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Beyond Silk: Turning Silkworms into Space Superfood

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Silkworms are traditionally valued for their silk production, but recent research explores their potential as a sustainable protein source for long-duration space missions. Their efficient biomass conversion, rapid reproduction, and nutrient-rich composition position them as promising contributors to space life-support systems. This article highlights the emerging role of silkworms in supporting food security and biomedical applications beyond Earth.

Keywords: sericulture, silkworm, space nutrition,

Introduction

The mulberry silkworm (*Bombyx mori* L.) has shared a long-standing association with human civilization. Renowned for producing the exquisite silk often referred to as the "queen of textiles," it has supported generations of farmers and artisans weaving its delicate threads into the economic and cultural fabric of society. From its early role along the ancient Silk Roads connecting China with Europe to the sericulture initiatives of colonial Georgia, this modest insect has influenced global trade, craftsmanship, and cultural exchange. Beyond its traditional importance in silk production, *B. mori* has emerged as a valuable model organism in biological and biotechnological research, contributing significantly to studies in genetics, physiology, and sustainable resource management.

In recent years, the scope of silkworm utilization has extended beyond Earth. Scientists have begun to explore its potential as a nutritious and sustainable food source for long-term space missions. Silkworms are exceptionally efficient in converting plant biomass into high-quality protein while requiring minimal space, water, and energy—critical factors in extraterrestrial habitats. They are rich in essential amino acids, reproduce rapidly, and can adapt to various plant-based feeds, including vegetable by-products, making them ideal for closed-loop life-support systems. Therefore, silkworm farming presents a promising avenue for supporting human nutrition and ecological balance in future space settlements, transforming this ancient silk producer into a cornerstone of sustainable living beyond our planet.

Nutritional Potential of Silkworms

Silkworm pupae are rich in long-chain polyunsaturated fatty acids, which impart a distinctive fishy taste and aroma, characteristics resulting in a distinct flavour profile. Despite sensory challenges, their high nutritional content, including both proteins and lipids, positions them as a potentially valuable food source for space missions. During long-duration missions, how acceptable a food becomes just as important as its nutrient content, because if astronauts find certain foods unappealing, they may eat less of them, which can result in nutritional deficiencies. Astronauts aboard the International Space Station rely on a limited menu of approximately 200 processed and prepackaged items, making menu fatigue a real concern

even among high-performing crew members. While NASA is not currently pursuing insects as part of astronaut diets, the agency previously commissioned a study, *Insects: A Nutritional Alternative* (1981), to evaluate their potential. If acceptable in taste, silkworms could complement predominantly plant-based diets and provide an alternative source of essential nutrients. Silkworm pupae are rich in protein, essential amino acids, vitamins, and beneficial fatty acids. In fact, they contain more protein than many common animal foods. This makes them useful for astronauts who need nutrient-dense foods during long missions. However, taste and food acceptability are important factors. Foods eaten frequently in space must be enjoyable, or astronauts may eat less than required. There is ongoing research to create silkworm-based food products in forms such as protein bars, dried snacks, or powders that can be mixed into meals.

Looking further ahead, in the context of long-term lunar or Martian habitats, silkworms could serve dual purposes: producing silk for material use and offering a sustainable, renewable protein source for human consumption. Although such applications are unlikely to be practical for short-term missions in low-Earth orbit, they illustrate the potential for insects to contribute to long-term off-world food security (Kong et al., 2024).

Fig: Picture showing the rearing of mulberry silkworm

Silk: A Promising Material for Space Medicine

Silk fibroin is strong (stronger than steel by weight), lightweight, biodegradable, and biocompatible, making it suitable for medical applications in space. In space missions, where astronauts may face injuries and transporting complex surgical equipment is challenging, silk-based biomaterials can play a crucial role. Silk sponges and patches could facilitate wound healing, while bioprinting with silk fibroin offers the potential to generate functional tissues on-site. Additionally, silk can be engineered into biosensors and controlled drug delivery systems (Wang et al., 2024). Thus, silk's applications extend beyond textiles, positioning it as a versatile material capable of supporting human health in space.

Conclusion

Thus, silkworms represent a unique intersection of nutrition and biomedical innovation for space exploration. Their pupae provide a sustainable source of protein and lipids that could support astronaut diets on long-duration missions, while silk fibroin offers versatile applications in space medicine, including wound healing, tissue engineering, and drug delivery. By combining their nutritional and biomedical potential, silkworms could become an integral part of future off-world habitats, demonstrating that even small, humble organisms can play a significant role in sustaining human life beyond Earth.

References

1. Wang, H. Y., Zhang, Y., Zhang, M., & Zhang, Y. Q. (2024). Functional modification of silk fibroin and its application to medical biomaterials: A review. *International Journal of Biological Macromolecules*, 259, 129099. https://doi.org/10.1016/j.ijbiomac.2023.129099.
2. Kong, X., Qin, Y., Pei, W., & Zhou, G. (2024). Recent progress in space life science research in China. *Life Sciences in Space Research*, 43, 35–42. https://doi.org/10.1016/j.lssr .2024.10.002