Corso di Dottorato di Ricerca in Scienze della Vita e dell'Ambiente – Ciclo XXXVII

Omega 3-enriched insect *Acheta domesticus* as a novel eco-sustainable food in Europe.

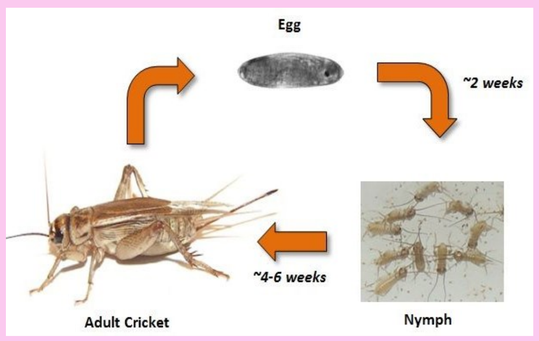
Student: Behixhe Ajdini. Tutor, Prof Cristina Truzzi; co-tutor, Dr Irene Biancarosa

Analytical Chemistry for Environment and Food Lab, DISVA

By the year 2050, the world's population is expected to grow by more than 9 billion, leading to a considerable increase in food demand. Traditional protein sources (cattle, pigs, poultry, sheep) are no longer sustainable due to their impact on the environment. Insects are a more eco-sustainable alternative to traditional animal farming, since they emit a quantity of greenhouse gases of two orders of magnitude lower than the latter, provide a higher percentage of edible mass, have a high feed-conversion efficiency, require less space and less water [1].

Novel foods: House cricket authorized by EFSA as food ingredient for the EU market since February 2022

- High protein content of more than 70%, with a good index of essential amino acids [2].
- High lipid content, but poor in unsaturated fatty acids, such as omega-3, known for their positive effects on human health.



Acheta domesticus
Life cycle

Seaweeds, (marine macroalgae), could be a good additive to the growth substrate for *A. domesticus*, since they:

- are rich in high-quality nutrients.
- contain up to 30% of protein with the essential amino acids [3].
- contain a good quantity of omega-3.

OBJECTIVE

To enrich the lipid profile of *Acheta domesticus* in omega-3 fatty acids.

METHODS

1. Study of macroalgae as growth substrates for *Acheta domesticus* in relation to the nutritional profile with the identification of 3-4 potentially usable species. Moreover, an assessment of the chemically risk will be carried out, in relation to the presence of Potentially Toxic Elements (PTEs).

2. Study the suitability of seaweed biomass as feeding substrate for house cricket production. Macroalgae will be added in different percentages in the rearing substrate. Once the best growth substrate has been defined, an evaluation will be carried out to determine whether the administration of substrates enriched in omega-3 in the last stages of growth of the insect is more or less effective than long-term administration.

Breeding at **Nutrinsect s.r.l.**

Four principal areas:

Hatching of eggs

Store

Breeding

Transformation

Università Politecnica delle Marche

Fatty Acid quantification

GC-MS: Agilent 6890 GC + 5973N quadrupole selective detector.

Heavy metals determination

Atomic Absorption Spectrometry

Direct Mercury Analyzer

EXPECTED RESULTS

Selection of marine macroalgae to be used as an additive in the rearing substrates of *A. domesticus* based on their nutritional profile and their chemical risk.

To evaluate the suitability of seaweed as feeding substrate for A. *domesticus* production, through the morphological study of the insect, the lipid profile analysis of the growth substrate and of the insect, especially in relation to the content of omega-3, the protein content in the insect and the chemical risk assessment.

Identification of the best growth phase of the insect for the administration of growth substrates based on seaweed, taking into account the welfare of the animal, its nutritional value in relation to the omega-3 content, and the cost/benefit ratio.

Preparation of an omega-3 enriched flour by *Acheta domesticus*, to be proposed as ingredient for the preparation of a "functional food".

REFERENCES

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3. Biancarosa, I., Espe, M., Bruckner, C. G., Heesch, S., Liland, N., Waagbø, R., ... & Lock, E. J. (2017). Journal of Applied Phycology, 29(2), 1001-1009