Effect of heating and high-pressure processing on the potential of Black Soldier Fly larvae as feed

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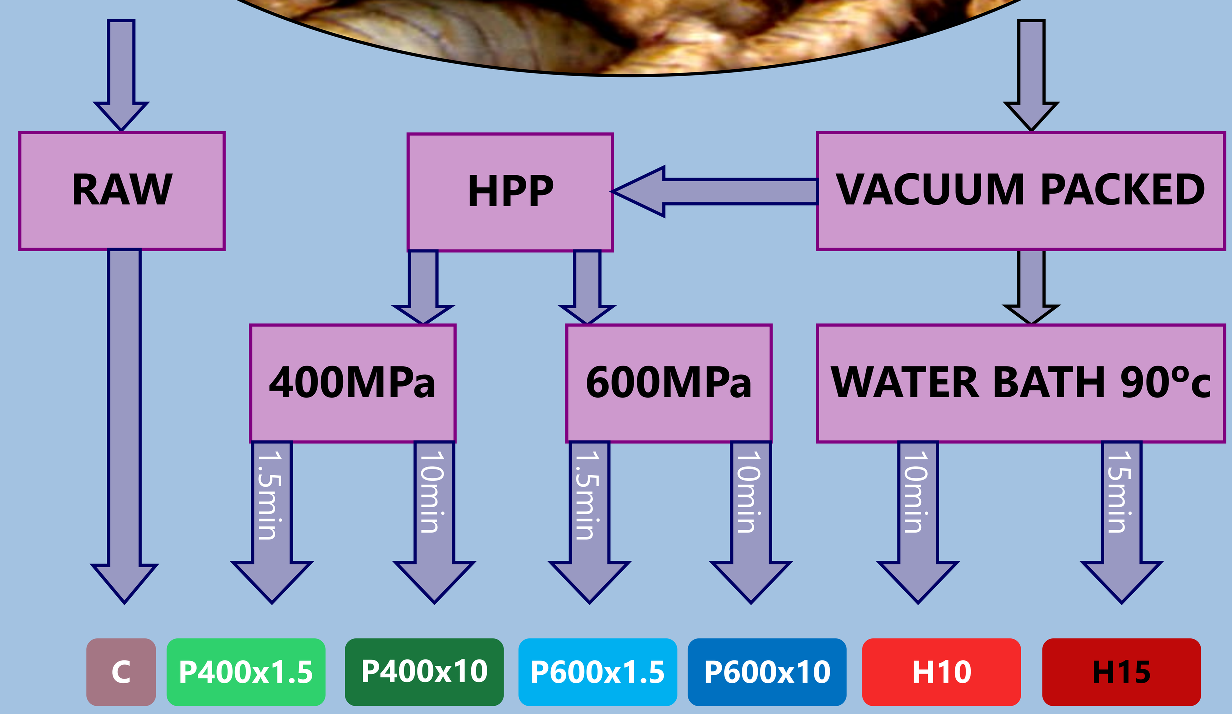
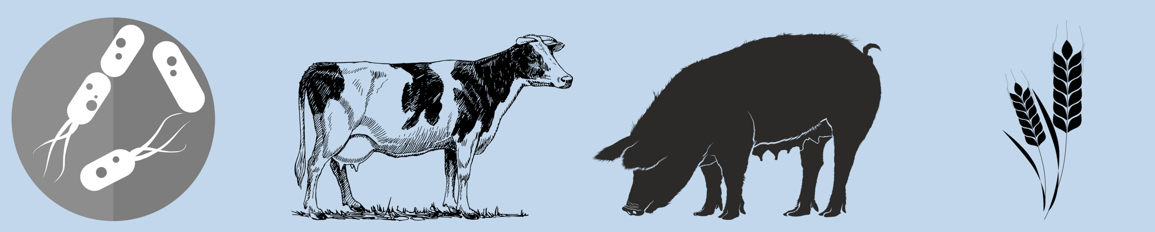
Introduction

The EU is moving towards considering insects as a source of alternative protein for animal feed. Black Soldier Fly (*Hermetia illucens*) is one of the insect species receiving more interest for large scale production due to its ability to upcycle various residual organic resources into protein- and fat-rich biomass. However, more information is needed to explore effective processing methods that certify insects as a safe and suitable ingredient to include in animal feeds. The present study assessed the effect of heating and high-pressure processing (HPP) on the decontamination of the whole Black Soldier Fly larvae (BSFL), the *In Vitro* Digestibility in ruminants and monogastrics, and the relationship with the detergent fibre content (NDF/ADF).

Material and methods



SPOILAGE MICROFLORA | ***In Vitro* DIGESTIBILITY** | **DETERGENT FIBRE**



Total Viable Counts (**TVC**)
Lactic Acid Bacteria (**LAB**)
Enterobacteria (**ENB**)
Yeasts and Moulds (**YM**)

Ruminant (**RUMIN**)
Daisy incubator (ANKOM)
Monograstric (**MONOG**)
Boisen et al. [1]

Neutral Detergent Fiber (**aNDF**)
Acid Detergent Fiber (**ADF**)
Van Soest [2]

Results

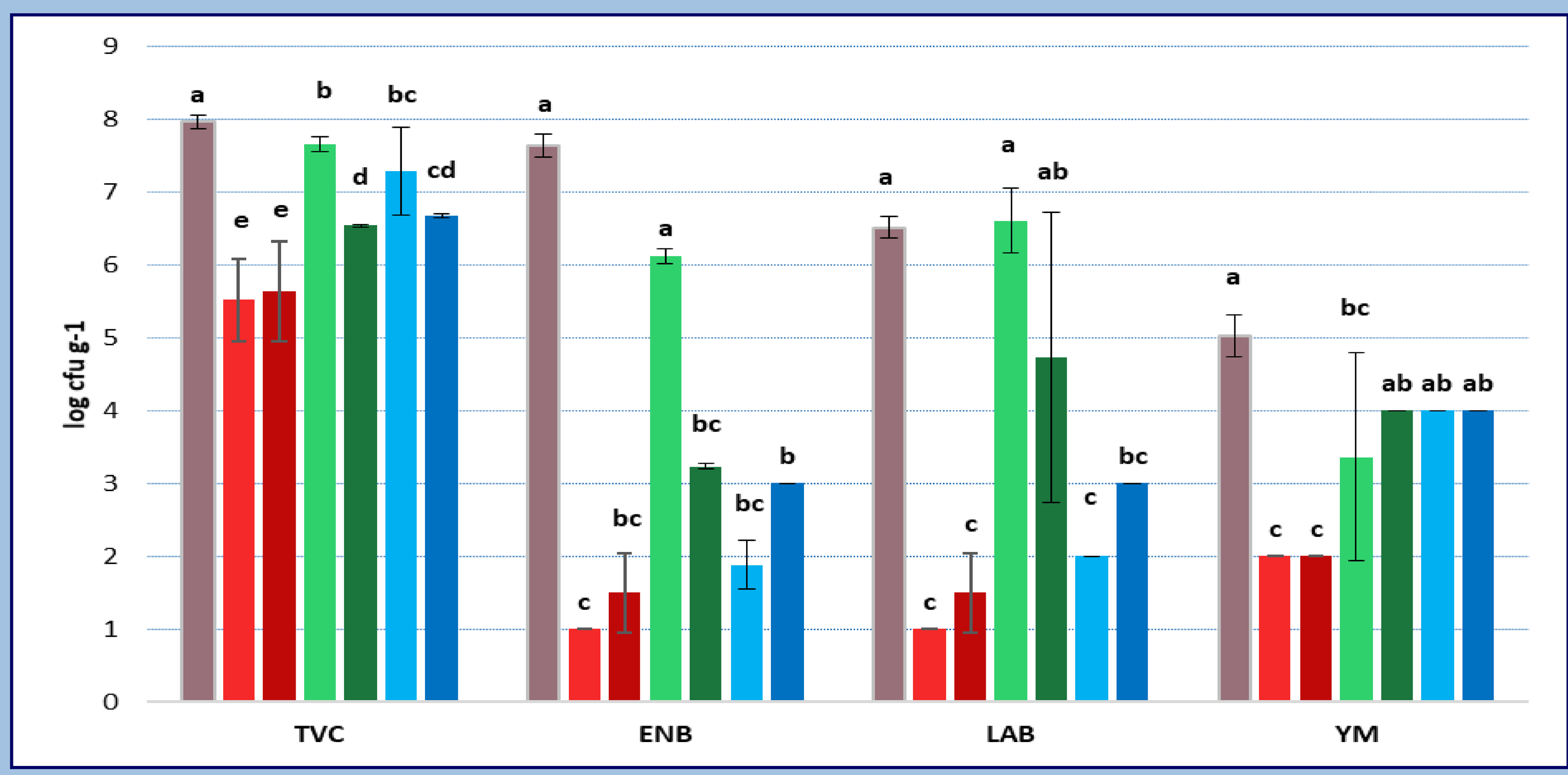


Fig. 1 Effect of the different combinations of treatment and time on the microbial quality of the whole BSFL.

Table 1 Digestibility and detergent fiber values (%DM) of the whole BSFL under different combinations of treatments and time.

Parameter	Control	Heating		HPP 400MPa		HPP 600MPa		s.e.m.	Effects		
Time (min)		10	15	1.5	10	1.5	10		Treatment	Time	TxT
MONOG	83.8^{b}	83.0^{b}	83.9^{b}	78.8^{a}	78.8^{a}	81.5^{ab}	81.3^{ab}	1.19	**	N.S.	N.S.
RUMIN	88.1^{a}	87.4^{a}	88.7^{a}	92.6^{b}	93.3^{b}	93.3^{b}	91.9^{b}	0.92	***	N.S.	N.S.
aNDF	12.7^{a}	14.3^{bc}	13.9^{b}	16.3^{d}	15.3^{c}	16.0^{cd}	14.2^{b}	0.29	*	**	N.S.
ADF	8.23^{a}	8.89^{bc}	8.50^{ab}	10.1^{d}	8.11^{a}	9.87^{d}	9.03^{c}	0.046	*	***	**

^{a,b,c,d} different superscripts in the same variable indicate statistical differences ($P \leq 0.05$) between treatments / s.e.m. = Standard Error of the Mean
P: Probability values. ***($P \leq 0.001$); **($P \leq 0.01$); *($P \leq 0.05$); N.S ($P > 0.05$)

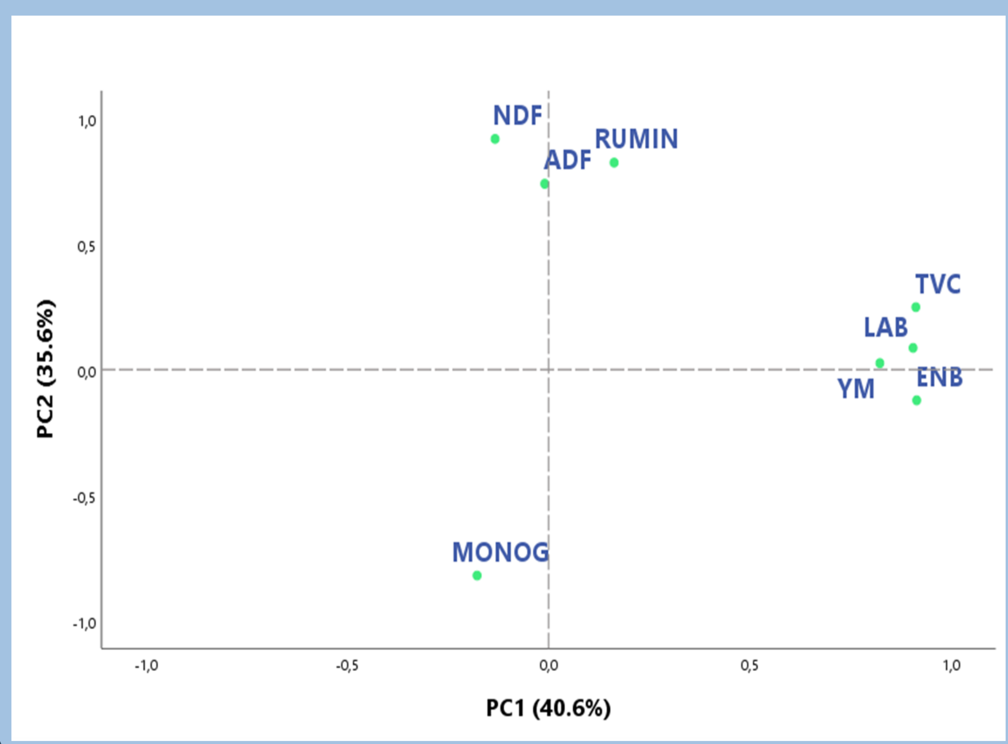


Fig. 2 Principal Component Analysis (PCA) loading plot for the microbiological, digestibility and detergent fiber variables.

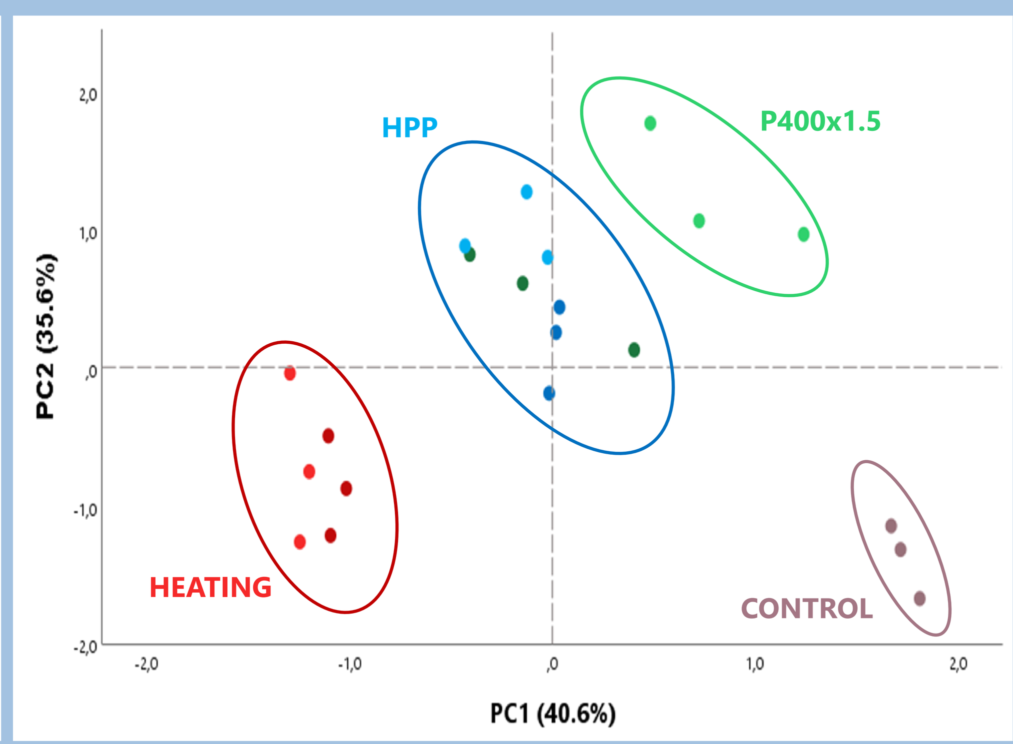


Fig. 3 Projection of the cases on the component plane.

Discussion

HPP showed a modest effect on the hygienisation of BSFL, lower than the reduction achieved by heating (90ºC) in a water bath. The mildest HPP treatment showed the weakest effect. Similar results were found previously in *Tenebrio molitor* larvae when comparing both treatments[3]. HPP also showed a limited impact on TVC reduction in BSFL[4]. Alternative conditions (pressure, time, temperature) or insect pre-treatments (blanching, grinding, water addition) might be considered to increase the decontamination effect of HPP in BSFL.

Heat-treated samples implied no change on digestibility, whereas HPP-BSFL increased and decreased the ruminant and monogastric digestibility, respectively. The effect of HPP seems to correlate to changes in the detergent fibre content. Further research will be needed to clarify the effect of HPP on insect chemical composition and digestibility.

References

[1] Boisen et al. (1997) *Anim Feed Sci Tech*; 68: 277-286
[2] Van Soest (1991) *J Dairy Sci*; 74: 3583-3597
[3] Rumpold et al. (2014) *Innov Food Sci Emerg*; 26: 232-241
[4] Kashiri et al. (2018) *PLoS One*; 13(3): e0194477

Acknowledgments