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Nutrient digestibility of diets containing five different insect meals in gilthead sea bream and European sea bass

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Given the growing interest in the use of insect meals in aquafeeds, it is advisable to evaluate their nutritional value for the farmed species by assessment of digestibility and efficient utilisation ability. The study aims to evaluate and compare the nutrient, amino acid and energy apparent digestibility coefficients (ADC) of diets which included 19.5% insect larvae meals from *Tenebrio molitor* (TM), *Hermetia illucens* (HI), *Musca domestica* (MD), *Zophobas morio* (ZM) or *Alphitobius diaperinus* (AD) in European sea bass (*Dicentrarchus labrax*) and gilthead sea bream (*Sparus aurata*). A diet in which fish meal (65%) was the only protein source was used as control (FM). Similar or slightly better digestibility was observed in diets TM and MD for European sea bass due to higher adjusted protein ADC, while the other nutrient ADCs were similar to the FM diet. Diets HI and AD exhibited worse overall digestibility compared to FM, with similar or lower ADCs. The ZM diet displayed moderate results with lower dry matter ADC compared to FM but higher protein ADC. Nonetheless, the differences in ADCs between the six diets were minute. Regarding gilthead sea bream, no differences were observed in the nutrient and energy ADCs, except for TM which had the lowest fat ADC. All amino acids were highly digestible in both fish species. Additionally, the digestibility of the sum of amino acids was not affected by the inclusion of different insect meals. In conclusion, our results show that, regarding nutrient digestibility, diets containing 19.5% of these insect meals are suitable for both fish species. This study was funded by European Union and Greek national funds through the National Strategic Reference Framework 2014-2020, Special Actions Aquaculture-Industrial Materials-Open innovation in culture (code: MIS 5045857, acronym: Entomo4fish).

Transfer of aflatoxins and heavy metals to egg and meat of laying hens fed fly larvae reared on contaminated substrate

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The use of low-grade substrates can improve the sustainability of insect-based feed ingredients but also poses food safety risks. These include mycotoxins and heavy metals present in substrates and insect-based feed, thereby being transferred to recipient animals and further into the food chain. We studied the transfer of selected contaminants to black soldier fly larvae (BSFL) and poultry-derived food. Four poultry diets were formulated from 4 partially defatted meals produced at 2 different facilities. In Indonesia, BSFL were reared on food waste containing animal by-products spiked with environmentally relevant concentrations of Cd (1.9 mg/kg), Pb (19 mg/kg) and aflatoxin B1 (1.5 mg/kg), next to a non-contaminated control. As an additional control, in Switzerland, BSFL were reared on substrates approved in the EU. Defatted BSFL were included at 200 g/kg diet for late-laying hens (n=9/treatment), and fed for 4 weeks. Only the diet including BSFL reared on Cd contaminated substrate exceeded the EU maximum level for Cd for complete feed (1.7 mg/kg vs 0.5 mg/kg). No diet affected laying performance or egg quality. Feeding heavy metal contaminated BSFL-based diet doubled Cd concentrations in breast meat and elevated Cd concentrations in kidneys and liver compared to the control. However, all respective poultry products and tissues (except kidneys) ranged below permitted limits for food. Our results show that, under certain conditions, even contaminated food can provide a suitable substrate to produce BSFL for use as feeds for poultry nutrition.

Insect production systems/genetics, nutrition, physiology, health & ethics

Influence of strain genetics on larval performance and bioconversion efficiency for *Hermetia illucens*

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Due to increasing welfare and population, demands for more sustainable protein sources are rising in today's society. Insects are considered such an alternative as they have short life cycles, high feed conversion and can be grown on low-value feedstocks. Particularly the black soldier fly *H. illucens* is able to convert low-value organic side streams into high-value biomass composed of proteins, lipids and chitin. Therefore, *H. illucens* larvae can be used for waste reduction paired with the production of high-value biomass, bringing more circularity in our food- and agricultural industry. Although the black soldier fly has been subject of extensive research and suggested as the crown jewel of an emerging insect-livestock sector, characterisations of its genetic resources, crucial for future breeding progress, have been neglected so far. Recent studies using wild and captive strains demonstrate that there is remarkable genetic variation across origins, including signatures of domestication. However, it still remains to be elucidated how genetic differentiation may translate into distinct phenotypic traits, such as economically interesting larval performance and bioconversion. In this study 10 captive *H. illucens* strains were obtained and reared using a standardised protocol. The strains were genotyped based on the 15 microsatellite markers developed by Kaya *et al*. Subsequently, larvae were reared on 3 different diets and larval performance and conversion efficiency was calculated. This allowed to investigate the influence and potential interactions of genotype and diet on these economically interesting traits.