UNIVERSITÀ DEGLI STUDI
DI MILANO

Survival rate, development time and nutritional features of insect according to rearing substrates

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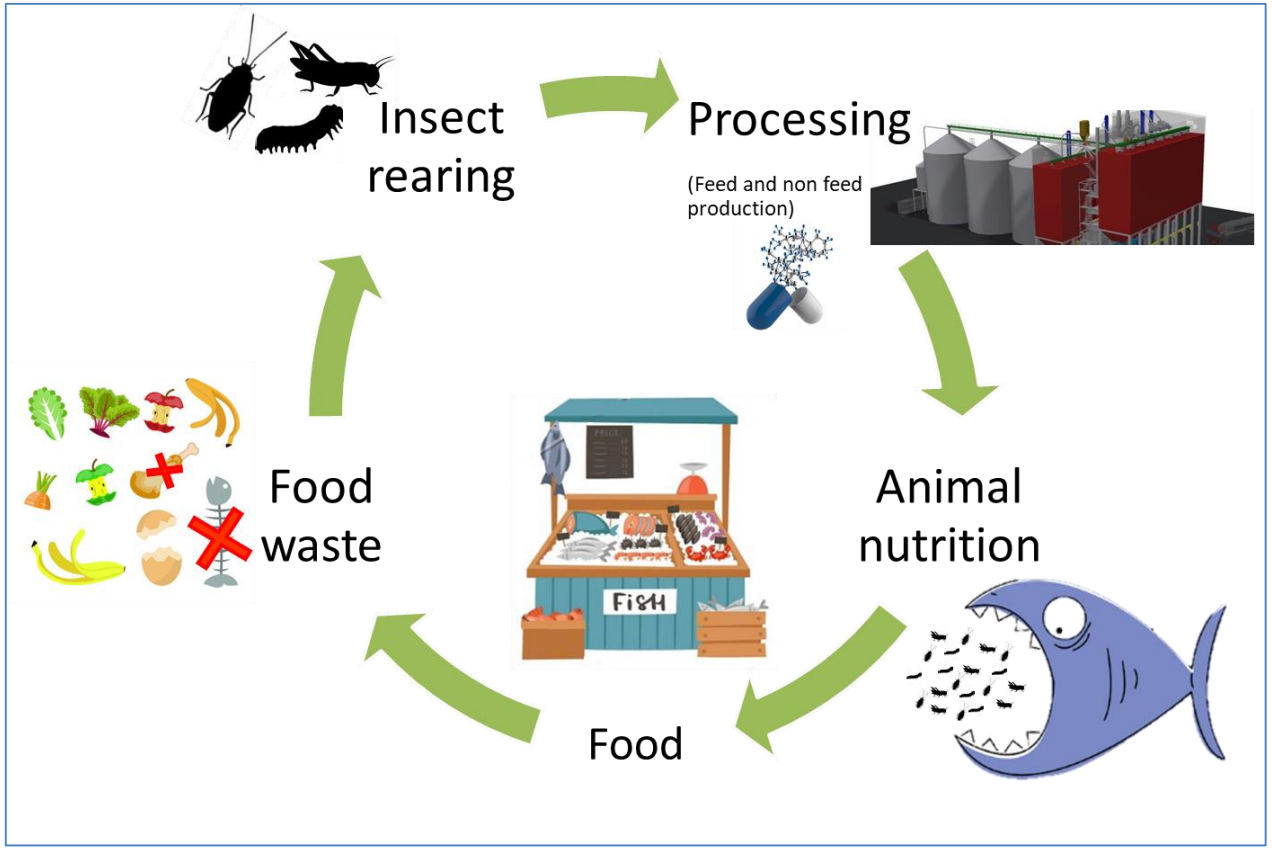
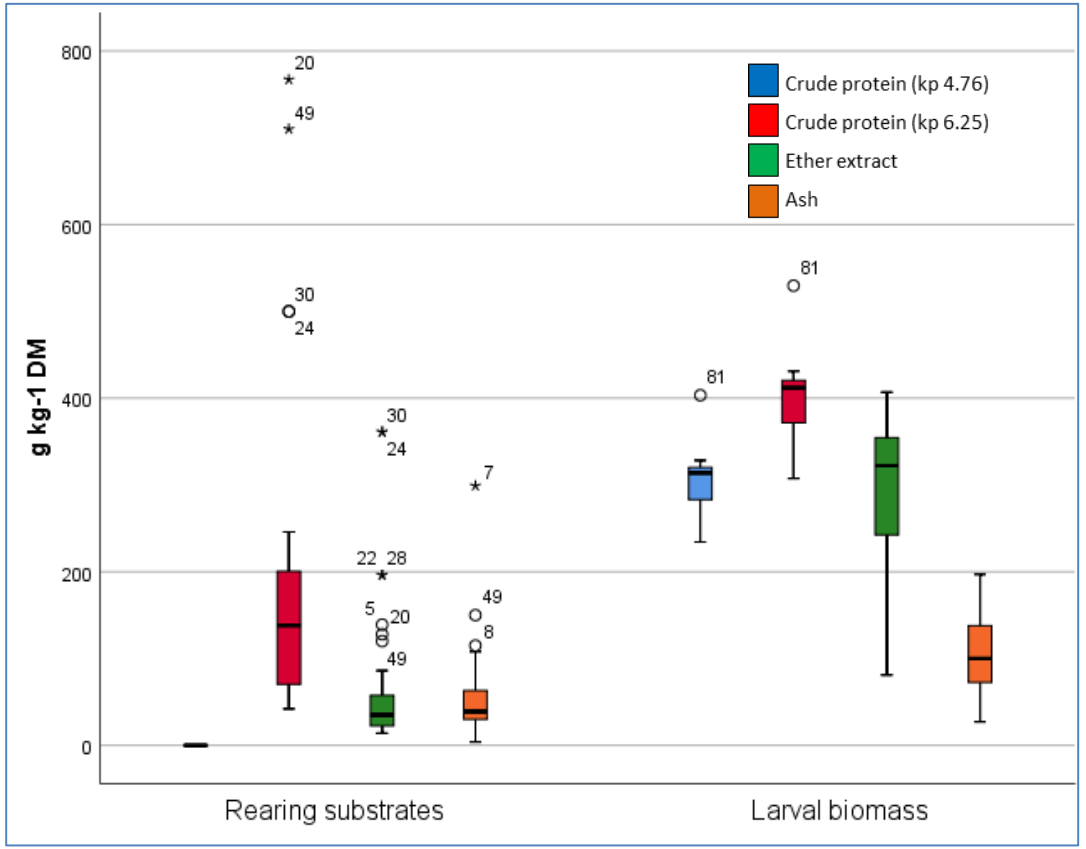
BSF potential





from Pinotti et al., 2019

Substrates proposed and growing condition

Substrates

- Feedstuffs, food by-products, manure, seaweeds

Growing condition

- Lab scale Vs field conditions
- Density
- Management/experimental plan

Objective

Collect, synthesize, discuss and review the available information on the substrates used for rearing BSF larvae in literature

MATERIALS AND METHODS_data sources

Literature search

performed using “Black *and* soldier *and* fly” OR “Hermetia *and* illucens” as the key words by using the **online journal databases** Web of Science (ISI, UK), and SCOPUS (Elsevier B.V)

Extra paper inclusion, were found by cross-referencing citations in retrieved articles.

Study inclusion requirements:

A. **Substrate used**;
B. **at least one of the studied variables** was reported, i.e Development time, survival rate, larvae density, food larva day, larval weigh, biomass yield, chitin content, chitin corr. protein, larvae CP, larvae EE, larvae Ash, moisture sub., CP sub., EE sub., Ash sub., IDF/NDF sub., NFC sub., FG sub., Energy sub. b) no confounding treatments were present

MATERIALS AND METHODS_data extraction

Dataset creation:

- Reference
- Substrate used

INSECT DATA NORMALIZATION

- Growing performance, nutrient content of larvae and substrate
- Mean value of each outcome (starting from 100 young larvae 4-6 day)

Data for all the analyses measured in each study, were extracted and entered into a spreadsheet.

MATERIALS AND METHODS_data treatment

Correlation studies

- performed by Pearson's or Spearman's correlation method to study the association between
  - Survival rate
  - Development time
  - Insect: nutritional composition, and biomass yield
  - Substrate: composition

Statistical software

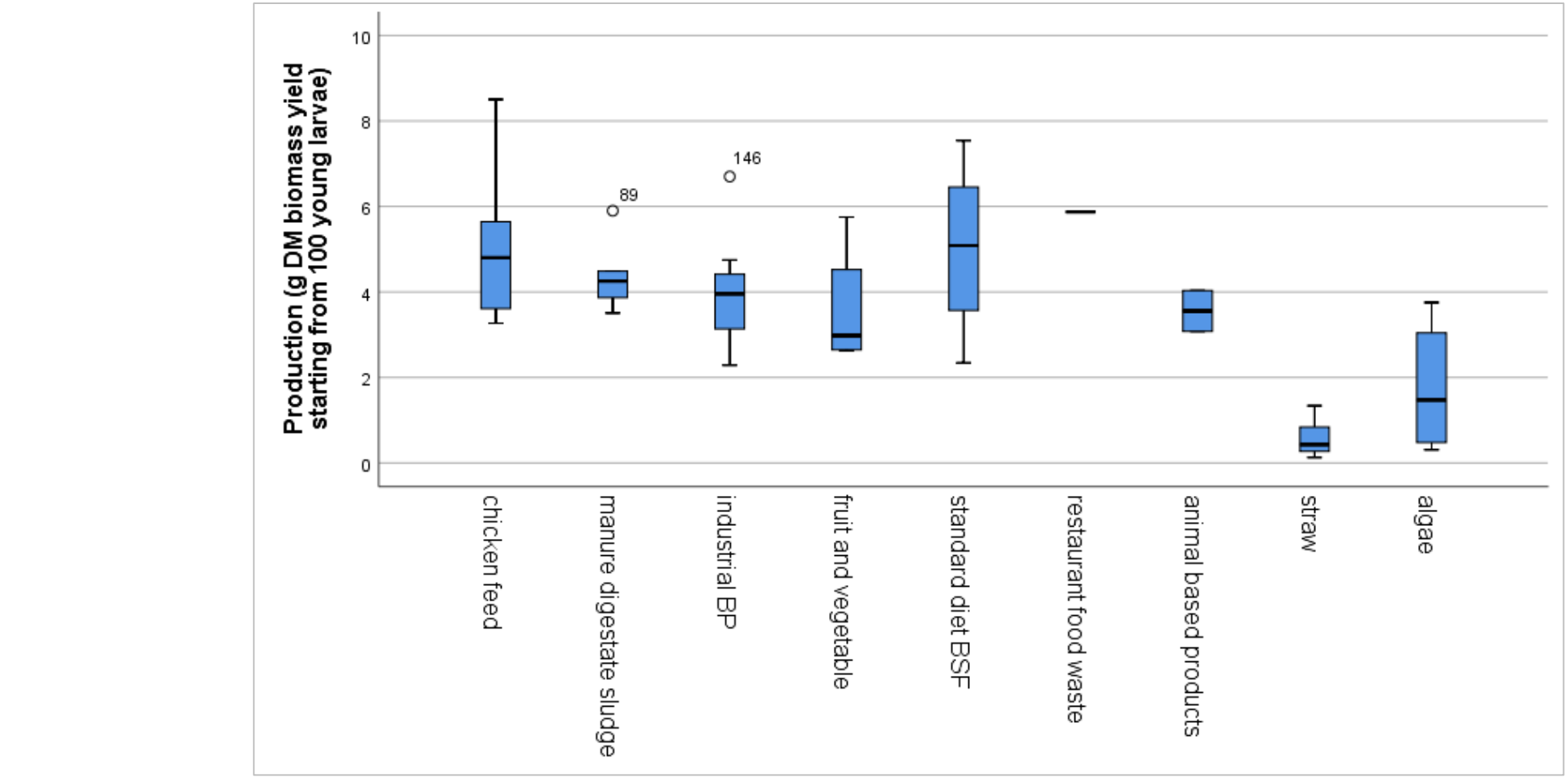
- IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.

Results_Studies included

Study	Substrate used																
	Brewery by-products	Winery by-products	Fruit waste	Fruit and vegetable waste	Restaurant waste	Digestate	Chicken feed	Manure	straw	fish	liver	bran	standard	sludge	Dog food	algae	cocco-soy
Meneguz et al. 2018	x	x	x	x													
Spranghers et al. 2017				x	x	x	x										
Li et al. 2011								x									
Manurung et al. 2016									x								
Myers et al. 2008								x									
Nguyen et al. 2015				x	x		x	x		x	x						
Nguyen et al. 2013				x	x		x	x		x	x						
Diener et al 2009							x										
Ma et al. 2018							x					x					
Oonincx et al 2015													x				
Bruno et al. 2019				x						x			x				
Lalander et al. 2019				x	x		x							x	x		
Barragan-Fonseca 2018													x				
Lim et al. 2019																	x
Liland et al. 2017																x	
Biancarossa et al. 2017																x	

Overall **80 experimental** group

BSF efficiency with different substrate



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Results_ insect biomass yield

Based on normalized data (100 larvae)

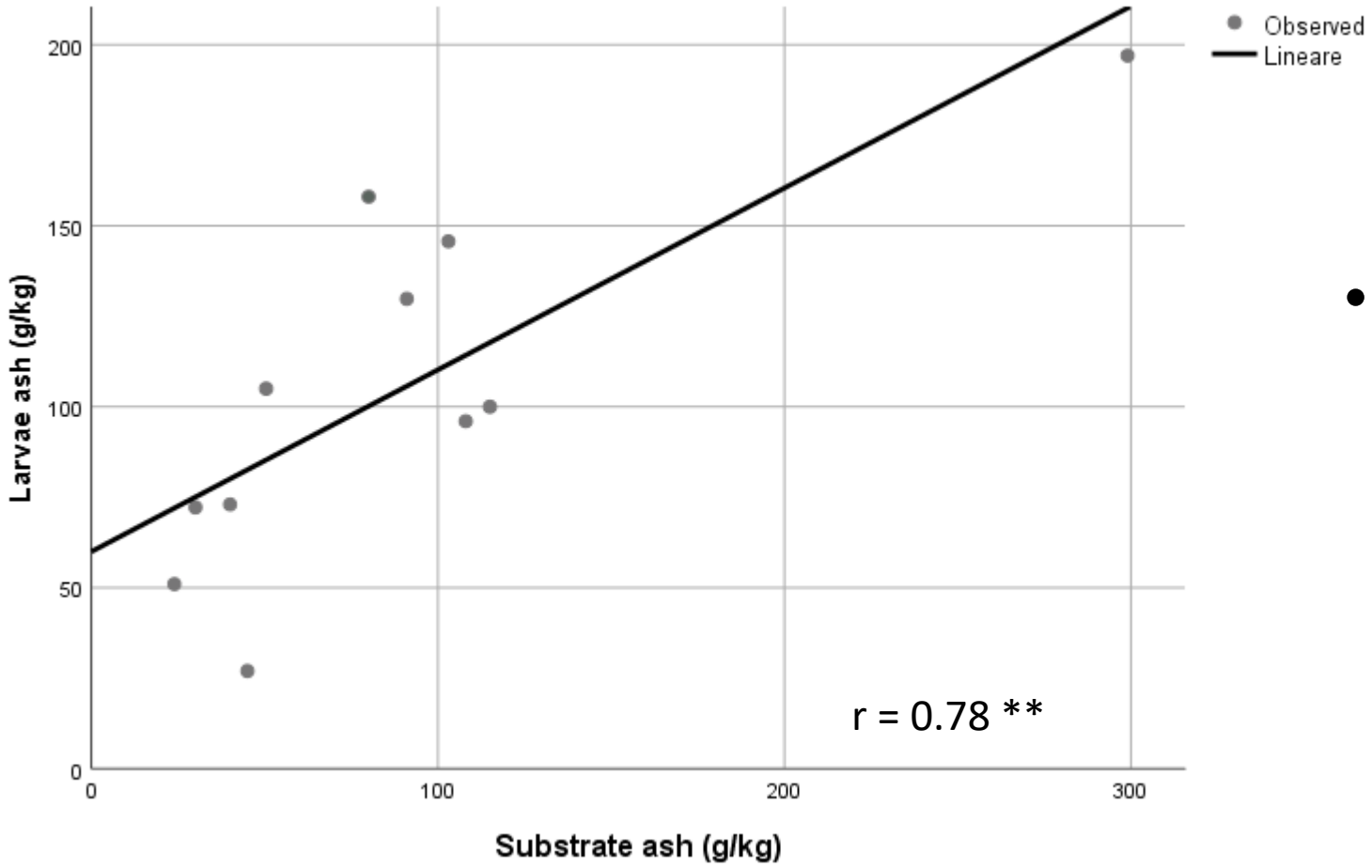
- No correlation between insect **biomass yield** and **substrate composition**
- Negative correlation (r = -0.71**) between insect **biomass yield** and **development time**

Results

Results_ larvae nutrient composition

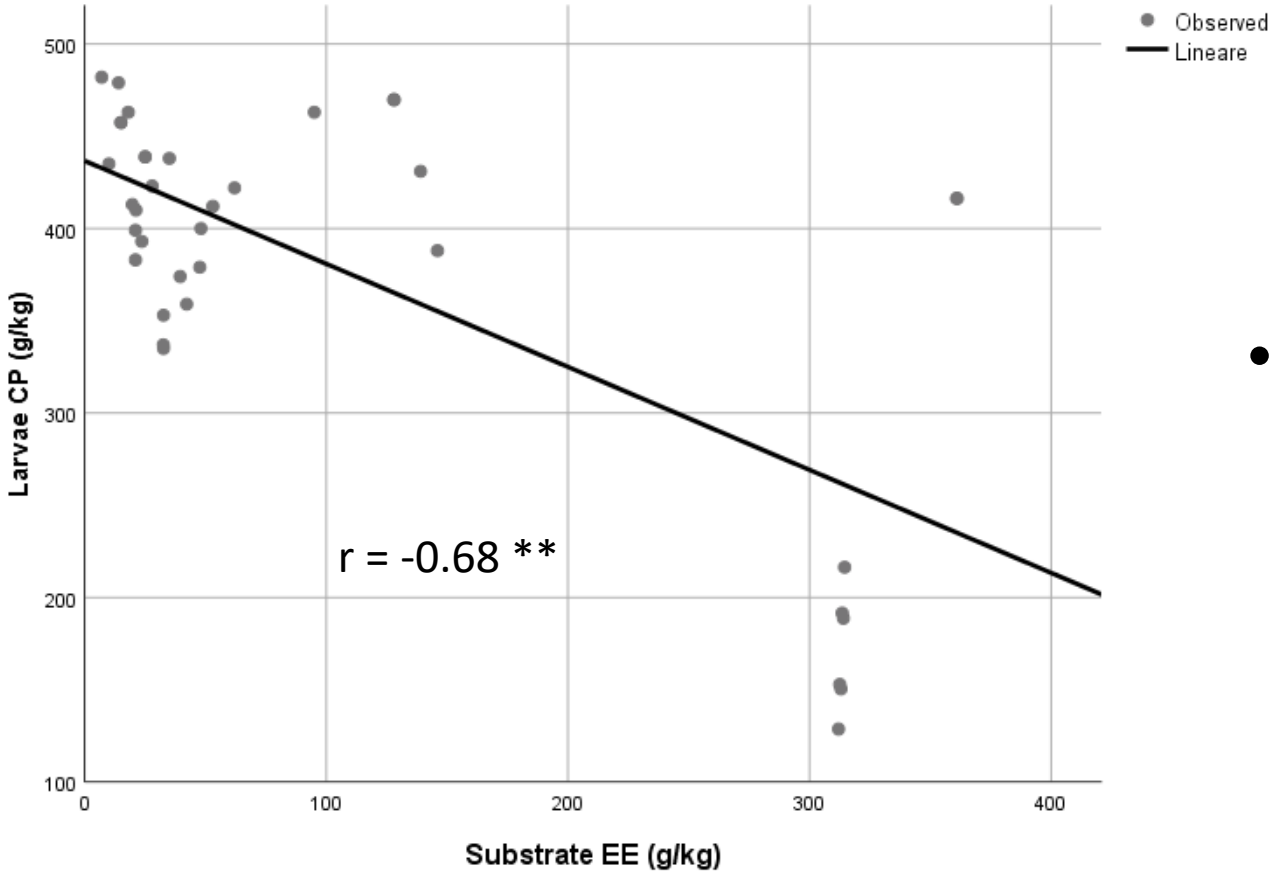
- CF (IDF/NDF), NFC, and humidity, do not affect biomass composition
- Ash in substrate affected ash in larvae
- EE in substrate affected CP and CPcorr. and EE in larvae

Results_ larvae nutrient composition



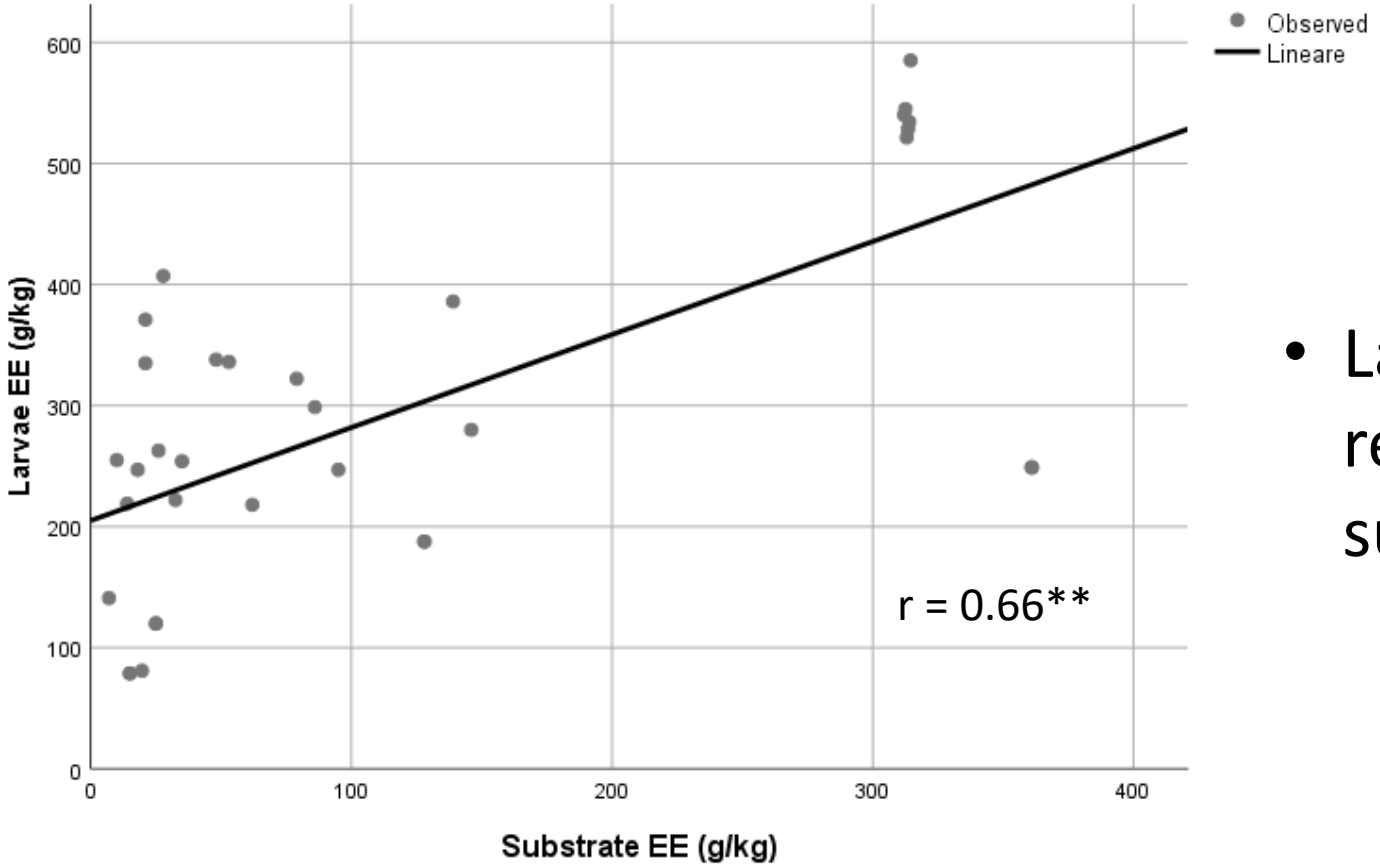
- High ash substrate generated high ash larvae

Results_ larvae nutrient composition



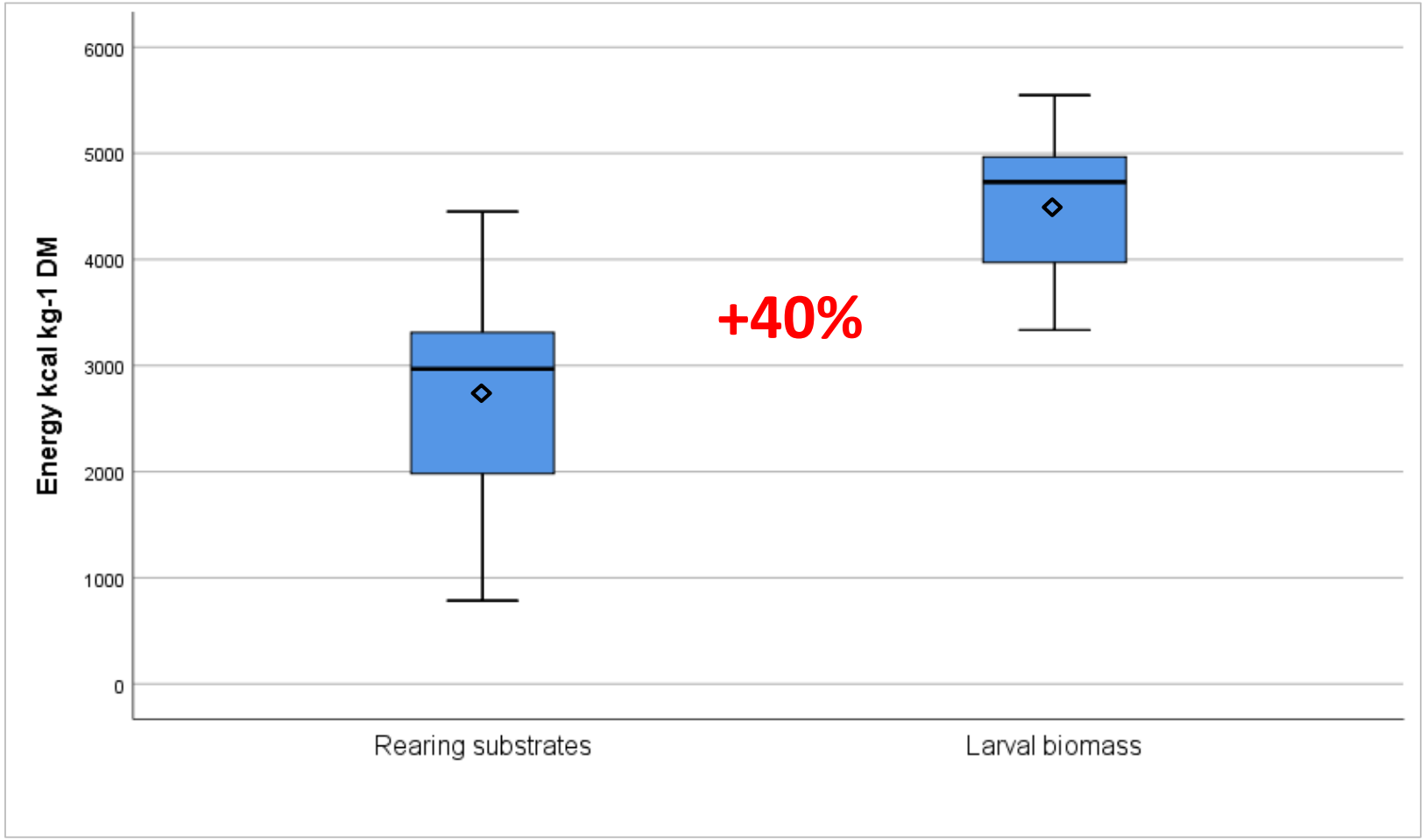
- EE content in substrate decreased the larvae CP

Results_ larvae nutrient composition

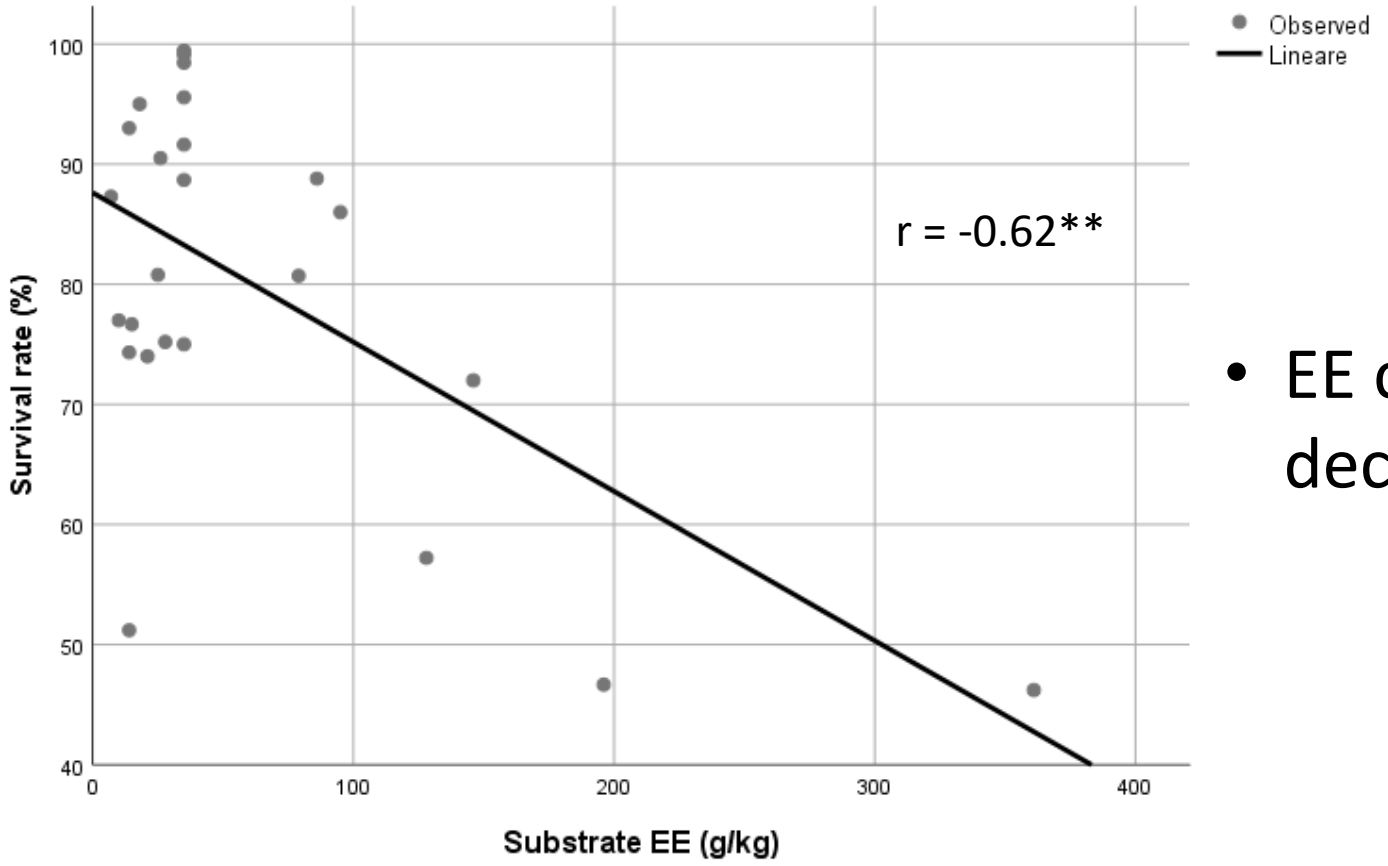


- Larvae EE content was related to EE content in substrate

BSF can upgrade low value substrate



Results_ larvae survival rate



- EE content in substrate decreased the survival rate

Summary

- Insect biomass yield: No correlation between insect biomass yield and substrate composition (**NORMALIZED DATA**)
- Insect composition: EE>ash>CP>CF(??)
- Insect energy content: SUBSTRATE → +40 → INSECT
- Survival rate: can be affected by selected nutrients like ether extract/fats in the substrate, > merit further investigation

Thank you for your attention