

Insect-mediated bioconversion: from organic waste to biobased materials. Digestion capability and lipid valorization

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The use of insects as agents for the bioconversion of organic waste and by-products could represent an innovative strategy to valorize low-value materials and obtain sustainable biobased products. To this purpose, one of the most promising insects is Black Soldier Fly (BSF) (*Hermetia illucens*; Diptera: Stratiomyidae) whose larvae can grow on a wide variety of low-quality biomass. In the framework of a project funded by Fondazione Cariplo, we are evaluating the biotransformation of Organic Fraction of Municipal Solid Waste (OFMSW) by BSF larvae to obtain sustainable biobased materials with high technological value, such as bioplastic films and bionanocomposites (from insect proteins), and biodiesel (from insect lipids).

As the midgut plays a fundamental role in bioconversion processes, first we evaluated the digestion capability of BSF larvae reared on two substrates that mimic the composition of OFMSW. Our results show that the larvae can set in motion post-ingestion responses to compensate variations in nutrient composition of the substrate through the regulation of expression and activity of digestive enzymes. Moreover, we assessed if and how the different nutritional content of two rearing substrates affected the insect composition. In particular, we performed lipidomics analysis on larvae and pupae to evaluate the impact of the rearing substrates and development on lipids profile. The results indicate that changes occur in lipid composition during insect development from both a quantitative and qualitative point of view and the rearing substrate affects lipid composition both in the larvae and pupae, but the total relative amount is not altered.

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