Safety and production performance of BSFL reared on catering waste

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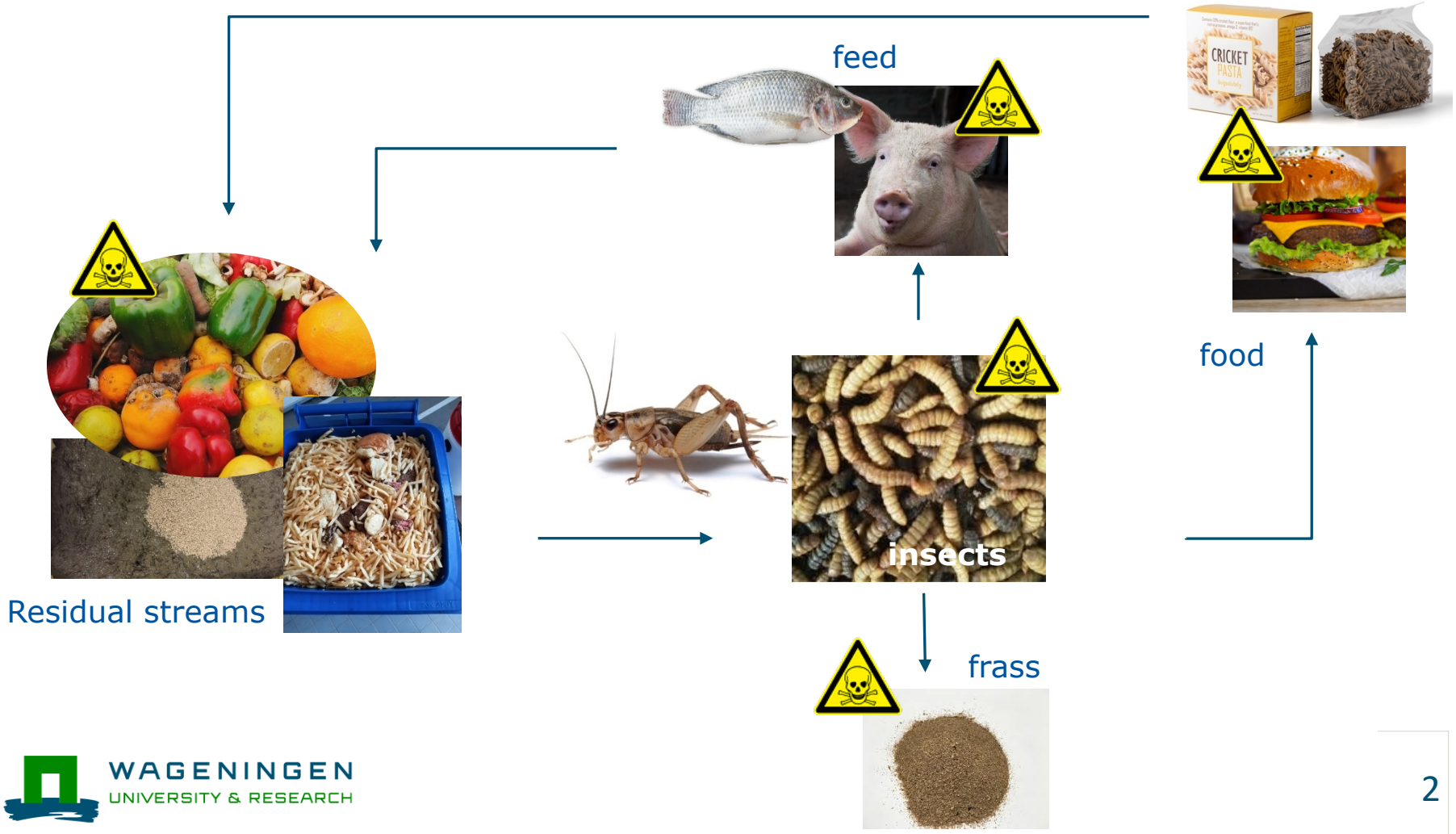
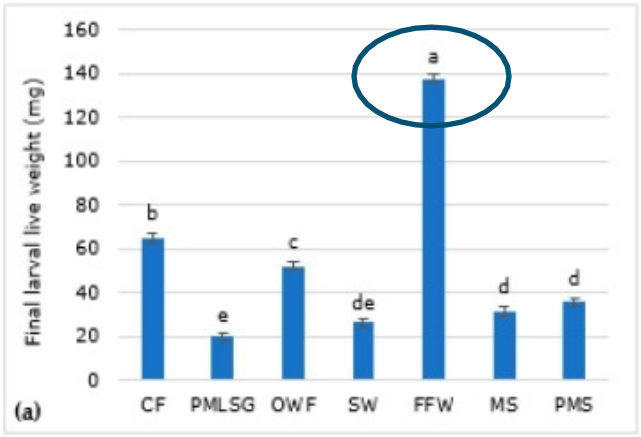
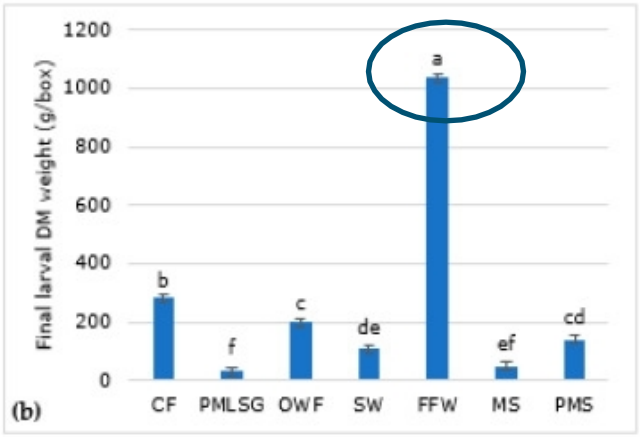
A circulair chain approach



Bioconversion of Different Waste Streams of Animal and Vegetal Origin and Manure by Black Soldier Fly Larvae

CF = control
FFW = catering waste





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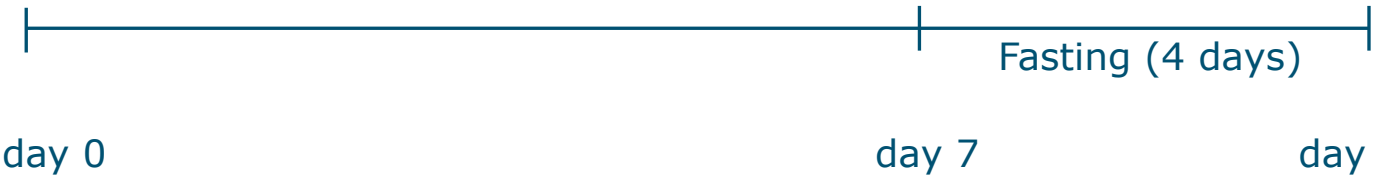
Naser El Deen et al., 2023 Bioconversion of Different Waste Streams of Animal and Vegetal Origin and Manure by Black Soldier Fly Larvae Hermetia illucens L. (Diptera: Stratiomyidae) - PMC (nih.gov)

7 days insect rearing on catering waste

Catering waste with and without meat

Different storage temperatures

BSF larvae

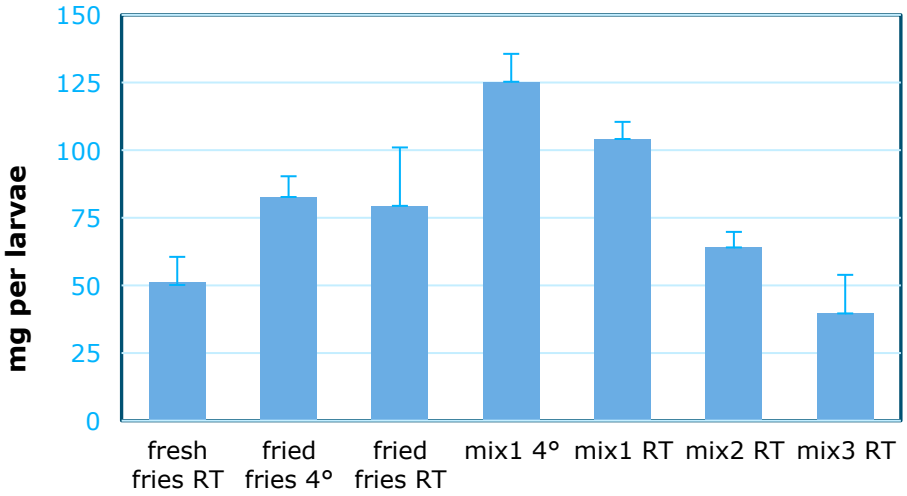


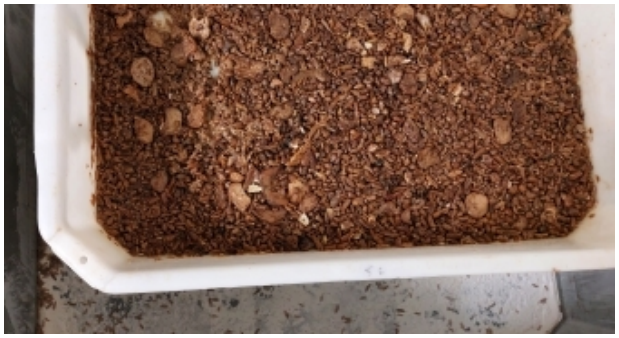
Experimental setup

- BSF larvae (7 days old)

#	Treatment	Storage temp.	Protein (%)
1	FFW1: Fries, raw	RT	7
2	FFW1: Fries, fried	4 °C	7
3	FFW1: Fries, fried	RT	7
4	FFW1: mix	4 °C	19
5	FFW1: mix	RT	19
6	FFW2: mix	RT	19
7	FFW3: mix	RT	19

Growth performance





Many larvae escaped during the experiment for the FFW mix treatments
A lot of fat in the FFW mix, which made sieving not possible

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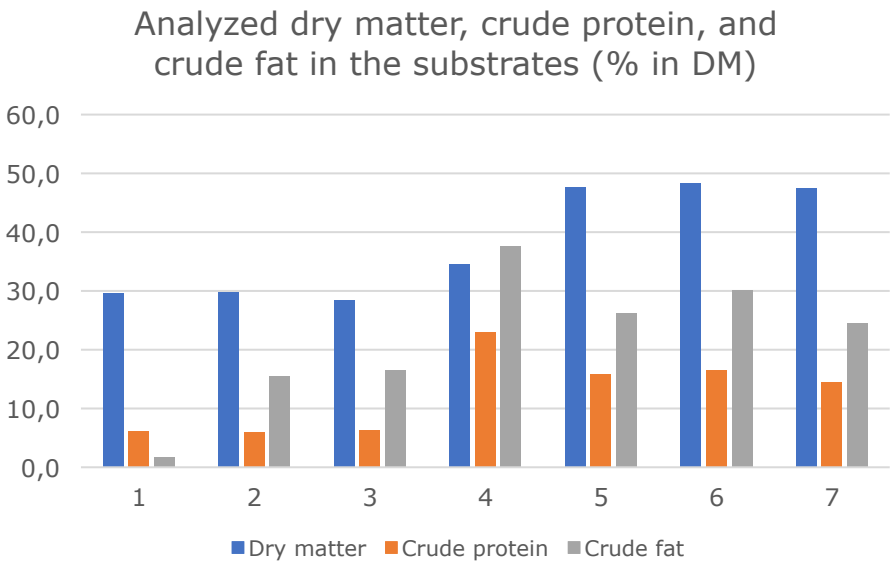
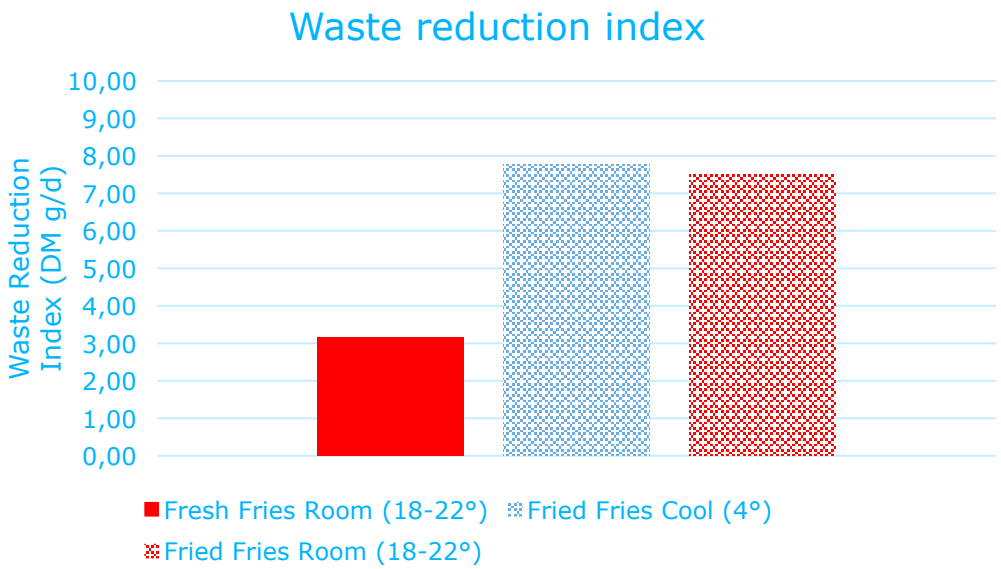
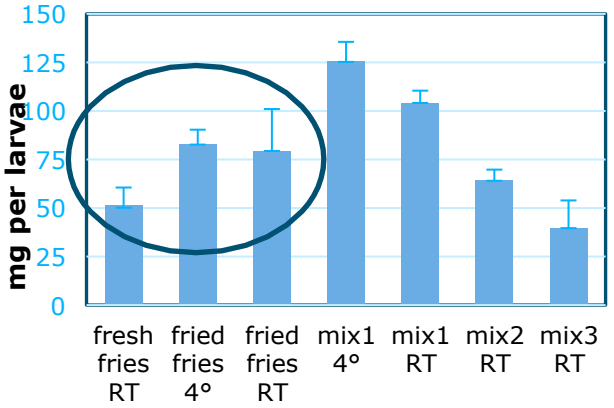
Nutritional composition



Waste reduction index





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Food safety

- Analyses animal DNA (ruminant, pig and poultry):

Using EURL Standard Operating Procedure (SOP)

  - DNA extraction
  - Real-time qPCR

- Microbiological analysis of
  - *Salm*. Spp.
  - *B. cereus*
  - *S. Aureus*
  - *C. perfringens*

Animal proteins: Background and legal framework

- Post Reg. 999/2001: feed ban + extended feed ban + prohibition intra-species recycling
- Since 2017: insect PAPs -> aquaculture
- Since 2021: insect PAPs -> poultry/pigs
- Wish by EU insect industry: permit former foodstuffs containing meat/fish as insect substrate
- Concerns over transfer of animal proteins from substrate, via insects, to target animal: indirect cannibalism?
    - Associated concerns over transfer prions / diseases

Results PCR

- DNA of all species detected in mix-substrate + larvae reared for 7 days on these substrates
- Traces found in few samples of French fries: cross-contamination?
- No animal DNA detected in any 4-day starved larvae

#	Composition feed	DNA recovered	Substrate	Larvae (after 7 days)	Larvae (starved)
1	French Fries, fried	Ruminant	-	-	-
		Pig	-	-	-
		Poultry	2/3 Detected	-	-
2	French Fries, fried	Ruminant	1/3 Detected	-	-
		Pig	-	-	-
		Poultry	-	-	-
3	Mix: French fries & meat	Ruminant	Detected	2/3 Detected	-
		Pig	Detected	Detected	-
		Poultry	Detected	Detected	-
4	Mix: Frenc fries & meat	Ruminant	Detected	2/3 Detected	-
		Pig	Detected	Detected	-
		Poultry	Detected	Detected	-

Discussion

- Lack of transfer of animal proteins via insect substrate observed, could alleviate (ethical) concerns over cannibalism
- DNA is indirect indicator for presence of animal proteins
- Unprocessed samples were analysed: processing of insects to be used as PAPs is expected to degrade DNA even further
- 4-days fasting is not ideal from commercial perspective:
    - More research needed to determine effects of shorter fasting periods;
    - Other methods to promote gut evacuation

Results microbiological pathogens (1/2)

#	Treatment	Matrix	*Salm*. Spp.	*B. cereus*	*S. Aureus*
1	FFW1: Fries, raw	Substrate	-	+++	-
		Larvae	-	++	-
2	FFW1: Fries, fried	Substrate	-	+	2/3 det.
		Larvae	-	-	-
3	FFW1: Fries, fried	Substrate	-	++	1/3 det.
		Larvae	-	-	-
4	FFW1: mix	Substrate	-	+	-
		Larvae	-	-	-
5	FFW1: mix	Substrate	-	-	-
		Larvae	-	-	-
6	FFW2: mix	Substrate	-	+	2/3 det.
		Larvae	-	-	-
7	FFW3: mix	Substrate	-	-	2/3 det.
		Larvae	-	-	1/3 det.

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Salmonella spp.
Bacillus cereus:
+: >1000, ++: >10.000, +++: >100.000 cfu/g
Coagulase positive *Staphylococcus aureus*

Results microbiological pathogens (2/2)

- *Salmonella* spp. absent from all samples
- *Bacillus cereus* detected in some, but not all substrates
  - Very high in treatment 1 (McD1: Fries, **raw**)
  - *B. cereus* also only on larval samples treatment 1
- *S. Aureus* present in most feeds, but only 1 larval sample of treatment 7
- Determination *Clostridium perfringens* attempted, but method unsuccessful

Conclusions

- Possibilities of insect rearing on catering waste dependent on fat content of the waste stream
- No animal DNA detected in any 4-days-fasted larvae
- Lower amount of food pathogens found on larvae compared to the substrates

Acknowledgements

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