Evaluation of the growth performance, digestive capabilities and midgut integrity of BSF larvae reared on a polyethylene terephthalate (PET)-contaminated substrate

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Abstract

Black soldier fly larvae (BSFL), *Hermetia illucens*, have demonstrated to be an efficient system for the bioconversion of organic waste into valuable insect biomass. The presence of contaminants such as microplastics (MPs) in organic substrates derived from food processing, agrifood chain, or municipal solid waste could potentially hamper the insect-mediated bioconversion of these substrates. However, the effects of MP exposure on BSFL performance are scarcely known. To address this issue, BSFL were reared on the organic fraction of municipal solid waste (OFMSW) spiked with different quantities (4 and 20% w/w) of polyethylene terephthalate (PET) microparticles, and their impact on larval growth performance, as well as gut physiology and morphology, were investigated.

Our findings demonstrate that larval growth rate was not influenced by PET exposure, although the analysis of bioconversion indexes indicated a lower substrate bioconversion efficiency in both PET treatments compared to control. Measurements of endo- and exopeptidases activity in the posterior midgut demonstrated the absence of significant differences between PET treatments and control, underling that PET ingestion did not affect protein digestion in the larvae. Furthermore, to investigate possible mechanical damages of the midgut due to MP transit, a morphological analysis was performed. No alterations in the epithelium or the peritrophic matrix were observed, demonstrating that MPs intake does not affect midgut integrity.

The results herein presented provide insights on the bioconversion of PET-contaminated organic waste using BSFL, expanding our knowledge on the potential of insect-mediated valorization of a challenging substrate as the OFMSW.