Poster 33

Preliminary evaluation of an electronic counting device for rapid and precise counting of black soldier fly larvae

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The mass production of insects for human food and animal feed application is emerging internationally. The production of these insects faces several challenges in the management and automation of production processes. Larval density is a fundamental parameter to control to provide consistency in final weight and production duration. Currently, counting is performed manually or by estimating the number of larvae for a defined weight, which is very labour intensive and can lack precision, as the young larvae are very small and fragile. Our lab is working to apply an existing technology, XpertCount™ currently used to rapidly and efficiently count small aquatic organisms (larval shrimp/fish, zooplankton and phytoplankton) using novel technologies based on optical image capture and analysis. Egg clutches from the Université Laval black soldier fly (BSF) colony were harvested from a 24-h period and suspended over 5 plastic containers containing Gainesville reference diet containing sodium benzoate (0.15% w:w). Incubator conditions were held constant: controlled photoperiod (12L:12D) at 27 ° C and a relative humidity of 80%. Four day old larvae were separated from the growing medium and manually counted. Groups of 1000 larvae where then introduced to the counting chamber to produce images of the larvae under varying conditions. Specific algorithms were developed to analyse larval images, and was optimised over a number of weekly counting sessions. Currently, under optimal conditions, lots of 600, 4 day old BSF larvae can be counted with an accuracy of 98%, within 5 seconds. Development of this technology continues to count significantly more larvae, as well as different stages- from eggs to pupae, as well as develop algorithms to estimate size and mass. This technology offers a strategic tool to optimize production for academic and industrial BSF production.

Poster 34

Total gas and methane emissions of black soldier fly *Hermetia illucens* grown on different organic wastes

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Edible insects have been suggested as an alternative source of protein for animal feeding. The production of insect meals should have a lower environmental impact as compared to other productions such as beef or dairy products. However, few information is available in literature with special regards to Green House gases emissions. An experiment was conducted to quantify emission of gas and methane by larvae of the black soldier fly (BSF) *Hermetia illucens* (Diptera Stratiomyidae) grown on different organic wastes. The experimental substrates were: a standard hen diet (control), okara, maize grain dry distillers and brewers spent grain mixed with trub (derived from brewing process). An *in vitro* method derived by evaluation of feed for ruminants using a semiautomatic pressure system was adapted for this purpose. Twenty BSF larvae were positioned in duplicate into serum bottles and added with the experimental substrates (diets) *ad libitum*. For each sample two blanks (i.e. substrates without larvae) were added. Headspace pressure was recorded after 24 hours of incubation using a digital manometer (model 840082, Sper Scientific, Scottsdale, AZ, USA). The gas pressure data were converted to moles of gas using the ideal gas law. A fixed-volume sample of gas was also collected for subsequent methane analysis using gas-tight syringes fitted with needles through the bottle top. The gas composition of the headspace was determined by micro GC gas chromatograph (Agilent Technologies, Santa Clara, CA, USA). An external standard mixture of CO_2 and CH_4 was used for instrument calibration. For all substrates, no detectable traces of methane were determined in the analysed air samples. There were differences on total gas (ml of Gas/g of incubated dry matter) produced by BSF larvae incubated with the different substrates and corrected for the blank gas production. Particularly, total gas productions were higher for larvae incubated with hen diet and brewers mixed with trub, intermediate for okara and lower for larvae incubated with distiller grains. The method proposed seems promising to estimate gas and CH_4 productions of BSF larvae in a simply and fast way. The differences in gas production between BSF larvae fed with the different substrates could be useful to better define the optimal diets for this species.