

# Zinc and selenium enriched by-product for insect meal production: effect on growth performance, chemical profile, and microelements bio accumulation

Andrea Moradei<sup>1\*</sup>, Matteo Ottoboni<sup>1</sup>, Costanza Jucker<sup>2</sup>, Serena Malabusini<sup>2</sup>, Sara Savoldelli<sup>2</sup>, Alice Luciano<sup>1</sup>, Veronika Sele<sup>4</sup>, Luciano Pinotti<sup>1-3</sup>

<sup>1</sup>Department of Veterinary Medicine and Animal Sciences, University of Milan, 26900 Lodi, Italy

<sup>2</sup>Department of Food, Environmental and Nutritional Sciences, University of Milan, via Celoria 2, 20133, Milan, Italy

<sup>3</sup>CRC I-WE, University of Milan, 20134 Milan, Italy

<sup>4</sup>Institute of Marine Research, 5017 Bergen, Norway

\*Corresponding author:

E-mail address: andrea.moradei@unimi.it

Black soldier fly larvae are converters of wide variety of rearing substrates, including agricultural by-products, into edible biomass. It has been demonstrated that these larvae possess the capacity to accumulate microelements when present in the rearing substrate, including heavy metals and pollutants. On the first hand this ability poses a risk in the selection of alternative substrates, on the other hand it could be exploited to produce insect meal (feed specialties) enriched with selected micronutrients. Thus, the objective of this experimental study was to assess the impact of an alternative substrate composed of okara and potato waste, as well as its potential enrichment with two selected micronutrients, zinc (Zn) and selenium (Se). An evaluation of the larval performances has been conducted, assessing their growth performance, chemical composition, and micronutrient, metal, and metalloids content. Five different substrates were prepared: I) a control diet composed of Gainesville diet (CTR); II) a substrate composed by 50% okara and 50% potato waste (OP); III) OP enriched with 150 mg/kg of inorganic Zn (OPZn); IV) OP enriched with 0.3 mg/kg of inorganic Se; V) OP-ZnSe enriched with both 150 mg/kg and 0.3 mg/kg. The experiment was conducted with five replicates for each diet. A total of 500 4-day-old larvae were selected for each replicate. The results indicated that the CTR group exhibited a higher total biomass. In contrast, the OP-based larvae demonstrated higher levels of lipid but lower ash content. The ingestion of Zn and Se resulted in the production of enriched larvae. Furthermore, the micronutrient levels observed indicated the presence of an interaction between these two elements. The metal and metalloids content resulted lower in the OP-based substrates. These findings suggest that okara and potato-based substrates, with and without Zn and Se supplementation, are suitable for BSFL rearing.

**Keywords:** *Hermetia illucens*, Feed, Microminerals, larval production, ICP-MS

## Acknowledgements:

The present study have been done in the frame of: Project Agritech National Research Center and received funding from the European Union Next-GenerationEU (PIANO NAZIONALE DI RIPRESA E RESILIENZA (PNRR) – MISSIONE 4 COMPONENTE 2, INVESTIMENTO 1.4 – D.D. 1032 17/06/2022, CN00000022