

# AgrEcoMed



FOSTERING AGROECOLOGICAL TRANSITION

*“New AGRoecological approach for soil fertility and biodiversity restoration to improve ECONomic and social resilience of MEDiterranean farming systems”*

## Deliverable D3.3 Formulations of larval frass



This project is part of the PRIMA Programme supported by the European Union, having received funding from it under grant agreement PRIMA21\_00018



## Document information

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Contact	Patrizia.falabella@unibas.it

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## 1) ACTIVITY

During the first year, trials on bioconversion mediated by *Hermetia illucens* larval stage were performed. Firstly, the bioconversion parameter of larvae reared on a standard diet composed of 50% of wheat bran, 30% of alfa alfa, 20% of mais were evaluated. This diet is properly optimized for the breeding of black soldier fly; indeed, it is a feeding substrate with balanced nutritional value such as 13.60% of protein, 3.5% of lipids, 13.90% of fiber, 6% of minerals and 12.50% of humidity. Starting from a laboratory scale experiment, at the beginning of the trial, we provided 0.14 g of dry matter/larvae for 150 larvae. The moisture was added using tap water to reach the 70% of substrate moisture that is the optimal level of moisture for larvae, to enhance the bioconversion performances. Trials were performed in triplicate, and we evaluated the total weight of larval biomass, individual weight of larva, survival rate, total weight of larval frass, waste reduction index, substrate reduction, efficiency of converted food, and development time. The latter was established when the first prepupae was recorded.

## RESULTS

Total weight of larval biomass: 25.27 g  $\pm$  2.52 g

Individual weight of larva: 0.173 g  $\pm$  0.014 g

Survival rate: 97.3%  $\pm$  1.54%

Total weight of frass: 34.5 g  $\pm$  1.01 g

Waste reduction index (%): 5.99%  $\pm$  0.15%

Substrate reduction (%): 53.95%  $\pm$  1.35%

Efficiency of converted food: 0.62  $\pm$  0.08

Development time: 9 days

## 2) ACTIVITY

These results obtained from the trials performed at laboratory scale have been used to scale the process in a semi-industrial scale. Starting from these considerations, we fed almost 13'000 (0.5 grams of eggs) with 0.14 g of dry matter/larvae. The moisture was added using tap water to reach the 70% of substrate moisture that is the optimal level of moisture for larvae, to enhance the bioconversion performances. Trials were performed in triplicate, and we evaluated the total weight of larval biomass, individual weight of larva, survival rate, total weight of larval frass, waste reduction index, substrate reduction, efficiency of converted food, and development time. The latter was established when the first prepupae was recorded. The scaling up is necessary to obtain the amount of frass needed to perform the fertilization experiments, as reported by the project.

## RESULTS

Total weight of larval biomass: 2066 g  $\pm$  57.73 g

Individual weight of larva: 0.162 g  $\pm$  0.014 g

Survival rate: 96%  $\pm$  1.37%

Total weight of frass: 2233 g  $\pm$  76.37 g

Waste reduction index (%): 7.8%  $\pm$  0.11%

Substrate reduction (%): 70.22%  $\pm$  1.02%



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Efficiency of converted food:  $0.39 \pm 0.01$

Development time: 9 days

### 3) ACTIVITY

After the bioconversion process, at the end of feeding period of larvae, we performed analysis on the formulation of larval frass. Chemical and microbiological composition of frass were evaluated (Tables 1-2).

## RESULTS

CHEMICAL ANALYSIS	
DRY MATTER	61.8%
MOISTURE	38.2%
pH	7.70
TOTAL NITROGEN (% P/P)	0.5
ORGANIC CARBON (% P/P)	2.82
C/N RATIO	5.64
LIPIDS (% P/P)	2.4
FIBER (% P/P)	14.5
ASH (% P/P)	3.9
CALCIUM (g/Kg)	1.54
POTASSIUM (g/Kg)	10.96
PHOSPHORUS (g/Kg)	5.38
MAGNESIUM (g/Kg)	3.04
SODIUM (g/Kg)	0.47

**Table 1: chemical physical analysis of frass of *Hermetia illucens* reared on standard diet.**

MICROBIOLOGICAL ANALYSIS	
Count microorganisms at 30°C (UFC/g)	>300000
Salmonella SPP (IN 25 g)	ABSENT
Enterobacteriaceae (UFC/g)	>150000

**Table 2: microbiological analysis of frass of *Hermetia illucens* reared on standard diet.**

### FUTURE ACTIVITIES

Once officinal plants will be available and will be provided by other partners, bioconversion trials on small and semi-industrial scale will be performed and the corresponding frass will be used for agronomical tests.

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