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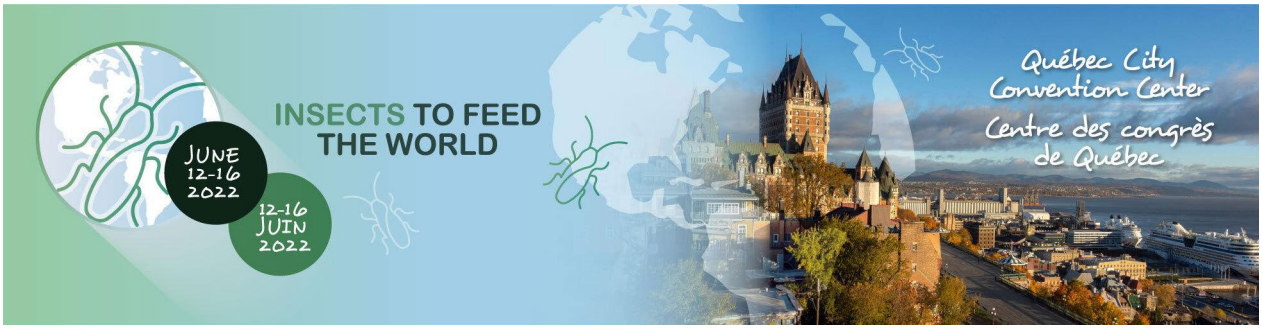


# Insects to Feed the World 2022

June 12 – 16, 2022

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# Foreword

'Insects to Feed the World' was born from a United Nations Food and Agriculture Organization (FAO) initiative. The conference was first organized in the Netherlands, through the collaboration of the Wageningen University and Research Centre (WUR) and the FAO. The conference was also held in Wuhan, China in 2018, and was organized as a virtual event from Quebec, Canada in 2020.

The 4th edition of 'Insects to Feed the World' from the 12th to the 16th of June 2022 in Quebec City (https://ifw2022.org/en) has continued its mission to facilitate the dialogue and the exchange of research results on the use of insects in the context of food and feed security, toward building evidence-based legislation, advancing communal knowledge, and promoting innovation for the sector. The conference gathered academics and experts from around the world to exchange on the latest advancements in the field of edible insects and entotechnologies.

IFW2022 was a unique opportunity to propel edible insects as an integral part in the future of sustainable agriculture and food systems. A part from a diversified scientific program, several panels were held to establish first contact and identify opportunities between academics and the industry (*Speed Networking activity*); to discuss about the wide range of applications of insect product commercialization for insect farmers (*Frass to Feed the World*); how to support insect farmers with critical equipment, software, and engineering support to scale up insect production and maximize output (*Scaling up insect production with key technologies*) and how to tackle both insect and worker health in insect farms (*Health & biosecurity workshop*). The second 'Global Roundtable for Insect Agriculture' initiated in Wuhan in 2018 allowed the international industry associations to continue their discussions on common issues.

The conference also sought to provide training on how getting started in insect rearing on a small to medium scale (*Training workshop*); to showcase the activities of the local industry (*Technical visit at Montréal*) and reach a wider audience in organizing 'Eating Insect North' at Le Grand Marché de Québec, a public event exhibiting local producers and transformers in edible insects across multiple kiosks, learn through conferences for the general public and view culinary demonstrations (https://ifw2020.org/en/program/eating-insects-north).

Finally, the conference has sought to begin initiatives to harmonize fundamental research procedures that will assist the sector to evolve in a more coordinated manner and contribute to coherent development of related policies and regulations (*OECD Workshop to establish standard methodologies for R&D*); to create in the following years new course training, transfer technology activities and research at an agronomic level (*Launch of the Chaire de Leadership en Enseignement en production et transformation primaire d'Insectes Comestibles* (CLEIC) at Université Laval' (https://cleic.fsaa.ulaval.ca) as well as to establish the foundation for the establishment of a new interdisciplinary scientific society that draws together members from diverse scientific backgrounds under the unified discipline of insects as food and feed.

The pooling of academic knowledge, in partnership with industry, will be a guarantee to maintain the impressive advancements required to anchor edible insects as the food and feed of the future. See you soon at IFW2024!

Marie-Hélène Deschamps and Grant Vandenberg

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

**M. Mastoraki[1,2], N. Panteli[2], Y.P. Kotzamanis[3], L. Gasco[4], S. Chatzifotis[1] and E. Antonopoulou[2]**
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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

**M. Heuel[1], M. Kreuzer[1], I.D.M. Gangnat[1], E. Frossard[1], C. Zurbrügg[2], J. Egger[2], B. Dortmans[2], M. Gold[2,3], A. Mathys[3], J. Jaster-Keller[4], S. Weigel[4], C. Sandrock[5] and M. Terranova[1,6]**
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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.