Influence of larval density on estimated digestibility of a standard diet in black soldier fly (Hermetia illucens)

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Can we ensure a humane death for black soldier fly larvae used in food and feed?

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The International Platform of Insects for Food and Feed (IPIFF) states that 'We are committed to promoting good welfare practices in husbandry, transport and at the point of death, caring for insects' well-being.' Good welfare at the point of death means a death that is free from pain or suffering, which can be achieved by killing the animal instantly. Blanching is often cited as a method to kill black soldier fly larvae (BSFL) instantly, and yet it appears that there is no empirical data to support this. This study piloted methodology to answer the question: what is the lowest temperature of water needed to cause instantaneous death in black soldier fly larvae. Instantaneous was defined as within one second, and death was defined as lack of response to mechanical stimulation and loss of turgidity. Results indicated that the proxy measures used to determine death need further refinement, in part through a clearer understanding as to whether post-mortem reflex activity can occur in BSFL. Through presenting this pilot work we wish to stimulate discussion and collaboration on the important topic of humane killing of insects used in food and feed, so that insect farming companies can meet the growing societal expectation that insects, as living creatures, are treated with care and respect.

Influence of larval density on estimated digestibility of a standard diet in black soldier fly (*Hermetia illucens*)

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Black soldier fly larvae (BSFL) efficiency at converting organic by-products into insect biomass suitable for livestock nutrition depends on the nature and macronutrient profile of their feed. Digestibility is a key parameter to the development of a diet formulation approach, but methods to assess digestibility in most insects are unsuitable for BSFL as ingesta is not measurable and pure faeces can not be obtained and analysed. This work defined estimated digestibility (ED) as the difference between feed and frass nutrient weight, divided by the weight of nutrient in feed, and explored its variation with larval density. ED of dry matter (DM), starch, nitrogen, ether extract (EE), neutral detergent fibre (NDF), acid detergent fibre (ADF), acid detergent lignin (ADL), ash and energy were evaluated using the same amount of chicken feed, same feeding time and densities from 0 to 29 larvae/cm^2. ED of DM, starch, nitrogen, EE and energy increased with larval density following an asymptotic trend. ED of ash also increased between 0 and 11.4 larvae/cm^2, but decreased for higher densities. For NDF, ADF and ADL, no clear results were obtained presumably because the fibre dosing procedure used was not specific enough and also accounted for chitin in the frass. ED of all nutrients but fibre fractions were modelled using a logistic equation. This method was able to propose asymptotic ED values for some major nutrients. This new indicator corresponds to the maximal fraction of each nutrient that BSFL can digest and shows potential for the development of a BSFL diet formulation approach based on digestible fractions rather than crude nutrient content. Future studies should compare asymptotic ED of various substrates to provide insight on BSFL ability to digest different ingredients.