



*“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

Project acronym: AgrEcoMed

Project title: New AGROecological approach for soil fertility and biodiversity restoration to improve ECONomic and social resilience of MEDiterranean farming systems

Project ID: 1712

Grant Agreement: PRIMA21\_00018

Start date of the project: 23/05/2022

Project duration: 36 months

Funding source: Partnership for Research and Innovation in the Mediterranean Area (PRIMA)

Call: Multi-topics 2021

Thematic Area: 2-Farming systems

Type of action: Research and Innovation Action (RIA)

Funding cycle: 2021

Project main website: <https://agrecomed.crea.gov.it/>

PRIMA website: <https://mel.cgiar.org/projects/1712>

Lead Organisation: University of Basilicata (UNIBAS)

Deliverable number	<b>D3.3</b>
Deliverable title	Formulations of larval frass
Work package title	WP3
Lead WP/Deliverable beneficiary:	P2 UNIBA
Author/s	Patrizia Falabella
Contributors	-
Due date of deliverable	20/06/2023
Actual submission date	26/05/2023
Status	F
Contact	Patrizia.falabella@unibas.it

Type of Deliverable	R-> Document, report (excluding the periodic and final reports)	<input checked="" type="checkbox"/>
	DEM -> Demonstrator, pilot, prototype, plan designs;	<input type="checkbox"/>
	DEC->Websites, patents filing, press & media actions, videos, etc.;	<input type="checkbox"/>
	OTHER-> Software, technical diagram, etc.	<input type="checkbox"/>

Dissemination Level	PU: Public, fully open	<input checked="" type="checkbox"/>
	CO: Confidential, restricted under conditions set out in Model Grant Agreement;	<input type="checkbox"/>
	CL: Classified, information as referred to in Commission Decision 2001/844/EC	<input type="checkbox"/>

## Revision history and quality check

Version	Date (DD/MM/YYYY)	Created/Amended by	Changes
1	26/05/2023	Prof. Patrizia Falabella	



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



## **Disclaimer**

The information, documentation, and figures available in this deliverable are written by the AgrEcoMed Consortium partners under PRIMA financing (Call: Multi-Topic 2021, Project ID: PRIMA21\_00018) and do not necessarily reflect the view of the European Commission.

The information in this document is provided “as is”, and no guarantee or warranty is given that the information is fit for any particular purpose. The reader uses the information at his/her sole risk and liability. This deliverable may be subject to final acceptance by the European Commission.

## **Statement for open documents & Copyrights**

This document is the property of the AgrEcoMed Consortium. The content of all or parts of these documents can be used and distributed provided that the AgrEcoMed project and the document are properly referenced. To the best of our knowledge, all third-party literary (articles/studies/reports/etc. or excerpts thereof) or artistic (photos/graphs/drawings/etc.) used to support this document are correctly cited and acknowledged.



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



## 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%



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



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.

### Acknowledgments

AgrEcoMed project (grant Number PRIMA21\_00018) is funded by PRIMA (Partnership for Research and Innovation in the Mediterranean Area), supported by the European Union.



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



