Journal of Insects as Food and Feed

ISSN 2352-4588

2022 – VOLUME 8 – SUPPLEMENT 1

Significant heritability of larval lipid storage in the housefly and its implication for breeding programs

F. Boatta[1], J.A.H. Smit[1], M.A.W.M. Lautenschutz[1], E.D. Ellen[2] and J. Ellers[1]
[1]Vrije University Amsterdam, Amsterdam Institute for Life and Environment, De Boelelaan 1085, 1081 HV Amsterdam, the Netherlands, [2]Wageningen University and Research, Animal Breeding and Genomics, Droevendaalsesteeg 1, 6708 PB Wageningen, the Netherlands; f.boatta@vu.nl

Lipids are essential nutrients for many critical insect functions (flight, development, reproduction). These nutrients form a significant fraction of the nutritional profile of insects and the presence of commercially relevant fatty acids make insect larvae a sustainable source of these valuable products. Lipid accumulation takes place during the larval growth. The quantity of lipids can vary among individuals and this trait is highly variable. An excess of energy intake can lead to obese larvae. Still, it is unknown to what degree lipid storage is genetically determined and inherited. Such knowledge is essential to selectively breed favourable phenotypes for commercial purposes. Here we determined the heritability of larval lipid storage in the common housefly (*Musca domestica*). A nested mating design consisting of 47 full-sib families produced 663 larvae which were individually phenotyped for their total fat content. Rearing conditions and adult selection were strictly standardised to reduce environmental variation in lipid content among individuals. Individuals were separated based on their time to reach pupation and their emergence day, and subsequently pooled into randomised groups. Three statistical models were built to estimate the heritability of larval lipid accumulation a linear model (lme4) and two animal models: a Marchov Chain Monte Carlo generalised linear model and one based on restricted maximum likelihood. The two animal models show a moderate heritability for larval lipid storage whereas the linear model estimated a low heritability. Contrarily, heritability estimates for larval dry weight were low independent of the model used. This study provides a first glimpse on the quantitative genetics of a trait of high relevance for the emerging insects as feed and food sector. It also informs on how to set up a tailored breeding program to select strains with improved lipid characteristics.

Agar as a nutrient carrier: a means for targeted delivery of nutrients to mealworms?

C.I. Rumbos[1], C. Adamaki-Sotiraki[1], G.V. Baliota[1], D. Deruytter[2], P. Soulioti[1], I. Karapanagiotidis[3] and C.G. Athanassiou[1]
[1]University of Thessaly, Department of Agriculture, Crop Production and Rural Environment, Lab of Entomology and Agricultural Zoology, Phytokou str., 38446 Volos, Greece, [2]Inagro, Insect Research Centre, Ieperseweg 87, Rumbeke-Beitem, Belgium, [3]University of Thessaly, Department of Ichtyology and Aquatic Environment, Aquaculture Laboratory, Phytokou str., 38446 Volos, Greece; crumbos@uth.gr

Insect diet impacts insect growth, therefore a lot of recent research has focused on the evaluation of alternative insect feeds. In the case of the yellow mealworm, *Tenebrio molitor* L., the diet comprises of both a dry feed and a wet feed. The latter serves mainly as a moisture source, as it has been shown that moisture availability enhances larval development. Agar can efficiently serve as a water source for *T. molitor*. It is also used as the gelling agent of artificial diets for several insect species, serving as the carrier of the diet nutritional components. However, the use of agar as a nutrient carrier for mealworms has not been evaluated yet. Hence, the objective of the study was to evaluate agar for the targeted delivery of nutrients to *T. molitor* larvae. In a first laboratory trial, groups of 50 freshly-hatched larvae were provided with wheat bran and agar (20 g/l; 1×1×1 cm cubes 3 times per week) with different concentrations of brewer's yeast (0, 0.5, 1, 2.5 and 5%) as wet feed. In two additional pilot-scale trials, approximately 10,000 larvae were reared in crates on wheat bran, providing agar with various concentrations of baker's yeast or white sugar (0, 2.5, 5 and 10%). The larval growth and performance was evaluated at weekly intervals. According to the results of the lab trial, the increase of the concentration of brewer's yeast in agar enhanced larval performance in terms of growth rate and larval weight. In contrast, the provision of high sugar agar (10%) negatively affected larval growth and reduced larval weight compared to control. Our study aims to highlight the potential of agar as nutrient carrier for the targeted delivery of nutrients to mealworms. This study was funded by the MIS 5045804 project under the 'Operational Programme Competitiveness, Entrepreneurship and Innovation – EPAnEK 2014-2020', Greece-EU.