Silkworm Gut Microbes: Essential Contributors to Silk Production

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OPEN ACCESS

Keywords

Gut Microbiota, Probiotics, Microbial Manipulation, Host-Microbe Interaction, Silk Yield

How to cite this article:

Komal, J., Kumar, P. V. D. and Nadaf, H. 2025. Silkworm Gut Microbes: Essential Contributors to Silk Production. *Vigyan Varta* 6(7): 71-73.

ABSTRACT

Silkworms (*Bombyx mori*) rely on a symbiotic relationship with their gut microbiota to support key physiological functions crucial for effective silk production. These microorganisms aid in the digestion of mulberry leaves, enhance nutrient absorption, and bolster the silkworm's immune response. Recent advances have revealed that manipulating the gut microbiota through probiotics and targeted microbial interventions can significantly improve larval health and silk yield. This review explores the functional roles of gut microbes in sericulture, highlights the importance of maintaining microbial balance, and discusses emerging strategies for optimizing microbiome-based approaches in silk farming. Integrating microbial management into sericulture promises to improve sustainability, reduce environmental impact, and enhance silk production outcomes.

INTRODUCTION

Silk production is a complex biological process primarily driven by the silkworm (Bombyx mori), which spins cocoons composed of silk proteins. According to recent studies, the gut microbiota of silkworms is essential for regulating a number of physiological processes that affect the quantity and quality of silk produced. This microbial consortium improves immunological responses, aids in digestion, and may have an impact on the production of silk proteins. Enhancing sericulture methods and

sustainability requires an understanding of the relationships between silkworms and their gut microbiota (Xin *et al*., 2024).

The Microbial Ecosystem in Silkworms

Silkworms harbor a diverse community of microorganisms within their digestive tract, forming a symbiotic relationship that supports host nutrition and health. These gut microbes contribute enzymatic activities that degrade complex polysaccharides and secondary metabolites present in mulberry leaves, the primary food source of silkworms. The metabolic products of microbial digestion enhance nutrient availability, which is essential for larval development and silk protein synthesis. Additionally, the gut microbiota influences the host's immune system by outcompeting pathogens and modulating immune effectors, thereby reducing disease susceptibility (Gheorghe *et al*., 2024).

Functional Roles of Gut Microbes in Silk Production

Silkworms harbor a diverse community of microorganisms within their digestive tract, forming a symbiotic relationship that supports host nutrition and health. The complex polysaccharides and secondary metabolites found in mulberry leaves, which are the primary source of food for silkworms, are broken down by the enzymatic activity of these gut microorganisms. Microbial digestion produces metabolic products that improve nutritional availability, which is crucial for silk protein synthesis and larval growth. Furthermore, by outcompeting pathogens and modulating immune effectors, the gut microbiota affects the host's immune system and lowers the risk of disease (Gheorghe *et al*., 2024).

Strategies for Microbial Manipulation in Sericulture

Advancements in microbiome research have enabled the exploration of microbial management strategies to enhance sericulture outcomes. Probiotic strains have been demonstrated to enhance silk production efficiency and improve larval health. For the best silk synthesis and disease prevention, the microbial equilibrium in the silkworm's gut must be maintained. Moreover, host-microbiome interactions are being characterized using molecular and metagenomic techniques, which makes it possible to create targeted microbial interventions meant to increase sericultural resilience and productivity (Suraporn *et al*., 2025).

CONCLUSION

The gut microbiota of silkworms constitutes an indispensable component of sericulture, contributing significantly to nutrient assimilation, immune defense, and silk protein production. Optimization of this microbial consortium offers a promising avenue for enhancing silk yield and quality while reducing reliance on chemical treatments that pose environmental and health risks. Systems for producing silk that are more efficient and sustainable can result from incorporating microbial management into sericulture procedures. Future studies that concentrate on the mechanistic understanding of the interactions between silkworms and microbes will be crucial in creating novel, microbiome-based approaches to enhance sericulture on both an ecological and economic level.

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