Optimization of houseflies' larvae production on pig wastes and brewers' grains for integrated fish and pig farms in the tropics

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Introduction

In the tropics, stored wet agricultural and agro-industrial by-products as well as on-farm wastes such as manure are prone to spilling due to the quick proliferation of maggots. However, on farms integrating pig production to fish farming, this issue can be turned into an opportunity. If the direct use of pig wastes into fish culture systems may be unacceptable or inferior to the use of more valuable inputs (Nuov *et al*, 1995), controlled production of fly larvae by farmers on these substrates could be an opportunity to provide an important additional source of high quality protein and to intensify fish production. Since maggot flour has an amino acid profile comparable to that of fish meal (Téguia *et al.,*2002), improved on-farm production methods could be a viable alternative that would drastically reduce the cost of fish feed in areas where access to commercial food and protein sources is not easy (Charlton *et al*., 2015) such as periurban farms around Kinshasa (Mafwila *et al.*, 2017).

Material and methods

Two experiments investigating complementary aspects of larvae production and growth of domestic houseflies (*Musca domestica*) were carried out on a farm integrating vegetable production to pig and fish farming in ponds in the Funa valley of Kinshasa (D.R.Congo). The first experiment compared the cumulated level of larvae production on different substrates over 6 d: brewers' grains (BG), pig manure (M), an equiproportional mixture of BG and M (BG-M), BG with 1% Lysine (BG-LYS), an equiproportional mixture of BG and cow blood (BG-B) and an equiproportional mixture of BG, M and B (BG-M-B). The second compared the production of larvae on BG-M and BG-M-B with two exposure methods to the flies: 18 d of permanent exposure (PERM) and 2 d of temporary exposure followed by 16 d of growth with no flies access (TEMP). For both experiments, all substrates were run in quadruplicate. The substrates were placed in plastic baskets, covered in the bottom with a mosquito mesh screen through which the larvae migrated to a plastic bin placed below for collection and quantification. During both experiments, natural laying of eggs by flies on the farm was used. Multiple parameters were measured: ambient and substrates temperature, weight and number of larvae, dry matter (DM) content of the substrates, evolution of the substrate thickness and chemical composition of the larvae.

Results and discussion

Experiment 1 showed that mixing brewers' grains with Lysine or manure and/or blood more than doubled the amount of larvae that were harvested on the substrates (Figure 1). Brewers' grains are good source of energy but are probably deficient in several amino acids to support the growth of maggots (Mussatto et al., 2006)

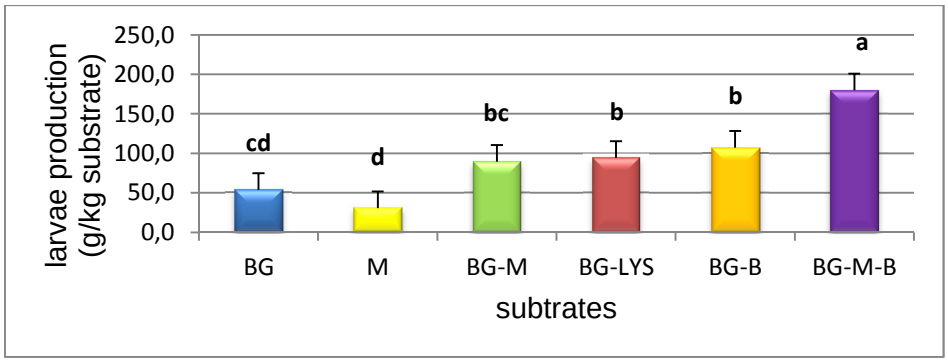

Figure 1: production of maggot per kg of substrate after 6 day of exposure to the flies

The peak of larvae production was reached after 6 days in Experiment 2. Apparently, only the first days of laying eggs are important since no difference (P value = 0.515) was observed between TEMP and PERM exposure modalities (Figure 2).

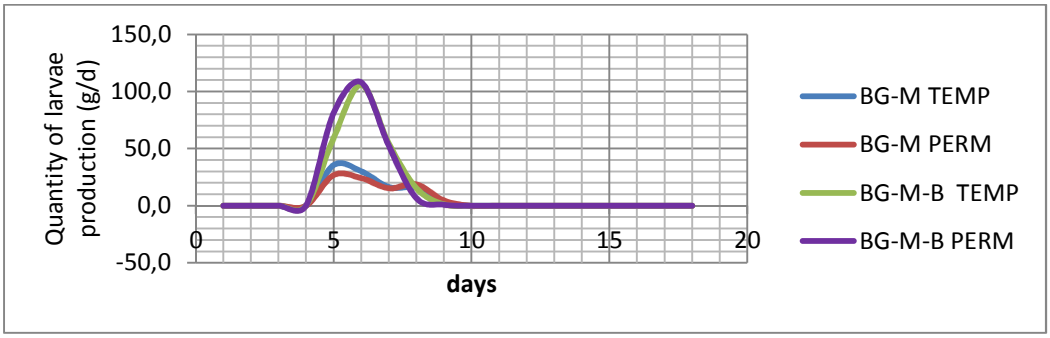

Figure 2. Evolution of the production per kg of substrate as a function of time with two contrasting exposures to the flies

Although not all the substrate was consumed by the larvae, the ratio between substrate disappearance and larvae production, both expressed in DM varied from 1.5 to 2.1. The lowest value was reached in the presence of cow blood confirming the importance of an adequate supply in amino acids. Further research must investigate the nutritive value for pond fishes as well as the global economic balance of the whole operation.

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