Potential of insects fed on organic wastes as a new fish feed source

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Introduction

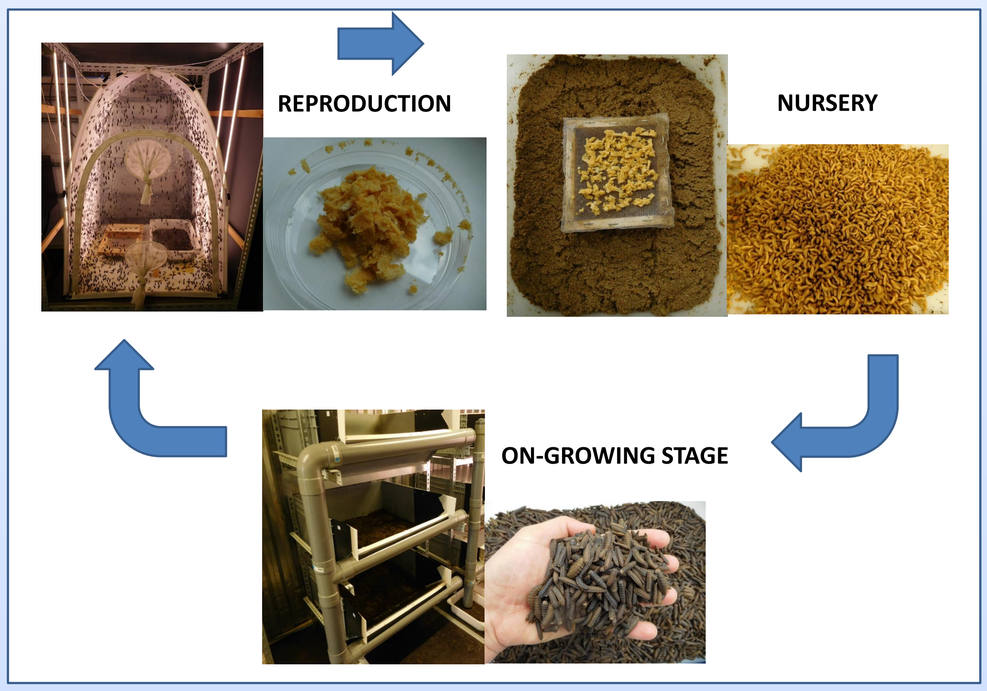
Global demand for fish still grows while fisheries harvests are stagnating. The development of aquaculture answers to this demand but requires the availability of fish food in quantity and quality. Insects are an alternative source of protein and fat with a very interesting nutritional profile that could partially fill the fish's food requirements. In addition, the insect farming has a small ecological footprint and allows the local bioconversion of many organic materials with few or no value.

Objectives

- ✓ Establishment and optimization of a black soldier fly rearing « *Hermetia illucens* ».
- ✓ Selection and valorization of co-products from Walloon agriculture and the agro-industry as insect feed.
- ✓ Formulation and testing of *Hermetia* prepupe feed on rainbow trout« *Oncorhynkus mykiss* ».

Methods

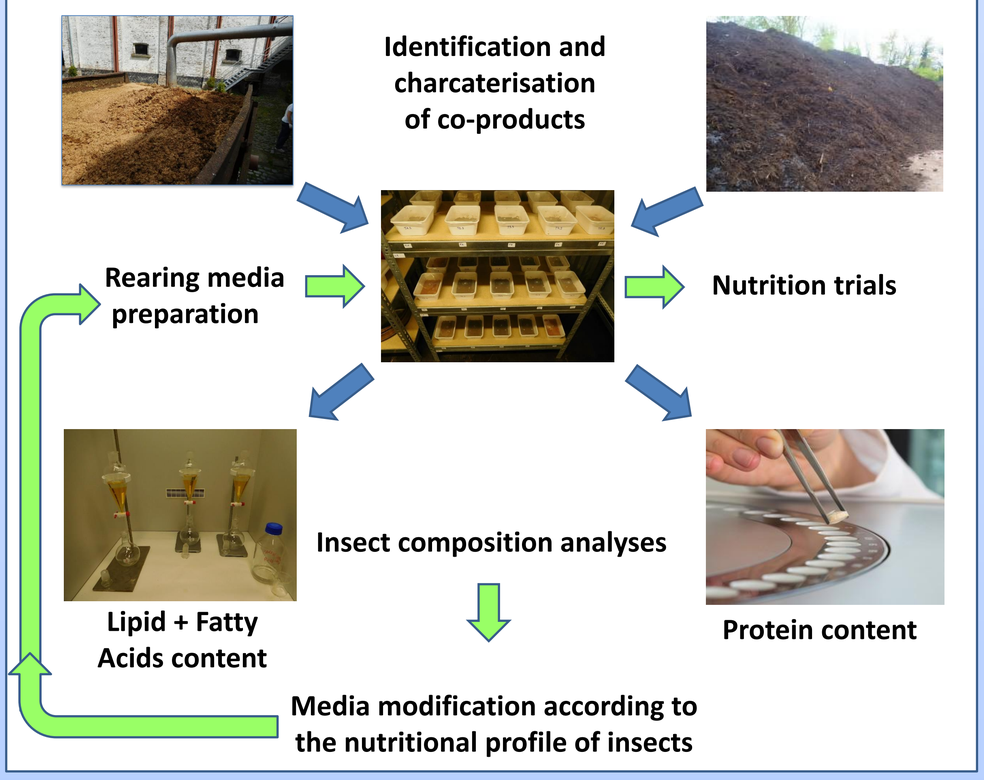
FIGURE 1 : EXPERIMENTAL REARING



Sizing of the facilities – Improvement of methods

➡ **Zootechnical itineraries**

FIGURE 2 : FEEDING INSECTS WITH CO-PRODUCTS



➡ **Diets formulation**

FIGURE 3 : FEEDING FISH WITH INSECTS

Addition of insect according to the nutritional needs of fish – Partial substitution of fish meal by insect

➡ **Formulation and manufacture of insect-based pellets**

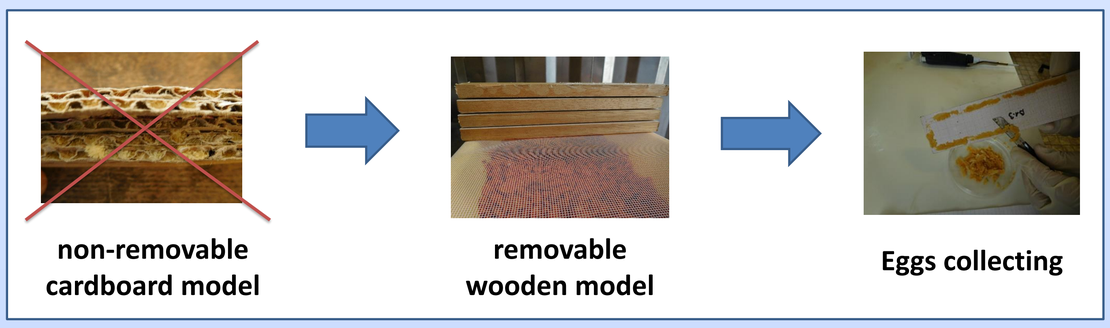
Preliminary results

Rearing optimization

Hermetia rearing is successfully conducted using **only co-products of plant origin** (spent grain, hop, vegetable waste, …).

Mating and oviposition are efficient in a **controlled environment under artificial light**.

Figure 4 : A nesting model with removable spawning support (wooden board) allows the **collection and quantification of eggs** which are then incubated over a specific diet.



A slope within the growing tanks followed by a pipe circuit allows **self-collection of mature larvae = "prepupa"**

Nutrition Test

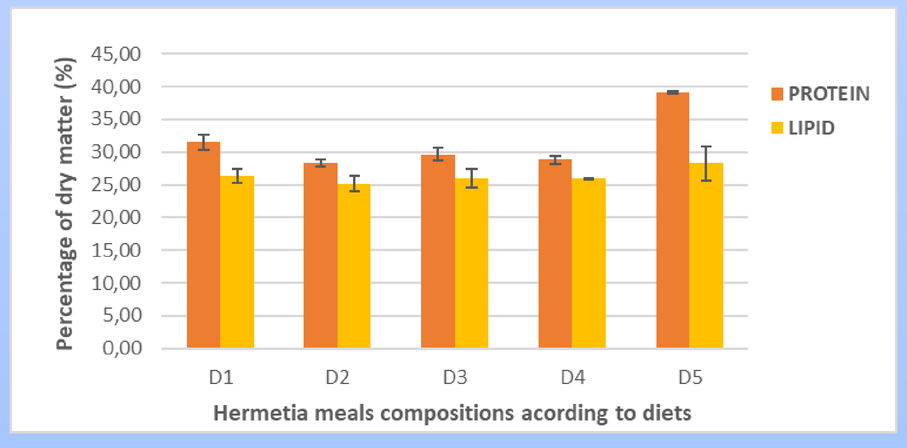
4 isoproteic (25%) and isolipidic (9%) diets (D1-2-3-4) formulated from “brewing waste and cakes” and 1 control “vegetable” (D5) (9% protein – 2% lipids).

Table 1 : Grow period and Prepupa weight

Parameters	D1	D2	D3	D4	D5
Grow period (week)	4	4	4	4	5
Prepupa weight (g)	0,178 ± 0,032	0,191 ± 0,030	0,210 ± 0,055	0,204 ± 0,037	0,148 ± 0,032

One week extention for the control diet growth

Table 2 : Lipid and protein contents of *Hermetia* meals



Hermetia meal obtained with the control diet contains the most protein.
Fatty acid profiles of meals will be analyzed and compared to the nutritional needs of the fish.

Conclusions

- ➢ Diets high in protein and fat show the fastest growth, the highest average weights but unfortunately the slowest protein composition.
- ➢ Indeed *Hermetia* is saprophagous and the availability of nutrients is largely related to commensal and symbiotic metabolisms of microorganisms in its rearing medium.
- ➢ Diets must therefore be formulated according to the nutritional value of the ingredients but also their potential for decomposition and transformation by the microorganisms of the rearing medium.
- ➢ The growths achieved with different co-products suggest that this insect rearing could be conduted by recycling a wide range of organic waste, ensuring more environmentaly sustainable animal production.