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Empowering Farmers: The Latest in Mulberry and Silkworm Technology

(*Abhishek Kumar Tamta[1] and Gunjan Kandpal[2])
[1]Senior Research Fellow, Department of Entomology, College of Agriculture,
G. B. Pant University of Agriculture and Technology
[2]Environmental Biotechnology Laboratory,
Centre for Rural Development and Technology, IIT, Hauz khas -110017, Delhi
*Corresponding Author's email: abhishek.tamta@outlook.com

In the heartlands of India's agriculture, where tradition meets innovation, the sericulture and moriculture industries have seen remarkable advancements in recent years. These developments are not just enhancing productivity and quality but also opening new avenues of profitability for farmers. From breakthroughs in mulberry genotypes to innovations in silkworm cultivation and disease management, the landscape of silk production is evolving rapidly. This article explores the transformative strides made in mulberry and silkworm cultivation, empowering farmers with knowledge and opportunities for sustainable growth.

Advances in mulberry host plant

1. Breakthrough Mulberry Genotypes

Higher Yielding Triploid Genotypes: Two new triploid genotypes, TRI-10 and TRI-8, have been identified with higher leaf yields than the existing G4 and Vishala varieties. These genotypes offer a promising option for farmers aiming to boost their productivity.

Registration of New Varieties: Five mulberry varieties—G-2, RC-1, AR-12, Sahana, and MSG-2—have been registered under the Protection of Plant Varieties and Farmers' Rights (PPVandFR) Act, 2001. This registration ensures the protection and recognition of these superior varieties, benefiting farmers by providing access to high-quality planting materials.

Improved Rainfed Varieties: The new genotype C-9 (C-2058) has shown a 10% higher leaf yield under rainfed red and laterite soils and in the North Eastern region compared to the check variety, C-2038. This variety is particularly valuable for farmers in regions with limited irrigation.

2. Optimized Cultivation Practices

Fertilizer Recommendations A finalized fertilizer dose recommendation for tree mulberry cultivation in southern states includes NPK @ 258:103:103 g/plant/year and 15 kg of farmyard manure (FYM) per plant per year. This recommendation ensures optimal nutrient supply, promoting healthy plant growth and higher yields.

Drip Fertigation Technology: The validation of drip fertigation technology has demonstrated a 17% increase in leaf yield compared to conventional methods while saving 25% on fertilizer use. This technology enhances water and nutrient efficiency, making it a sustainable and cost-effective option for farmers.

3. Enhancing Mulberry Leaf Quality and Resistance

Formulations for Improved Leaf Yield: Two formulations, BAP+AA and SNP, have been identified to reduce leaf senescence by 50-65% compared to control plants, leading to

improved leaf yield and quality. These formulations help maintain healthy foliage, which is essential for high-quality silkworm feed.

Powdery Mildew Resistance: Seven powdery mildew-resistant progenies have been identified from the S-1 × Vietnam-2 population. Additionally, two candidate genes, MLO2 and MLO6A, involved in powdery mildew susceptibility, have been identified for developing resistant varieties. These advancements help reduce the impact of diseases, ensuring healthier mulberry plants and consistent leaf production.

4. Expanding Genetic Diversity

Collection of New Germplasms: Eight new mulberry germplasms from Kurung Kumey and Kara Dadi Districts of Arunachal Pradesh and five from Varanasi, UP, have been collected. This collection enhances the genetic diversity of mulberry plants, providing valuable resources for breeding programs aimed at developing new, improved varieties.

Chromosome Study Protocol: A standardized protocol for chromosome study of mulberry has been developed and published. This protocol facilitates genetic research and breeding efforts, contributing to the development of superior mulberry varieties.

5. Productivity and Farmer Empowerment

Increased Productivity: Research and development have significantly improved mulberry productivity from 50 MT/ha/year in 2005-06 to 65-67 MT/ha/year in 2022-23. This increase in productivity directly benefits farmers by boosting their income and ensuring a steady supply of high-quality leaves for silkworm rearing.

Training and Support: Farmers are being empowered through education and resources related to these advancements. Extension services, training programs, and access to high-quality planting material enable farmers to adopt best practices and optimize their mulberry farming operations.

Advances in mulberry silkworm

1. Enhanced Silkworm Lines

Multivoltine Silkworm Lines: Six new multivoltine silkworm lines with improved silk quality have been developed. Among these, the combination MAS-3 × BM2 has shown exceptional results, producing 3A grade silk. The parentage of MAS-3, MV1 × S8, ensures robustness and superior performance.

Superior Bivoltine Hybrids: A new bivoltine double hybrid, BFC1 × BFC10, has been evaluated in southern states, recording an impressive average cocoon yield of 68-72 kg/100 DFLs, with a shell percentage of 23.4 and a silk grade of 2A-3A. This hybrid is a promising option for farmers seeking high yields and quality.

Multi-viral Tolerant Hybrids: The double hybrid RDIN1, known for its multi-viral tolerance, has demonstrated a high pupation rate of 97.4%, compared to 91.4% for the FC1 × FC2 hybrid. This resistance ensures consistent production across various seasons, reducing losses due to viral infections.

2. Innovations in Silkworm Nutrition and By-products

Extraction of Pupae Oil: A process for extracting pupae oil and concentrating alpha-linolenic acid (ALA) has been developed. This innovation not only provides a valuable by-product but also opens new avenues for the utilization of silkworm pupae in various industries.

Human Food Products: Researchers have successfully prepared human food products from mulberry silkworm pupae, including pasta, cookies, beverage mixes, and mayonnaise. Additionally, eri pupae have been used to create roasted and spiced pupae and pickle products, showcasing the nutritional and culinary potential of silkworm pupae.

Animal Feed Formulations: Silkworm pupae-based poultry and fish feed formulations have been developed and tested, proving their efficacy in feeding trials. These formulations offer a

sustainable and nutritious alternative for animal feed, leveraging the protein-rich composition of silkworm pupae.

3. Disease Management and Resistance

Detection of Pesticide Contamination: A paper strip method has been developed for detecting pesticide contamination in mulberry leaves and soil. This simple and efficient tool helps farmers ensure the safety and quality of their feed for silkworms, minimizing the risk of contamination.

Antimicrobial Peptides: Two antimicrobial peptides, PR1 and OLP, have been identified from mulberry leaf proteins. These peptides inhibit bacterial pathogen growth, providing a natural defence against diseases such as flacherie in Bomby× mori. Specifically, sPR1 has shown significant activity against *Staphylococcus* spp., inhibiting up to 90% of growth at higher concentrations.

Thermal and Humidity Tolerant Breeds: Five bivoltine breeds—SK7HH, B.Con4HH, N5HH, WB1HH, and HTH10HH—have been identified for their high tolerance to temperature and humidity. DNA markers for thermo-tolerance (S0803 and S0816) and humidity tolerance (Py×3 and Py×4) have been screened in these breeds, ensuring their adaptability to varying climatic conditions.

4. Improved Cocoon Productivity

Productive Cross Breeds: The crossbreed 12Y × BFC1 has shown a promising average cocoon yield of 45.3 kg/100 DFLs, outperforming the control variety. This hybrid has been recommended for commercial exploitation in Eastern and North-Eastern India, offering farmers a reliable and productive option.

Higher Yield Double Hybrids: The resistant double hybrid (DHR) FC1R (CSR6R × CSR26R) × FC2R (CSR2R × CSR27R) has shown a 3-12% increase in survivability and yield compared to control varieties. This hybrid has been tested and recommended for its superior performance, providing farmers with a high-yielding and resilient option.

Conclusion

As we reflect on the advancements discussed, it becomes evident that the future of sericulture and moriculture in India is promising. With higher yielding mulberry genotypes, superior silkworm hybrids, and innovative agricultural practices, farmers are poised to achieve greater productivity and profitability. The integration of modern technologies with traditional farming wisdom ensures resilience against challenges while maximizing the potential of these age-old practices. By embracing these advancements, farmers can embark on a journey towards sustainable agriculture and prosperous livelihoods.

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