

Waste-Based Diet for *Galleria mellonella* Insect Production

Problem/Challenge

The increasing interest in insects as food or feed has attracted growing research attention due to their high efficiency in the use of resources such as energy, water, and land. *Galleria mellonella*, an insect with potential for both food and feed applications, is currently constrained by high production costs, largely driven by diet formulation. At the same time, the food industry contributes to exacerbating pressure on waste management systems in Mediterranean countries.

Our Solution/Key Finding

The FrontAg Nexus project investigated the small-scale rearing of *Galleria mellonella* (wax moth) larvae as a valuable, protein- and fat-rich feed ingredient, using alternative diets based on food-industry waste streams. Food-industry by-products can be adopted as alternative ingredients to replace components of the conventional *Galleria mellonella* diet, in line with circular economy principles. This approach not only reduces production costs of the rearing but also alleviates pressure on urban waste management systems.

Benefits & Impact

Galleria mellonella represents a nutritious alternative either for food or feed, requiring minimal water inputs (all the water needed is recovered from the moisture of the diet) [1].

Its production can be integrated into circular agricultural systems by converting organic waste streams—such as breadcrumbs and brewery spent grain recovered from the brewing industry—thereby reducing the environmental footprint compared with conventional feed sources. This approach enhances resource-use efficiency and contributes to the diversification of protein sources within the Water-Energy-Food-Ecosystem (WEFE) Nexus.

Applicability Box

Theme: Niche Insect Production, Sustainable Animal Feed, Waste Utilization

Keywords: *Galleria mellonella*, Wax Moth, Insect Feed, Sustainable Protein, Low-Input, Waste Valorization

Context: Small-scale feed production, pet food, aquaculture, waste valorization.

Required Resources: Climatic chamber/incubator, non-toxic plastic boxes, appropriate feed substrate (e.g., corn flour, brewery spent grain as alternative waste), technical knowledge of insect rearing.

Scalability: Adaptable for small-scale and decentralized production.

Readiness Levels: Emerging TRL, still at experimental level (TRL=4). BRL/SRL still developing due to regulatory landscape and market acceptance for new feed ingredients [2].

Risk Management/Considerations: The waste-based diet could reduce the fecundity of the insect. The management strategy include the maintenance of a line of parental reproducers using conventional diet.

Practical Recommendations

Alternative waste materials can be used for domestic production of *Galleria mellonella*, replacing conventional white flour with an equal amount (by weight) of either breadcrumbs or brewery spent grain. Preliminary results indicate that brewery spent grain performs better than breadcrumbs; however, because breadcrumb is more readily available, it can also be adopted especially for domestic production. Users should be aware that alternative ingredients may reduce adult fecundity across generations. As research is still ongoing, it is recommended that users assess whether a breeding line should be maintained on the conventional diet, reserving a small proportion of individuals for reproduction, while rearing the remaining population on the alternative waste-based diet.

References and Further Information

- [1] E. Appolloni, A. Morelli, S. Francati, C. Peri, F. Orsini and M. L. Dindo, "How to produce *Galleria mellonella* in a small-scale insect farm," FrontAG Nexus Implementation Guide, Bologna, 2024.
- [2] E. Appolloni, V. Cerasola, G. Pennisi, W. Biru, G. Buchenrieder, T. Uyar and Y. Yavuz, "D1.1: Systematic literature review (SLR) of frontier agriculture systems and empirical evidence in the Mediterranean Region," FrontAg Nexus Project Deliverable, Bologna, 2023.

About this practice abstract

Publisher: FrontAg Nexus

Authors: V. A. Cerasola; S. Francati; F. Orsini, M. L. Dindo (University of Bologna (UniBo))

Contact: Vito Aurelio Cerasola (UniBo), vito.cerasola@unibo.it

Review: Michael Reuter (aquaponik manufaktur (APM))

FrontAg Nexus: The project was launched in May 2023 to promote sustainable agri-food practices by applying the Water-Energy-Food-Ecosystems (WEFE) Nexus approach. Focusing on six Mediterranean countries—Israel, Italy, Morocco, Tunisia, Turkey, and Jordan—the project addresses climate change, resource scarcity, and food insecurity through collaborative research and innovation.

© 2025

Project Website: <https://frontagnexus.eu>

Funding



This work is part of the FrontAg Nexus project. This project (GA n° [2242]) is part of the PRIMA program supported by the European Union.



**Co-funded by
the European Union**

Views and opinions expressed are those of the author(s) only and do not necessarily reflect those of the European Union. Neither the European Union nor the granting authority can be held responsible for them.