

Influence of the Use of Fruits Byproducts on the Lipid Profile of *Hermetia illucens*, *Tenebrio molitor* and *Zophoba morio* Larvae

Authors : Rebeca P Ramos-Bueno, Maria Jose Gonzalez-Fernandez, Rosa M. Moreno-Zamora, Antonia Barros Heras, Yolanda Serrano Alonso, Carolina Sanchez Barranco

Abstract : Insects are a new source of fatty acids (FA), so they are considered a sustainable and environmentally friendly alternative for both animal feed and the human diet, and furthermore, their harvesting/rearing require a low-tech and low capital investment. For that reason, lipids obtained by insect breeding open interesting possibilities with alimentary and industrial purposes, i.e., the production of biodiesel. Particularly, certain insect species, especially during the larval stage, contain high proportions of fat which is highly dependent on their feed and stage of development. Among them, *Hermetia illucens* larvae can be bred on food wastes to produce fat- and protein-rich raw materials for food by-product management. So, insects can act as excellent bioconverters of organic waste to nutrient-rich materials. In this regard, the aim of the study was to evaluate the effects of fruit byproducts on the FA compositions of *Tenebrio molitor*, *Zophoba morio*, and *H. illucens* larvae. Firstly, oil was extracted with the green solvent ethyl acetate, and FA methyl ester was obtained and analyzed by GC to show the FA profile. In addition, the triacylglycerol (TAG) profile was obtained by HPLC. Dehydrated watermelon, tomato, and papaya by-products, as well as wheat-based control feed, were assayed. High FA content was reached by *Z. morio* larvae fed with all fruits; however, no differences were shown in lipid profile with any change. It is worth highlighting that both *Z. morio* and *H. illucens* could be selected as the best candidates for biodiesel production due to their high content of saturated FA. On the other hand, *T. molitor* larvae showed a higher content of monounsaturated FA than control larvae, whereas the n-6 polyunsaturated FA content decreased in larvae fed with fruits. This result indicates that the improvement of the FA profile of *Tenebrio* can depend on both the type of feeding and the intended use. The lipid profile of *H. illucens* larvae fed with papaya and tomato showed a slight increase in the content of α -linoleic acid (ALA, 18:3n3). This FA is the precursor of docosahexaenoic acid (DHA, 22:6n3), which plays an important role as a component of structural lipids in cell membranes as well as in the synthesis of eicosanoids, protecting and resolving. Also, it was evaluated the TAG profile of *Z. morio* larvae due to their highest oil content. The results showed a high oleic acid (OA, 18:1n9) content, which displays modulatory effects in a wide range of physiological functions, having anti-inflammatory and anti-atherogenic properties. In conclusion, this study clearly shows that *Z. morio* and *H. illucens* larvae constitute an alternative source of OA- and ALA-rich oils, respectively, which can be devoted for food use, as well as for using in the food and pharmaceutical industries, with agronomic implications. Finally, although the profile of *Z. morio* was not improved with fruit feeding, this kind of feeding could be used due to its low environmental impact.

Keywords : fatty acids, fruit byproducts, *Hermetia illucens*, *Zophoba morio*, *Tenebrio molitor*, insect rearing

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