Wallonie recherche CRA-W

Walloon Agricultural Research Centre

UMONS University of Mons

Manure as a substrate for insect breeding : ecological progress or health risk ?

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EAAP 2023 – 28 August 2023 – Lyon, France

Some background

- 8 insect species authorised for feed in the European Union
- Authorised for aquaculture, pig and poultry sectors
- Very rich in protein, easy to breed, minimal maintenance
- Known for recycling organic waste and transform low-quality material into a very high protein product

Health risk ?

From left to right and top to bottom : *A. domesticus*, *G. assimilis*, *G. sigillatus*, *T. molitor*, *A. diaperinus*, *M. domestica*, *B. mori*, *H. illucens*.

Industrial processing technologies

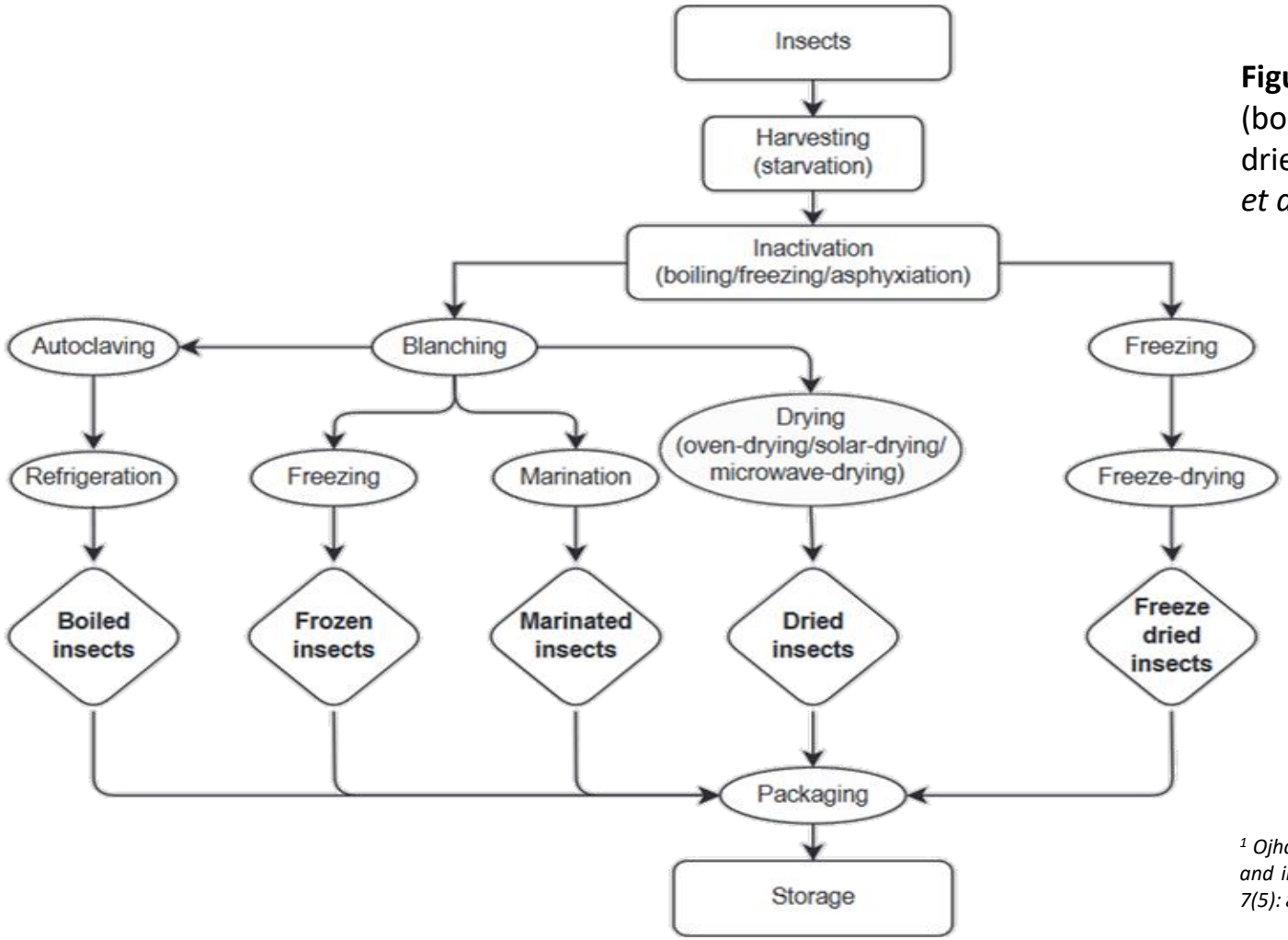

Figure 1. Processing pathways for the production of whole (boiled/frozen/oven-dried/freeze-dried/microwave-dried/marinated) edible insects. From the article by *Ojha et al. (2021)* [1]

[1] *Ojha S, Bussler S, Psarianos M, Rossi G and Schlüter O.K. Edible insect processing pathways and implementation of emerging technologies. Journal of Insects as Food and Feed. 2021 ; 7(5): 877-900. doi: 10.3920/JIFF2020.0121.*

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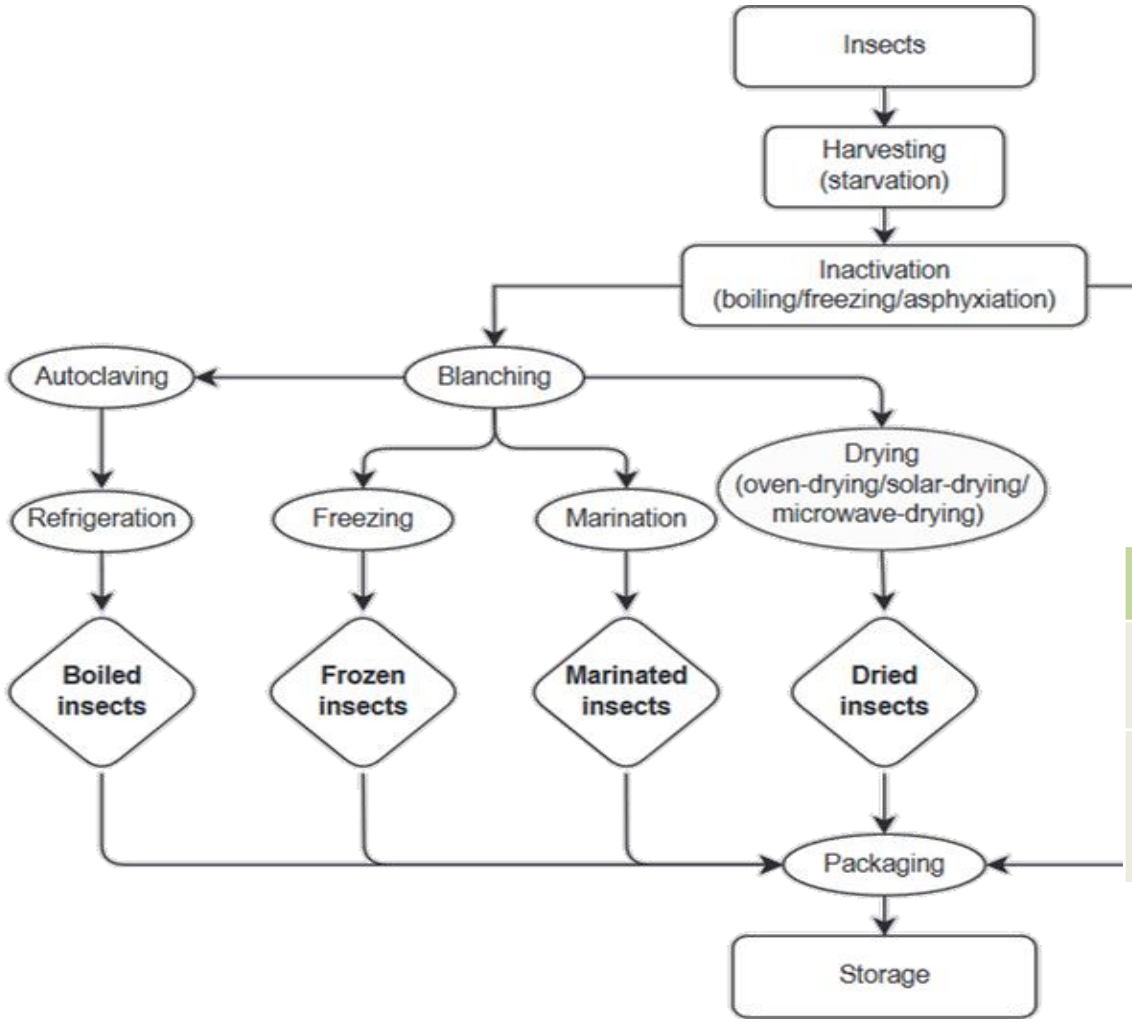

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	RT-PCR results	
Sample	Ruminant	*Hermetia illucens*
Substrate containing ruminant product	+ (23,3)	
Hermetia illucens larvae reared on substrate containing ruminant product	+ (34,2)	+ (18,2)

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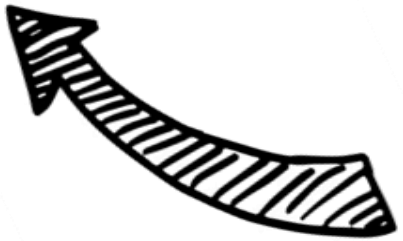
Industrial processing technologies

Tuesday 29 August - Session 36 - 17h15

Proteomics evaluation of the barrier role of insects for the indirect recycling of fast food in feed

M.C. Lecrenier, M. Aerts, A. Cordonnier, L. Plasman, O. Fumière and V. Baeten



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Experimentation design

- *T. molitor* larvae reared on a substrate adulterated with 5, 15 or 25% bovine manure
- Put in an incubator at **20°C** ± 2°C and ambient (**27%**) humidity, in the dark, for 15 days.
- Recovered, cleaned (**sodium hypochlorite** bath 5min), dried overnight at 50°C, ground and analysed

Objective: *See if we still detect manure on the grinded larvae.*

Analysis of the *T. molitor* larvae meal

Light microscopy (LM) and RT-PCR

	Light microscopy results			RT-PCR results			
Sample	Number of slides	Terrestrial particles	Insects particles	Ruminant (35,97)		*Tenebrio molitor*	
				Results	Ct (mean)	Results	Ct (mean)
Manure	10	-	-	+	24,8		
T. molitor reared on control substrate	10	-	+	-		+	29,6
T. molitor reared on substrate adulterated with 5% manure	10	-	+	-		+	31,44
T. molitor reared on substrate adulterated with 15% manure	10	-	+	-		+	32,76
T. molitor reared on substrate adulterated with 25% manure	10	-	+	-		+	32,82

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No ruminant observation/signal detected in both LM and RT-PCR analyses

Analysis of the *T. molitor* larvae meal

Impact of processing on nutritional value and bacteria counts

- Processing methods can have an impact on nutritional value [2]

Nitrogen Kjeldahl * 6,25	*T. molitor* meal control	*T. molitor* meal + 5% manure	*T. molitor* meal + 15% manure	*T. molitor* meal + 25 % manure	*T. molitor* larvae meal		*T. molitor* larvae
Crude protein (%)	53,83	53,13	52,02	53,91	55,27 [3]	50,79 [4]	53,22 [5]
p-value	0,238				0,158		

- How does meal processing affect the presence of faecal bacteria?

  ⇒ Blanching is sufficient to reduce bacterial counts below the detection limit

  ⇒ Our case : samples could not be analysed because of too much interfering flora (probably due to the drying method)

[2] Melgar-Lalanne, G., et al. (2019). Edible Insects Processing: Traditional and Innovative Technologies. Comprehensive Reviews in Food Science and Food Safety, 18: 1166-1191. [3] De Marco, et al. (2015).Nutritional value of two insect larval meals (Tenebrio molitor and Hermetia illucens) for broiler chickens: Apparent nutrient digestibility, apparent ileal amino acid digestibility and apparent metabolizable energy. Anim. Feed Sci. Technol. 209, 211–218. [4] Yoo, J.S., et al. (2019). Nutrient ileal digestibility evaluation of dried mealworm (Tenebrio molitor) larvae compared to three animal protein by-products in growing pigs. Asian-Australas. J. Anim. Sci. 32, 387–394. [5] Ghosh, S., et al. (2017). Nutritional composition of five commercial edible insects in South Korea. J. Asia-Pac. Entomol. 20, 686–694.

Conclusion

More drastic insect larvae processing :

- Manure not detected in *T. molitor* meal produced, regardless of substrate adulteration percentage
- No impact on sample protein value

Additional analyses still need to be carried out (mass spectrometry, complete nutritional value, microbiology, etc.).

Conclusion

Feeding animals a product treated using this processing method ?

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Feeding animals a product treated using this processing method ?

The use of manure to rear insects is possible, but still present health risks

- Develop solutions/methods to potentially enable the use of new products without health risks
- What about the presence of prions ?

Thanks to all those who have worked and are still working on this experiment !

Thanks for your attention !