findings highlight the potential of specific mulberry genotypes for nutritional enhancement, cultivar improvement, and diversification of mulberry-based functional foods.

**Keywords:** mulberry fruit; physico-chemical; functional food;

### **T3P9: Bioprospecting of Vanya Silkworm for High-Value Non-Textile Applications: A Review**

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#### **Abstract**

Vanya silkworms, including tasar (*Antheraea mylitta*), muga (*Antheraea assamensis*), and eri (*Samia ricini*), represent a rich yet underexploited reservoir of biomaterials with immense potential beyond textile applications. The present paper explores the bioprospecting potential of fibroin, sericin, pupal biomass, and chitinous residues derived from vanya silkworms for advanced biomedical and regenerative uses, aligning with sustainable utilization of seri-genetic resources. Vanya silk fibroin possesses superior tensile strength, higher thermal stability, and distinct amino acid composition compared to mulberry silk, offering enhanced structural integrity for medical applications. Experimental wound healing models using non-mulberry silk fibroin scaffolds have demonstrated 30–50% faster wound contraction, increased collagen deposition, and improved angiogenesis compared to conventional dressings. In vitro studies report >85–90% cell viability and enhanced fibroblast proliferation on tasar and eri fibroin matrices, indicating excellent cytocompatibility. Preliminary clinical observations of silk-based adhesive dressings show hypersensitivity rates as low as 0–2%, significantly lower than synthetic counterparts (up to 20–24%), highlighting their low immunogenicity and suitability for surgical applications. Sericin recovered from degumming waste exhibits antioxidant, antimicrobial, and moisturizing properties, making it suitable for hydrogel-based wound dressings and bioactive coatings. Vanya pupal oil, rich in unsaturated fatty acids, and chitin/chitosan extracted from pupal shells further expand applications into nutraceuticals, antimicrobial films, and tissue engineering composites. Additionally, fibroin-based matrices enable sustained drug release for 7–21 days, enhancing localized

therapeutic efficiency while reducing systemic dosage. Integration of biotechnology and advanced fabrication methods such as electrospinning and 3D bioprinting enables the development of vanya silk-based scaffolds for cartilage, bone, nerve, and skin regeneration. Strategic bioprospecting of vanya silkworm by-products thus represents a paradigm shift from fiber-centric utilization to high-value biomedical innovation. Harnessing these indigenous seri resources for non-textile applications will enhance economic diversification, value addition, and ecological sustainability of the Indian sericulture sector, strengthening its global competitiveness.

**Keywords:** Vanya, silkworm, tasar, muga, eri, fibroin, sericin, by-products, bioprospecting, non-textile, applications.

### **T3P10: Underutilized mulberry fruits as novel functional foods**

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#### **Abstract**

Mulberry fruits are rich source of carbohydrates, vitamins, fibre, minerals and polyphenols including flavonols, riboflavin, ascorbic acid, carotene and nicotinic acid which possess wide spectrum of biochemical activities such as antioxidant, antibacterial, anti cancer, anti diabetic, anti-inflammatory, neuroprotective and hepatoprotective activities. Though the mulberry fruits having immense nutraceutical and pharmaceutical properties, it is underutilized in India due to its shorter shelf life, lack of awareness, research and development. With this background, the current study was focused on the evaluation of antioxidant, antibacterial activity of mulberry fruits and development of functional food products. The results showed that mulberry fruits were found to have strong antioxidant and antibacterial activity than standard. Mulberry fruits were harvested and extracted juice was utilized to develop functional foods like, jam, squash, RTS and dehydrated fruits. The products obtained had good sensory scores for colour & appearance, body & texture, taste & flavour and overall acceptability. Hence, the present study suggested that processing of mulberry fruits into functional food products opens new economic opportunities. This transformation not only reduces post-harvest losses but also provides additional income to farmers particularly in rural communities. As there is increasing consumer demand towards new natural food products, mulberry fruit with both nutritional and functional properties has great scope in the functional food market.

**Keywords:** Mulberry fruits, underutilized, nutraceuticals, antioxidant, antibacterial, functional foods

### **T3P11: Silk fibroin from sericulture by-products: a sustainable biomaterial for advanced regenerative medicine**

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#### **Abstract**

Silk fibroin (SF), the insoluble core protein comprising 70-80 % of *Bombyx mori* cocoons, emerges as a cornerstone biomaterial in biomedical engineering, transforming sericulture by-products into high-value assets beyond textiles. Extracted via degumming and regenerated into versatile formats like hydrogels, scaffolds, films, and nanofibers, SF offers exceptional biocompatibility, tunable mechanical properties (tensile strength up to 500 MPa, modulus 1-10 GPa), and controlled biodegradability (months to years), making it ideal for tissue engineering and regenerative medicine. SF's bioprospecting potential from sericulture waste leverages sustainable processing, such as formic acid or ionic liquid dissolution, to yield porous 3D scaffolds (80-95 % porosity) that mimic the extracellular matrix. In bone regeneration, SF composites with hydroxyapatite or BMP-2 promote osteogenic differentiation of mesenchymal stem cells, achieving 70-80 % mineralization in 28 days and a 50 % increase in bone volume in calvarial defects. For skin repair, electrospun SF nanofibers (200-500 nm diameter) accelerate wound closure twofold via enhanced fibroblast migration, collagen deposition, and vascular endothelial growth factor (VEGF) expression, with antimicrobial doping (e.g., AgNPs) combating biofilms. Neural applications utilize aligned SF conduits for peripheral nerve gaps, supporting fourfold neurite outgrowth and 85% functional recovery in sciatic models. Cardiac patches from SF films restore contractility after myocardial infarction, while ocular implants enable corneal regeneration. Recent advances include 3D bioprinting for vascularized tissues and CRISPR-loaded nanoparticles for targeted gene therapy, bridging sericulture's circular economy with precision medicine. Challenges such as batch variability and scale-up are addressed via recombinant SF and enzymatic crosslinking. Economically, SF valorization boosts sericulture income by 30-50 %, fostering rural innovation in India. SF exemplifies the bioprospecting of sericulture by-products for next-generation biomedicine, aligning sustainability with clinical translation.

**Keywords:** Silk fibroin, sericulture by-product, biomedical engineering, tissue engineering, regenerative medicine.

### **T3P12: Silk Sericin as a Sustainable Functional Biopolymer for Biomedical and Pharmaceutical Applications**

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#### **Abstract**

Sericin is a natural biopolymer obtained from silkworm cocoons during the degumming of *Bombyx mori* silk. Once considered a waste product of silk processing, sericin is now recognized as a high-value biomaterial, driven by environmental concerns over its disposal and growing evidence of its biomedical utility. Valorization of sericin supports circular bioeconomy approaches by converting sericulture by-products into functional healthcare materials with economic, social, and environmental benefits. Biologically, sericin demonstrates excellent biocompatibility, biodegradability, and low immunogenicity, making it suitable for pharmaceutical and biomedical use. It exhibits multiple bioactivities, including antioxidant, anti-inflammatory, antibacterial, anticoagulant, and photoprotective effects. These properties contribute to its therapeutic potential in reducing oxidative stress, supporting tissue repair, and protecting against microbial infection. Nutritionally and physiologically, sericin has been associated with gut health support, improved lipid metabolism, and potential antitumor effects, although these benefits require further clinical validation. Structurally, sericin is a high-molecular-weight, hydrophilic protein with a gelatinous nature. Its abundance of polar amino acids and hydroxyl groups enables high water-binding capacity and moisture retention. This property underpins its effectiveness in wound healing, where it promotes cell adhesion, proliferation, and re-epithelialization, as well as in dermatological and cosmetic formulations for skin hydration and UV protection. Technologically, sericin can be fabricated into hydrogels, films, sponges, foams, fibers, and micro- or nanoparticles. These formats enable applications in tissue engineering scaffolds, drug delivery systems, wound dressings with sustained release, cell culture supplements, and cryopreservation media. Collectively, its multifunctionality and renewability position sericin as a sustainable alternative to synthetic polymers in advanced biomedical and pharmaceutical applications.

**Keywords:** Silk sericin, biocompatibility, biodegradability, wound healing, drug delivery, sustainable biomaterial

### **T3P13: Seri by-product as emerging resources for bioeconomy and sustainable development**

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#### **Abstract**

Sericulture by-products are increasingly recognized as emerging resources that can significantly contribute to the bioeconomy and sustainable development. Beyond silk fibre production, the sericulture value chain generates a wide range of underutilized materials, including silkworm pupae, sericin, mulberry biomass and rearing waste. Traditionally considered low-value residues these by-products are now being explored for high-value applications in food, pharmaceuticals, cosmetics, agriculture and biomaterials. Silkworm pupae are rich in proteins, lipids, and bioactive compounds offering potential as functional foods, animal feed, and sources of antimicrobial and antioxidant agents. Sericin a protein removed during silk processing, demonstrates promising properties such as biocompatibility, moisturizing capacity and wound-healing activity, making it suitable for biomedical and cosmetic formulations. Mulberry leaves and agro-residues can be converted into nutraceuticals, biofertilizers, and bioenergy, supporting circular resource use. Integrating sericulture by-products into value-added supply chains aligns with circular economy principles by reducing waste, enhancing resource efficiency, and generating additional income for rural communities. This diversification strengthens livelihood resilience among smallholder farmers and promotes inclusive green growth. Moreover, valorization of these resources reduces environmental burdens associated with disposal and supports climate-smart agricultural practices. Despite their potential, challenges remain in terms of standardization, scalable processing technologies, regulatory approval, and market development. Strategic investments in research, innovation, and policy support are essential to unlock the full potential of sericulture by-products within the bioeconomy framework. Harnessing these emerging resources can transform sericulture from a fibre-centric industry into a multi-product, sustainable bio-based sector contributing to food security, rural development, and environmental sustainability.

**Keywords:** Sericulture by-products, Bioeconomy, Sustainable development

### **T3P14: Translational Potential of Silk Fibroin and Sericin: Bioprospecting Sericulture By-Products for Biomedical and Commercial Applications**

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#### **Abstract**

Sericulture by-products, particularly silk fibroin and sericin, represent an emerging frontier in bioprospecting for high-value non-textile applications across biomedicine, cosmetics, and nutraceuticals. The global silk protein market is projected to reach approximately USD 1.7-1.8 billion by 2033, reflecting increasing scientific and commercial interest in these biomaterials. Silk fibroin, constituting 60–80% of raw silk, is a crystalline,  $\beta$ -sheet-rich structural protein characterized by high mechanical strength, biocompatibility, and biodegradability. These attributes have enabled its successful commercialization in sutures, tissue scaffolds, and advanced drug delivery systems, establishing fibroin as a clinically validated biomaterial. In contrast, silk sericin, accounting for 15-35% of silk and traditionally discarded during degumming, is an amorphous, hydrophilic protein enriched in serine residues that confer strong antioxidant, antimicrobial, UV-protective, and wound-healing properties. Increasing evidence from *in vitro* and limited *in vivo* studies highlights sericin's potential in cosmeceuticals, tissue engineering, nanocarriers, and regenerative medicine. Sericin hygroscopic capacity and bioactivity have positioned it as a promising ingredient in dermatological and cosmetic formulations. Furthermore, recovery of sericin from industrial wastewater aligns with circular bio-economy principles by converting waste streams into value added products while reducing environmental burden. Despite these advantages, significant barriers hinder full scale commercialization, particularly for sericin. Challenges include non-standardized extraction and purification protocols, batch to batch variability, scalability limitations, and insufficient clinical validation to satisfy regulatory requirements. While fibroin serves as a successful template for market translation, sericin and other sericulture by-products remain underexploited. This review critically evaluates the current state of research, technological advancements, and market readiness of sericulture derived biomaterials. It underscores the need for standardized processing methods, robust *in vivo* studies, comprehensive clinical trials, and long-term safety assessments to bridge the translational gap and fully realize the biomedical and commercial potential of sericulture by-products.

**Keywords:** sericulture; by-products; sericin; fibroin;

### **T3P15: Cordyceps militaris in Pharmaceutical and Nutraceutical Applications: Chemistry and Standardization**

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#### **Abstract**

*Cordyceps militaris* is an entomophagous mushroom gaining significant attention due to its excellent medicinal properties. It parasitize insects, the fruiting bodies of these fungi erupts from the body of larva, pupa and adult of many insects species, of the orders Lepidoptera, Coleoptera and Hymenoptera, their natural occurrence is rare and economically limited. Consequently, artificial cultivation has emerged as viable alternative; however, commercial production remains constrained by limited availability of seeding material and complex developmental requirements. In this context, silkworm pupae is rich in carbohydrate, moisture and low fat content could be a good host for the growth of *C. militaris* to produce fruiting bodies from which cordecepin and adenosine are extracted. Various silkworm species, including Mulberry (Daeseungjam, Keumokjam and Baegokjam), Tasar, Eri and Muga, effectively supports fungal growth and sclerotium formation. Among different inoculation methods evaluated-spraying, dipping and injecting-the injection technique demonstrated the highest sclerotium yield, suggesting superior colonization efficiency and nutrient assimilation. Biochemical analyses confirm that silkworm-derived *C. militaris* retains high levels of protein (39.15 %), essential amino acids like Lysin (15.06 %), Glutamic acid (8.79), Proline (6.68 %), Arginine (5.29), Aspartic acid (4.75%), fatty acids like Linolenic acid (61.3), Palmitic acid (24.5 %), adenosine (0.18 %) and cordycepin (0.97 %) which exhibits antiviral, immune-modulating, antioxidant, anticancer, anti-tyrosinase, anti-diabetic effects, anti-inflammatory and anti-aging properties, underscoring its pharmaceutical and nutraceutical relevance.

The enhanced bioactive profile obtained through optimized silkworm-based cultivation, particularly via injection inoculation, suggests strong potential for expanding medicinal applications. Standardized production strategies focusing on high cordycepin and adenosine yield can support the development of functional foods, dietary supplements and evidence-based therapeutic formulations. Consequently, silkworm-derived *C. militaris* represents a promising bioresource for advancing pharmaceutical innovations and value-added nutraceutical products.

**Keywords:** *Cordyceps militaris*; biochemical analysis; bioresource;

### **T3P16: Unravelling the accumulation of isoprenoid pigment in silkworm for functional insights and value-added bioprospecting**

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#### **Abstract**

Pigments play vital roles in silkworm biology, contributing to defence, attraction, camouflage, sun protection and regulation of photoperiodic responses. Carotenoids are isoprenoid pigments synthesized exclusively by plants and microorganisms; animals, including silkworms, cannot produce them *de novo* and must obtain them from their diet. Once silkworm are ingested with mulberry leaves, carotenoids are absorbed in the midgut, transported to various tissues by plasma proteins and ultimately deposited in the silk gland. In natural coloured mulberry silkworms, ether-soluble carotenoids are responsible for the characteristic yellow, golden and orange cocoons. Six major carotenoids, including lutein,  $\beta$ -carotene, neo- $\beta$ -carotene, neo-lutein, tetraaxanthin and violaxanthin, have been reported from yellow cocoons, reflecting the pigment composition of the host plant and its efficient transfer via haemolymph to the silk gland. Silkworms are therefore not only silk producers but also effective biofactories of dietary carotenoids. These pigments fulfil key functions such as light harvesting and photoprotection, antioxidant defence, pro-vitamin A activity, visual and behavioural signalling. Carotenoid absorption and tissue-specific deposition are governed by a specialized genetic and molecular network that regulates pigment uptake, transport and storage. Differences in this system explain the wide range of cocoon colours seen in *Bombyx mori* strains and make them useful models for studying carotenoid metabolism. Carotenoid-rich extracts from cocoons, pupae and silk by-products exhibit strong antioxidant, anti-inflammatory and photoprotective activities, with promising applications in cosmetics, nutraceuticals, ocular health and functional biomaterials. Emerging technologies such as enzymatic and green solvent extraction, carotenoid-infused sericin scaffolds and nano-delivery systems further enhance the scope for value addition. Understanding the carotenoid uptake, transport, function and bioprospecting in silkworms can integrate sericulture with biotechnology and materials science and promote sustainable utilization of seri-biodiversity.

**Keywords:** Carotenoids; *Bombyx mori*; cocoon coloration; antioxidant activity; value-added sericulture

### **T3P17: Production of biodegradable hydrogel by utilisation of seri waste for non-textile applications**

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#### **Abstract**

Sericulture generates considerable quantities of Seri waste, including pierced cocoons, reeling residues, and silk floss, which remain largely underutilized despite containing valuable silk proteins such as sericin and fibroin. Recent scientific developments have indicated that sericin possesses excellent hydrophilic, biodegradable, and biocompatible properties, enabling its potential use in hydrogel formation. The present work proposes the utilisation of Seri waste as a sustainable raw material for the production of biodegradable hydrogel intended for non-textile applications, particularly in agriculture. Production of hydrogel involves extraction of sericin protein from Seri waste through controlled degumming processes, followed by purification and cross-linking treatments to facilitate hydrogel formation under regulated processing conditions. Based on findings from earlier scientific studies, sericin-based hydrogels are known to exhibit high swelling capacity and water absorption potential, allowing gradual moisture release to plant root zones and improving soil water retention (Alonso-Cuevas *et al.*, 2025). Such characteristics indicate their suitability as eco-friendly soil moisture conditioning materials. Utilisation of Seri waste-derived hydrogel offers multiple potential benefits including value addition to sericulture by-products, reduction of waste accumulation, and development of biodegradable agricultural inputs. The technology is expected to contribute towards improved irrigation efficiency (Fonteno and Bilderback, 2019), enhanced plant establishment under moisture stress conditions, and promotion of sustainable farming practices. Additionally, this approach supports circular bioeconomy by integrating waste valorisation with climate-resilient agriculture. Conversion of seri waste into biodegradable hydrogel supports efficient sericulture waste management and agricultural water conservation. The technology promotes resource efficiency, eco-friendly agricultural inputs, and waste-to-wealth opportunities. Additionally, it demonstrates potential for technological advancement and large-scale integration into sustainable agricultural systems.

**Keywords:** seri-waste; sericin; hydrogel; biodegradable;

### **T3P18: Silkworm Excreta as a Sustainable Precursor for Nitrogen-Doped Activated Carbon: A Review for Wastewater Remediation**

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#### **Abstract**

Escalating global water scarcity, coupled with the discharge of industrial effluents containing toxic heavy metals and synthetic dyes, necessitates the development of sustainable, cost-effective, and environmentally benign water purification materials. In this context, silkworm excreta (SE), an abundantly available nitrogen-rich by-product of the sericulture industry, has emerged as a promising and underutilized bioresource for the synthesis of high-performance activated carbon. Recent studies have reported the successful transformation of SE into nitrogen-doped porous carbon through controlled carbonization followed by chemical activation, particularly using potassium hydroxide and microwave-assisted techniques to promote rapid pore development. The resulting materials have been shown to exhibit exceptionally high specific surface areas exceeding  $2500 \text{ m}^2 \text{ g}^{-1}$ , along with well-developed hierarchical pore structures. The inherent presence of chlorophyll-derived porphyrin nitrogen and protein-originated functional groups enables in situ nitrogen doping, enhancing surface polarity and generating abundant active adsorption sites. Published findings indicate superior removal efficiencies exceeding 95% for heavy metals such as  $\text{Pb}^{2+}$ ,  $\text{Cd}^{2+}$ , and  $\text{Cr}^{6+}$  ions, as well as remarkable adsorption capacities for textile dyes including methylene blue (up to  $902 \text{ mg g}^{-1}$ ). The dominant removal mechanisms are reported to involve pore filling, electrostatic attraction, and surface complexation facilitated by nitrogen-containing functional groups. Overall, the valorization of silkworm excreta into advanced adsorbent materials represents a promising circular bioeconomy strategy, offering sustainable waste-to-wealth solutions for wastewater treatment and environmental remediation.

**Keywords:** silkworm excreta; wastewater remediation; byproduct;

### **T3P19: Mulberry Silkworm Pupae Meal as an Alternative Protein Source: Effects on Broiler Production Performance**

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#### **Abstract**

The search for sustainable and economical protein sources for poultry feeding has gained importance due to rising feed costs and the need to utilize agro-industrial by-products efficiently. Mulberry silkworm pupae meal (SWPM), a nutrient-rich by-product of the sericulture industry containing high levels of protein, lipids and essential fatty acids, offers potential as an alternative feed ingredient for broiler chickens. The present study was conducted to evaluate the effects of dietary inclusion of raw and processed (cuticle-removed) SWPM at graded levels (2%, 4% and 6%) on growth performance, feed utilization, carcass characteristics, economic efficiency and fatty acid composition of broiler meat under commercial rearing conditions. A total of 560 broiler chicks were reared for 35 days and assigned to different treatment groups, and their performance was compared with birds fed a control diet without SWPM. The results indicated that inclusion of SWPM up to 6% did not adversely affect growth performance, as body weight gain, cumulative feed intake and feed conversion ratio were comparable or slightly improved compared to the control group. Dressing percentage remained satisfactory across treatments, and feed cost per kilogram of live weight gain was reduced in SWPM-fed groups, indicating economic advantage. Importantly, breast muscle alpha-linolenic acid content increased significantly with increasing levels of SWPM, reaching up to fourfold higher values than the control, thereby improving the nutritional quality of broiler meat, while ether extract content showed no significant variation among treatments. Overall, the findings demonstrate that both raw and processed mulberry silkworm pupae meal can be safely incorporated up to 6% in broiler diets without compromising performance, while enhancing economic returns and producing nutritionally enriched meat, supporting its use as a sustainable feed resource in poultry production systems.

**Keywords:** Silkworm pupae meal, Broiler chicken, Alternative protein source, Feed efficiency, Alpha-linolenic acid, Sustainable poultry nutrition, Economic efficiency.

### **T3P20: Silkworm excreta as novel bio-sources of natural pigments**

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#### **Abstract**

Silkworm excreta, a significant by-product of sericulture, is a biological resource that has not yet been fully utilized but has great potential for the creation of sustainable pigments. Large amounts of larval excreta are produced during rearing, and they are usually thrown away or used for low-value purposes like composting and soil amendment. Recent research has shown that silkworm excreta contain mulberry leaf metabolite derivatives, such as pheophorbide, 3,5,7-trihydroxy-3',4',5'-trimethoxyflavone and quercetin 3'-methyl ether, products of chlorophyll are breakdown and have chromophoric qualities appropriate for natural coloring applications. This work investigates the extraction and functional evaluation of natural pigment compounds present in silkworm excreta, aiming to valorize the sericultural by-product for eco-friendly dyeing and fabric coloration. The findings revealed that pigments obtained from silkworm excreta exhibit unique absorbance characteristics within the visible spectrum and demonstrated an enhanced thermal and light stability compared to pigments from the source leaves, a property that is likely attributed to metabolic modifications occurring during digestion. When used on protein-based substrates such as silk, cotton and wool, these bio-pigments demonstrated acceptable colour fastness with antimicrobial properties. The research emphasizes the practicality of upcycling silkworm excreta into high-value natural pigments, supporting the goals of sustainable material development and a circular bioeconomy. Future investigations should concentrate on enhancing extraction efficiency, diversifying pigment characterization and evaluating scalability for industrial use in textile applications.

**Keywords:** excreta, colour, silkworm, sustainable, larva

### **T3P21: Bioprospecting Cassava Products: Sustainable Valorization**

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#### **Abstract**

Cassava, known scientifically as *Manihot esculenta*, serves as a cornerstone staple in tropical agriculture, where its roots and associated parts offer immense potential for sustainable food systems. Bioprospecting cassava products involves exploring the entire plant—roots, leaves, peels, fibrous residues, and processing by-products—to unlock nutritional and functional value through eco-friendly preparation methods. Traditional processing transforms fresh roots into safe, versatile staples such as flour, tapioca pearls, and fermented pastes, while detoxification techniques like soaking, fermentation, and boiling effectively neutralize inherent anti-nutritional factors, rendering the material suitable for diverse culinary applications. Leaves, once underutilized, emerge as a protein-rich resource when properly prepared, lending themselves to incorporation into soups, stir-fries, or blended dishes that enhance dietary diversity. Peels and fibrous residues, often viewed as waste, undergo valorization into nutrient-dense flours enriched with dietary fiber and resistant starch, which improve texture and nutritional profiles in bakery items, porridges, and gluten-free formulations. Blending cassava-based materials with natural enhancers, such as leafy greens or tuber peels, elevates protein content, mineral bioavailability, and antioxidant properties, resulting in balanced, health-promoting foods with lower glycemic responses and better digestibility. These approaches support circular economy principles by minimizing waste, reducing environmental burdens from discarded residues, and promoting resource-efficient food preparation that aligns with goals for food security and nutrition. Challenges persist in optimizing sensory qualities and widespread adoption, yet ongoing innovations in integrated processing promise expanded use of cassava in everyday meals, functional foods, and community-based nutrition strategies, fostering resilient, sustainable food systems for future generations.

**Keywords:** Cassava, Bioprospecting, Valorization, By-product

### **T3P22: Physicochemical characterization of pva-based biocomposite films reinforced with tasar eggshells**

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#### **Abstract**

Tasar silkworm eggshell, a waste by-product of the tasar silk industry, represents a sustainable and mineral-rich biofiller with potential application in polymer composites. In this study, eggshell powder derived from *Antheraea mylitta* was incorporated into a polyvinyl alcohol (PVA) matrix to fabricate biodegradable biocomposite films with improved structural and functional properties. The eggshell waste product has been successfully used to develop PVA-EG composite films containing varying percentages of eggshell powder, i.e., 0%, 0.25%, and 0.5% by weight. Notably, the FESEM analysis showed the heterogeneous distribution of the filler, indicating improved matrix–filler interaction. Fourier-transform infrared (FTIR) spectroscopy confirmed enhanced hydrogen bonding between the hydroxyl groups of PVA and the calcium carbonate-rich eggshell filler, without evidence of chemical modification of the polymer backbone. X-ray diffraction (XRD) analysis demonstrated the presence of crystalline calcite phases originating from the eggshells, which contributed to increased overall crystallinity of the composite films. The enhanced crystalline structure correlated with improved mechanical performance. Thermogravimetric analysis (TGA) further indicated that thermal stability increased with eggshell incorporation, suggesting restricted polymer chain mobility due to strong interfacial interactions. Contact angle measurements showed increased surface hydrophilicity of the composite films, attributable to the inherent polarity of the filler. Moreover, soil burial studies confirmed accelerated biodegradation of eggshell-reinforced films compared to neat PVA, likely due to improved moisture uptake and enhanced microbial accessibility. In summary, the findings show the potential of tasar silkworm eggshell powder as an effective bio-based reinforcing filler in terms of its contribution to crystallinity, thermal stability, and biodegradability of PVA-based films without compromising their structural integrity. This present study provides an alternative value-added approach for waste generated in silk processing.

**Keywords:** Biocomposite films, *A. mylitta*, biodegradability

### **T3P23: Valorization of sericultural rearing waste into hydrochar-based solid biofuel pellet through hydrothermal carbonization**

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#### **Abstract**

Sericulture generates substantial quantities of organic waste in the form of spent rearing bed materials, silkworm excreta, leftover mulberry leaf biomass, and pupal residues. For instance, rearing of one commercial silkworm crop ( $\approx 20,000$  eggs) typically requires 350–650 kg of mulberry leaves, resulting in large volumes of moist residues during late instars and post-harvest cleaning operations. Currently, these wastes are managed through on-farm composting, vermicomposting, direct land application, limited use as animal or fish feed, open dumping, or occasional burning. While composting recycles nutrients, it is slow and often associated with odour, pathogen survival, nutrient leaching, and greenhouse gas emissions; open dumping and burning further aggravate local air, soil, and water pollution. Hydrothermal carbonization (HTC) of sericultural rearing waste provides an effective strategy for converting wet, heterogeneous residues into value-added solid biofuel pellets. HTC is particularly suited to sericultural waste because of its high moisture and protein content, eliminating the need for energy-intensive drying. Processing at moderate temperatures (180–260 °C) converts unstable biomass into carbon-rich hydrochar with lower O/C and H/C ratios, improved structural stability, and enhanced fuel characteristics. Subsequent pelletization yields dense, durable solid biofuel pellets suitable for household heating, institutional boilers, and small agro-industrial energy applications. The hydrochar pellets can also serve as co-firing material, reducing dependence on fossil fuels. This approach reduces uncontrolled waste decomposition, lowers methane and odour emissions, and prevents nutrient runoff, thereby improving local environmental quality. Socially, it creates decentralized energy resources, additional income streams for sericulture farmers and sustainable rural development.

**Keywords:** Sericultural rearing waste, Hydrothermal carbonization, Hydrochar, Solid biofuel pellets, Waste-to-energy

# Theme 4

## Automation and AI tools in reduction of drudgery in Seri-germplasm conservation



## **T4O1: Decoding Climate-Sensitive Bio-predictors of Silkworm Productivity Using Machine Learning**

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### **Abstract**

Sericulture plays a vital role in the socio-economic framework of the Kashmir Valley; however, its productivity is increasingly influenced by changing climatic patterns. The present investigation quantitatively evaluates the effects of spatiotemporal climate variability on silkworm performance using an 11-year longitudinal dataset (2013–2023) generated at the Central Sericultural Research and Training Institute, Pampore (J&K). Missing observations were addressed through Random Forest–based data imputation, followed by Principal Component Analysis to construct a Composite Performance Index, with the leading component explaining 26.69% of the observed variability. Machine learning algorithms, including Random Forest and Gradient Boosting models, were employed to identify and prioritize critical bioclimatic predictors influencing silkworm performance, highlighting variables such as BIO13 and PREC1 as dominant contributors. Temporal differences in performance were further validated using a Generalized Linear Model, demonstrating statistically significant inter-annual variation. Additionally, K-means clustering delineated distinct pheno-climatic groups, revealing both climate-resilient and climate-sensitive clusters. The study offers a robust analytical framework for climate risk assessment in sericulture and supports the development of location-specific adaptive strategies to enhance resilience and long-term sustainability of silk production systems.

**Keywords:** bio-predictors; climate variability; machine learning

## **T4O2: Integration of artificial intelligence for identification of temperate mulberry germplasm at CSB-P4-BASIC Seed Farm Manasbal**

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### **Abstract**

The P4, Basic Silkworm Seed Farm is situated at the North Bank of Manasbal Lake about 32 km North of Srinagar, Jammu and Kashmir, 34° 14'59"N, 74° 39'11"E; 1583m above sea level. It has predominantly rural surroundings with three villages, Kondabal, Jarokbal and Gratbal. This station maintains the National Germplasm of mulberry of India (150 varieties), Japan, Europe, Australia, China, Indonesia, Middle East. This is a station in India, which maintain all temperate (cold region) germplasm of Exotic and Indigenous mulberry varieties in Central Silk Board other than CSB-CSGRC, Hosur. Artificial intelligence plays a vital role in development and management of plant germplasm by enhancing various aspects of plant sciences. It can be utilized in genomic selections, phenotyping, disease and pest detection, yield prediction, plant health & growth, stress management and many more. One more identification can be done through bark during autumn and winter period which is also a vital tool to identify the mulberry plant variety by seeing the bark structure. At Manasbal, each variety can be identified through bark during winter period, which is being linked with the barcode for each variety of plant. The bark plays a vital role in plant during snow period and throughout the year plant variety can be identified easily. AI based identification of plant through bark in mulberry germplasm will help breeders in selection of plants before sprouting and also help plant taxonomists to identify the plant and variety.

**Keywords:** Germplasm, Mulberry, varieties, AI

### **T4O3: Digital Seri Germplasm Passport System – A Unified Model for Conservation**

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#### **Abstract**

Seri Genetic resources comprising silkworm breeds, ecoraces and host plant (mulberry & vanya) germplasm - varieties, hybrids, landraces are essential for sustainable sericulture and climate-resilient silk production. However, their conservation and utilization are often constrained by fragmented documentation, weak traceability, non-uniform descriptor systems and limited integration of pedigree and genealogical records, increasing the risk of genetic erosion of indigenous resources. Digital Seri Germplasm Passport System (DSGPS) is an integrated framework for conservation, characterization, utilization and legal protection of seri genetic resources. The model consolidates passport data, standardized descriptors, DUS characterization, pedigree and genealogical information, evaluation outputs, regeneration cycles and diseases/health and biosecurity records into a unified digital platform. It further incorporates QR-based tagging for field level identity validation, GIS mapping for hotspot identification and special prioritization, and molecular marker-based identification (DNA finger printing, SNP/SSR markers). AI-enabled methods such as computer vision for phenotyping and disease detection, machine learning for trait prediction and parental selection, and NLP based digitization of legacy records will strengthen the trait investigation and authentication. Also supports gene bank maintenance through *insitu* and *exsitu* conservation including preservation methods such as cryopreservation, filed banks, herbarium-based documentation for host plant resources. The DSGPS enhances transparency, reduces duplication, strengthens conservation of ecoraces and landraces and accelerates development of vigorous hybrids and stress/disease-resistant breeds and varieties. Community-based conservation models can generate livelihood opportunities for tribal and local communities while protecting seri biodiversity. In the context of accelerating biodiversity loss due to climate change and anthropogenic pressures, this digital and evidence-based approach supports timely access, foster national/international collaboration and sustainable sericulture while aligning with PPV&FRA through standardized DUS characters, documented proof (publications & inscriptions) and bioinformatics (genomic, transcriptomic & proteomic data) boosts quality and efficiency.

**Keywords:** seri germplasm; conservation; digital;

## **T4P1: Microclimate monitoring devices for improving grainage efficiency**

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### **Abstract**

Efficient silkworm grainage depends on maintaining stable temperature and relative humidity, as seasonal fluctuations in microclimate can adversely affect moth emergence, coupling, oviposition, egg viability, DFL production and egg recovery. The present study evaluates the performance of an Automatic Temperature and Humidity Controller (ATHC) developed and installed in silkworm grainage rooms to ensure controlled environmental conditions. The efficiency of ATHC was assessed through multiple experimental batches (FC1 and FC2) by recording grainage performance parameters such as day-wise emergence, pairing percentage, rejection percentage, DFL percentage, cocoon-to-DFL ratio and comparing results with batches maintained under manual control (WATHC). The results revealed that ATHC assisted batches produced more stable and consistent grainage outcomes, with improved pairing percentage, reduced rejection rate and enhanced DFL recovery. In FC2 batches, pairing was higher in ATHC ( $45.64 \pm 0.16\%$ ) compared to manual control ( $42.83 \pm 0.72\%$ ), while rejection was lower in ATHC ( $9.76 \pm 0.28\%$ ) than manual control ( $11.96 \pm 0.39\%$ ). DFL percentage was also higher in ATHC batches ( $35.8 \pm 0.07\%$ ) than manual batches ( $32.87 \pm 0.20\%$ ). Similar improvement was observed in FC1 batches, where pairing was  $45.56 \pm 0.327\%$  in ATHC compared to  $43.1 \pm 0.322\%$  in manual control and rejection reduced from  $11.78 \pm 0.35\%$  (manual) to  $10.46 \pm 0.31\%$  (ATHC). Overall recovery percentage ranged between 32.92% in manual control and 35.60% in ATHC, indicating better egg preservation and operational efficiency under automated microclimate regulation. In addition for improving grainage performance, ATHC significantly reduced monitoring frequency and labour requirement, as environmental parameters were automatically maintained with minimal manual intervention. The automated system required only periodic observation, thereby reducing

manpower dependency and ensuring uniform microclimate stability throughout the grainage period. Hence, adoption of ATHC in grainage operations can significantly enhance grainage efficiency, quality and consistency while reducing variability and labour associated with manual monitoring.

**Keywords:** Automatic temperature control, Humidity regulation, Grainage efficiency, Silkworm, DFL production, Microclimate management, Labour reduction.

## **T4P2: Transforming seri-genetic resource conservation through automation and ai-driven approaches**

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### **Abstract**

Seri-germplasm conservation constitutes a fundamental component of sustainable sericulture, ensuring the preservation of genetic diversity in mulberry, silkworm and related genetic resources. The maintenance and management of germplasm repositories involve labor-intensive operations, viz., field evaluation, phenotypic characterization, irrigation scheduling, pest and disease surveillance, accession labeling, data documentation and periodic regeneration. These activities require sustained manual intervention, contributing to physical drudgery, operational inefficiencies and potential human errors. In the context of expanding germplasm collections and limited skilled manpower, technological integration has become increasingly imperative. Recent advancements in automation and artificial intelligence (AI) have introduced innovative solutions to enhance efficiency and reduce manual workload in seri-genetic resource conservation. Automated irrigation and fertigation systems, sensor-based microclimate monitoring and internet of things (IoT) enabled surveillance platforms facilitate precision resource management and continuous environmental assessment. Drone-based remote sensing and machine vision technologies enable high-throughput phenotyping, early stress detection and disease identification in mulberry germplasm blocks. In silkworm germplasm centers, automated rearing systems, programmable environmental control chambers and AI-assisted image analysis improve the accuracy of trait evaluation and stock maintenance. Furthermore, digital germplasm databases integrated with AI-driven analytics support real-time data management, predictive modeling, regeneration planning and risk mitigation strategies. The incorporation of robotics, quick response (QR) codes and radio frequency identification (RFID) based tagging systems and smart inventory management further streamlines accession tracking while minimizing labeling and documentation errors. Collectively, these technological interventions not only reduce physical drudgery but also enhance precision, reliability and long-term sustainability of germplasm conservation programs. This review synthesizes current advancements,

practical applications, associated challenges and future perspectives of automation and AI in seri-genetic resource management, emphasizing their role in modernizing conservation systems and strengthening climate-resilient sericulture.

**Keywords:** AI; Automation; Conservation; Drudgery; Mulberry; Robotics; Silkworm; Seri-germplasm

### **T4P3: A Conceptual AI-Driven Automation Framework for Streamlining Ex-Situ Mulberry Germplasm Conservation**

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#### **Abstract**

Mulberry germplasm conservation is essential for sustaining sericultural productivity and maintaining genetic diversity. However, in ex-situ conservation of mulberry germplasm, routine field operations such as planting, pruning, weed management, irrigation management, fertilizer application, and pest and disease monitoring are highly labour-intensive and physically demanding. These repetitive activities contribute significantly to drudgery, increased operational costs, and inconsistency in germplasm maintenance practices. The present work proposes a conceptual AI-integrated automation framework designed to reduce manual drudgery in mulberry germplasm conservation systematically. The model envisions the integration of mechanization, sensor-based monitoring, and artificial intelligence-driven decision support within a unified operational structure. Field activities are envisioned to be digitally structured, beginning with geospatial mapping and accession tagging to ensure traceability and organized block management. Routine crop management can be supported through intelligent monitoring systems that assess canopy growth dynamics and guide timely pruning. Power-assisted pruning implements help to minimize physical strain, while weed management is facilitated through mechanized inter-row cultivation. Water and nutrient management are conceptualized through sensor-enabled precision systems that continuously monitor soil conditions and facilitate need-based irrigation and fertigation via automated control mechanisms. Image-based analytical tools are further incorporated to strengthen early detection of pest and disease incidence, enabling proactive intervention. All modules are unified through a centralized digital platform enabling synchronized data capture, monitoring, and accession-wise traceability across the mulberry germplasm block. By integrating decision-support tools with mechanized and sensor-based systems, the framework aims to reduce manual workload, enhance operational precision, optimize resource utilization, and promote systematic management of mulberry genetic resources. The model provides a scalable foundation for future pilot validation and technological advancement in mulberry germplasm conservation.

**Keywords:** Mulberry germplasm, Drudgery reduction, AI, Automation

#### **T4P4: Predicting the impact of climate change on potential distribution of *Bombyx mori* under present and future climatic scenarios**

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#### **Abstract**

Climate change poses significant risks to sericulture sustainability in India. This study assessed the present and future climatic suitability of the mulberry silkworm, *Bombyx mori*, across India using the CLIMEX 4 bioclimatic modelling framework. Species-specific thermal and moisture parameters were derived from established Indian sericulture literature and incorporated to generate Ecoclimatic Index (EI) values under current climate conditions and projected 2050 scenarios (RCP 4.5 and RCP 8.5). Under present conditions, southern and eastern states, particularly Karnataka, Tamil Nadu, Assam, and West Bengal, exhibited high climatic suitability (EI > 20), aligning with major silk-producing regions. Arid western areas and high-altitude Himalayan regions showed marginal to unsuitable conditions due to dry and cold stress accumulation. The national mean EI under the present climate was 16.54, indicating overall moderate suitability across key sericultural zones. Future projections suggest a slight decline in mean EI under RCP 4.5 (15.77; -0.77 units), indicating manageable impacts under moderate warming. However, under RCP 8.5, mean EI decreases to 13.38 (-3.16 units), reflecting increased heat stress in southern and central India. Conversely, selected Himalayan valleys demonstrate improved suitability under warming due to reduced cold stress. Statistical comparison among scenarios revealed significant differences in EI values ( $p < 0.05$ ), confirming that climate change is likely to alter the spatial distribution of sericulture suitability within India. These findings highlight the need for adaptive, climate-resilient sericulture strategies nationwide. Additionally, the spatial suitability maps generated in this study provide a scientific basis for prioritizing regions for germplasm conservation and maintenance of diverse silkworm genetic resources under changing climatic conditions. Identifying future stable and emerging suitable zones will support strategic relocation, in situ conservation, and long-term preservation of valuable *B. mori* breeds for sustainable sericulture development.

**Key words:** CLIMEX modelling, Ecoclimatic Index (EI), *Bombyx mori*, Climate change, RCP 4.5 and RCP 8.5, Climatic suitability

#### **T4P5: Potentiality of IoT-Based Smart preservation for efficient utilization of Seri-Genetic Resources**

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#### **Abstract**

Conservation of biodiversity plays a pivotal role in sustainable agricultural development and long-term genetic security. The Central Sericultural Germplasm Resources Centre (CSGRC), Hosur, is a unique national repository dedicated to the conservation of both mulberry and silkworm genetic resources. Currently, 489 silkworm accessions are maintained through continuous crop cycles, intermittently supported by preservation of silkworm eggs under controlled temperature schedules. As these accessions are shifted across different temperature gradients during preservation, the manual maintenance of the optimum temperature, humidity and light intensity during aestivation period becomes critical. Further, safe duration of the storage is directly correlated to the stage of embryo and strain of silkworms. The integration of an Internet of Things (IoT)-based smart preservation system significantly enhances the efficiency and precision of exposure of eggs to different temperatures (25<sup>0</sup>C, 20<sup>0</sup>C, 15<sup>0</sup>C, 10<sup>0</sup>C, 5<sup>0</sup>C & 2.5<sup>0</sup>C). IoT-enabled tools facilitate real-time monitoring of storage conditions, enabling accurate regulation of temperature gradients and minimizing human error. Whenever there is a deviation from optimum temperature or humidity or light intensity, the sensor will send the signal to IoT controller and cloud server which inturn activates the cooler or humidifier/dehumidifier or light on/off respectively thereby it maintains optimum conditions inside the cold rooms. Furthermore, the platform assists in synchronizing egg hatching with mulberry leaf availability, ensuring optimal rearing conditions. The incorporation of mobile application-based control allows timely decision-making for early or delayed egg release, thereby reducing manual drudgery and operational

uncertainties. This smart preservation framework not only strengthens the conservation strategy of silkworm germplasm but also ensures sustainable management of seri-genetic resources. Therefore, the adoption of IoT-based interventions is essential for enhancing precision, reliability and long-term conservation efficiency of seri-genetic resources.

**Keywords:** IoT, preservation, temperature, monitoring.

## **T4P6: Remote Sensing and Automation for reducing drudgery in Mulberry Germplasm Conservation**

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### **Abstract**

Mulberry (*Morus* spp.) is the main food plant of silkworms and a critical component in the silk production. The Mulberry germplasm conservation in field gene banks involves monitoring plants for proper growth, leaf yield, pests and disease, nutrient content, and irrigation requirements on a continuous basis. Manual monitoring of field is time consuming. Remote sensing provides a rapid and non-destructive approach for systematic crop monitoring through various applications say early detection of abiotic and biotic stresses, automatic irrigation, site specific application of nutrients. Multispectral imaging captures spectral reflectance data, giving vegetation indices like NDVI and NDRE can help in early detection of biotic and abiotic stresses before visible symptoms become severe and allowing timely corrective measures and reduces potential germplasm loss. The AI including Machine learning algorithms like SVM can classify healthy and stressed plants based on spectral data. Deep learning models, particularly CNN, can analyze leaf images to automatically detect disease symptoms and nutrient deficiencies with high accuracy. Integration of IoT-based soil moisture sensors facilitates automated irrigation management. Real-time soil moisture information can also be utilized in precision irrigation technology based on threshold levels, ensuring optimal water supply with minimal human interaction and water waste. Variable Rate Technology (VRT) also improves site-specific crop management based on spatial variability identified applies the fertilizers, pesticides, herbicides, and weedicides only to the affected area and not to the entire field which will reduce the use of chemicals. Real-time monitoring using remote sensing integrated with AI, IoT, and GIS allows for real-time decision-making in mulberry germplasm conservation.

**Keywords:** Remote sensing, GIS, Sericultural Genetic resources, AI

## T4P7: Smart Muga: AI for Golden Silk Conservation

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### Abstract

Muga silk, produced by the endemic silkworm *Antheraea assamensis* in the Brahmaputra valley of Northeast India, represents a unique biocultural heritage and a vital rural livelihood resource. However, muga production faces increasing challenges from climate variability, host plant fluctuations (Som and Soalu), disease outbreaks such as pebrine, declining grainage efficiency, and fragmented field monitoring systems. These constraints threaten both productivity and long-term conservation of this “Golden Silk.” The present paper proposes “Smart Muga”, an Artificial Intelligence (AI)-enabled framework for conservation-oriented sericulture. The approach integrates machine learning, computer vision, Internet of Things (IoT) sensors, and geospatial analytics to enhance real-time monitoring and predictive decision-making across the muga value chain. AI-driven image analysis can facilitate early detection of pebrine infection and larval health anomalies, while climate-based predictive models support optimized brushing schedules and crop planning. Remote sensing and GIS-based mapping enable habitat suitability assessment for Som (*Persea bombycina*) and Soalu (*Litsea monopetala*), promoting sustainable host plant management. Additionally, AI-powered decision support systems can assist grainage operations through improved seed quality assessment and environmental regulation. By reducing disease losses, optimizing resource use, and strengthening climate resilience, Smart Muga contributes to sustainable intensification without compromising ecological integrity. The framework emphasizes conservation through technology-preserving indigenous germplasm, enhancing farmer advisory systems, and enabling data-driven policy interventions. This study highlights how digital transformation can bridge traditional sericulture knowledge with modern analytics, ensuring productivity, profitability, and preservation of Muga silk in Northeast India. The integration of AI into muga ecosystems represents a strategic pathway toward safeguarding India’s Golden Silk heritage under changing environmental conditions.

**Keywords:** *Antheraea assamensis*; golden silk; GIS; Smart-Muga

## **T4P8: *ROBEVA-Morus*: A Robust Multivariate Evaluation Method for Selecting Mulberry Genetic Resources**

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### **Abstract**

Selection of promising mulberry genetic resources or genotypes based on multiple economically important traits is inherently challenging. Most multivariate selection approaches are often affected by econometric issues such as multicollinearity, outliers or extreme observations, and complex positive or negative trait associations, along with the influence of traits with disproportionately high or low values. To address these limitations, a robust and efficient statistical tool, *ROBEVA-Morus*, was developed for the selection of superior genotypes in mulberry breeding programs. This method is a multi-trait selection index based on principal component analysis (PCA), wherein the data are normalized and weights are assigned according to principal components with higher eigenvalues. The utility of *ROBEVA-Morus* was demonstrated using data from a preliminary mulberry trial comprising 28 traits evaluated across 33 genotypes. The method produced desirable selection gains, yielding negative gains for traits targeted for reduction and positive gains for traits intended for improvement. *ROBEVA-Morus* is user-friendly in both computation and interpretation, and it provides graphical outputs such as box plots, correlation heatmaps, cluster heatmaps, and biplots for enhanced visualization. In toto, proposed tool can significantly reduce time and resource requirements in mulberry breeding trials while ensuring sustainable long-term gains in leaf yield. A step-by-step execution guide, along with R and Python packages/algorithms containing all necessary functions, is also provided to facilitate its adoption in future studies.

**Keywords:** Mulberry, Sericulture, Multi-trait selection, PCA, *ROBEVA-Morus*, Genotype evaluation

## **T4P9: Innovative Germplasm Conservation Approaches in Sericulture**

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### **Abstract**

The integration of sericultural genetic resources, encompassing diverse domesticated silkworm (*Bombyx mori*) breeds and mulberry germplasm, forms the cornerstone of sustainable silk production by enabling targeted genetic enhancement programs. Recent progress in silkworm genomics has elucidated patterns of genetic diversity, identified molecular markers, and mapped trait-associated loci critical for effective conservation and selective breeding. Despite these advances, traditional germplasm management practices remain predominantly labor-intensive, dependent on subjective manual phenotyping, and constrained by static documentation systems. Such limitations impede scalability, hinder accurate prediction of phenotypic outcomes, and restrict adaptive responses to environmental variability. The convergence of Artificial Intelligence, Machine Learning, Internet of Things, and Blockchain technologies presents a paradigm shifting opportunity to establish intelligent, next generation conservation frameworks. AI driven digital phenotyping, leveraging deep learning architectures, facilitates automated, high throughput quantification of cocoon morphological traits, early detection of diseases, and comprehensive growth monitoring, thereby minimizing human bias and substantially increasing analytical efficiency. Machine learning models enable robust predictive analytics of genotype by environment interactions and accurate classification of strains under heterogeneous agroclimatic regimes. IoT enabled smart sericulture systems, incorporating real time environmental sensors and cloud based analytics, support precise microclimate control and continuous germplasm monitoring to enhance stability and performance resilience. Blockchain technology further introduces decentralized, immutable ledgers that ensure full traceability, transparency, and data integrity throughout genetic resource exchange and distribution networks. This synergistic integration paves the way for the development of a Smart Germplasm Bank, a digitally unified, predictive, and climate adaptive

conservation platform that transitions sericulture from conventional static preservation toward automated, evidence-based, and resilience focused genetic resource stewardship. Such an approach holds substantial promise for elevating productivity, sustainability, and adaptive capacity in global sericulture systems.

**Key words:** breeds, conservation, germplasm, mulberry, phenotyping and silkworm

## **T4P10: AI-Based Duplicate Accession Detection and Smart Genebank Management in Mulberry Germplasm Conservation**

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### **Abstract**

Efficient conservation of seri-genetic resources requires accurate identification of unique accessions and rational management of germplasm repositories. Large mulberry (*Morus* spp.) genebank often contain duplicate or closely related accessions due to exchanges, morphological similarities, and incomplete documentation, resulting in increased maintenance costs and labour-intensive curation. This study proposes an Artificial Intelligence (AI)-enabled framework for duplicate accession detection and automated genebank management. Integrated datasets comprising morphological descriptors, biochemical traits, molecular marker profiles, and geo-referenced passport information were analysed using machine learning algorithms. Unsupervised clustering methods, similarity matrices, and pattern recognition models identified redundant accessions with higher resolution than conventional descriptor-based approaches. AI-assisted analytics supported evidence-based rationalization of collections while preserving maximum genetic diversity. AI-driven genebank management systems facilitated automated data validation, anomaly detection, predictive trait analytics, and dynamic inventory updates. Web-enabled interfaces enhanced public access to non-sensitive germplasm information, allowing researchers and breeders to query trait-specific datasets efficiently. The integration of AI for duplicate detection, automation of documentation, and intelligent database management significantly reduces operational drudgery, optimizes resource allocation, and strengthens strategic conservation planning. Technology-enabled genebank modernization thus provides a scalable and sustainable model for managing seri-genetic resources in the era of digital agriculture.

**Keywords:** Artificial Intelligence; Duplicate Detection; Digital Automation; Genebank Management; Machine Learning; Mulberry Germplasm

## **T4P11: Artificial Intelligence-Driven Image-Based Race Identification in Silkworm Germplasm Conservation**

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### **Abstract**

Silkworm germplasm forms the foundation of sustainable sericulture by conserving the genetic diversity of the domesticated silkworm, *Bombyx mori* Linnaeus 1758, thereby supporting breeding for productivity, disease tolerance, and climate resilience. Germplasm maintenance is labour-intensive, involving repeated measurement of cocoon traits, visual verification of race characteristics, and manual documentation, which increases drudgery and the likelihood of subjective errors. Artificial Intelligence (AI), encompassing Machine Learning (ML) and Deep Learning (DL) approaches, provides a practical and scalable solution for automated race identification and germplasm monitoring. High-resolution cocoon images captured under standardized illumination and background conditions can be analysed to extract quantifiable colour, shape, and other spectral features. Supervised learning models, including convolutional neural networks (CNNs) and other classification algorithms, can be trained on these extracted features to classify different races. Emphasis is placed on robust, image-based phenotypic markers rather than complex or difficult-to-measure structural traits. The expected outcome is a practical and scalable digital system that reduces manual work, enhances the accuracy of germplasm identification, and facilitates better management of silkworm genetic resources.

**Keywords:** Silkworm germplasm, Artificial Intelligence, Convolutional Neural Networks, Race classification

## **T4P12: Quantitative Investigation of Technological Drivers on Cocoon Production in Mulberry Sericulture**

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### **Abstract**

The study examines how key sericulture technologies influence cocoon yield, using cocoon yield per 100 dfls as the main performance indicator. Correlation results show strong positive associations with plant spacing (0.602), rearing method (0.782), and mountages (0.568), confirming that modern rearing practices substantially improve productivity. Moderate correlations for mulberry variety, irrigation, rearing house, number of crops per year, and silkworm hybrids further highlight their collective contribution, while age of plantation shows a negative relationship (-0.332), indicating yield decline in older gardens.

An OLS regression model was developed with cocoon yield as the dependent variable. The model exhibited strong explanatory strength ( $R^2 = 0.667$ ; Adjusted  $R^2 = 0.666$ ), showing that 66.7% of yield variation is explained by technological factors. The overall model was highly significant ( $F = 947$ ,  $p < 0.001$ ), and the Durbin-Watson value (1.905) indicated no autocorrelation. Positive and significant predictors included mulberry variety, irrigation, spacing, rearing house, rearing method, mountages, number of crops per year, and silkworm hybrids, whereas age of plantation had a negative impact. Diagnostic checks confirmed normally distributed residuals, supporting model validity. Overall, the findings underscore that integrated adoption of improved cultivation and rearing technologies is crucial for enhancing cocoon production and guiding technology-driven interventions in sericulture.

**Keywords:** Regression, Ordinary Least Square Estimation, Correlation, Mulberry Sericulture, R-Square.





*Seri-biodiversity is our National Heritage. Conserve it for Posterity.*



**CSB-Central Sericultural Germplasm Resources Centre**  
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