

Utilization of yeast supplement for improving *Hermetia illucens* reproductive and larval performance

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Introduction

The *Hermetia illucens* larvae are able to bioconvert a vast range of organic waste streams into high quality protein and lipids, suitable to be used as food and feed. However, the reproductive (egg production) and rearing (larval growth and survival) performances can highly be influenced by the larval feed source and can lead to high fluctuations of production outputs (protein and lipids). Therefore, utilization of supplement, which aims to consolidate the feed quality and increase production outputs are of high interest.

Aim

Improving *H. illucens* reproductive and larval performance by increasing substrate quality through addition of low inclusion rates of Lallemand yeast products.

Methods

- Utilized substrates: i) control and main substrate: Gainesville diet (GD); ii) Lallemand yeast products: Torula inactivated yeast (TIY), Sterol inactivated yeast (SIY), Vitamin B enriched yeast (BIY) and Mineral enriched yeast (MIY) (table 1);
- Substrate processing: all substrates were grinded (<1mm) before being mixed;
- Yeast inclusion rates: 5% and 10% mixed with GD on a dry matter basis (table 1);
- Production trays: L60xW40cm (3xtreatment);
- Feedings: 3 feedings (day 0:2kg, day 3: 1.5kg and day 6: 2kg);
- Substrates dry matter: 30%;
- Larval density: 10,000 larvae/tray (~5 individuals/cm²);
- Cages:L60xW60xH60cm (1xtreatment) (table 1);
- Abiotic factors: T:28°C, RH: 60%, photoperiod: 14/10 (LED);
- Fly density: 1,600 flies/cage;
- Sex ratio: F: 50% - M: 50%;
- Oviposition sites: DTI odour attractant and egg collector;
- Measured parameters: larval weight after 8 days (at harvest), prepupa weight (physiological time) and egg production per cage.

Inclusion rates DM	Larvae rearing			Flies reproduction
	GD	GD	GD	GD
0%	GD	GD	GD	GD
10%	TIY/GD	TIY/GD	TIY/GD	TIY/GD
10%	SIY/GD	SIY/GD	SIY/GD	SIY/GD
10%	BIY/GD	BIY/GD	BIY/GD	BIY/GD
10%	MIY/GD	MIY/GD	MIY/GD	MIY/GD
5%	TIY/GD	TIY/GD	TIY/GD	TIY/GD
5%	SIY/GD	SIY/GD	SIY/GD	SIY/GD
5%	BIY/GD	BIY/GD	BIY/GD	BIY/GD
5%	MIY/GD	MIY/GD	MIY/GD	MIY/GD

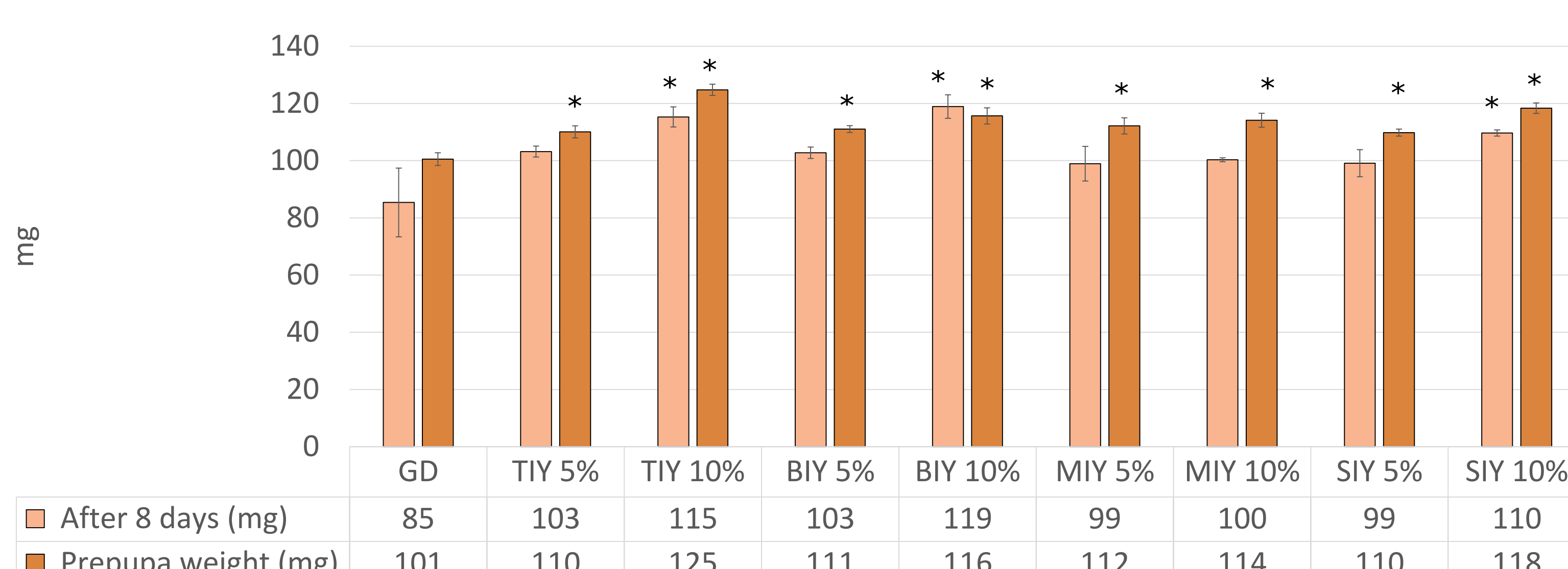
Table 1: Experimental design of Lallemand's yeast products in *Hermetia illucens* production



Figure 1: Experimental setup of Lallemand's yeast products in *Hermetia illucens* production

Results

Effect of yeast inclusion rate on larval performance



* Significant difference (t-test, p<0.05) between larval reared on the yeasts at 2 inclusion rates and the control (plain Gainesville diet) measured either after 8 days or in the pupa stage

Figure 2: Larval weight (mg) *H. illucens* reared on Gainesville diet enriched with Lallemand's yeast products at 5% and 10% inclusion rates and measured after 8 days and in the prepupa stage.

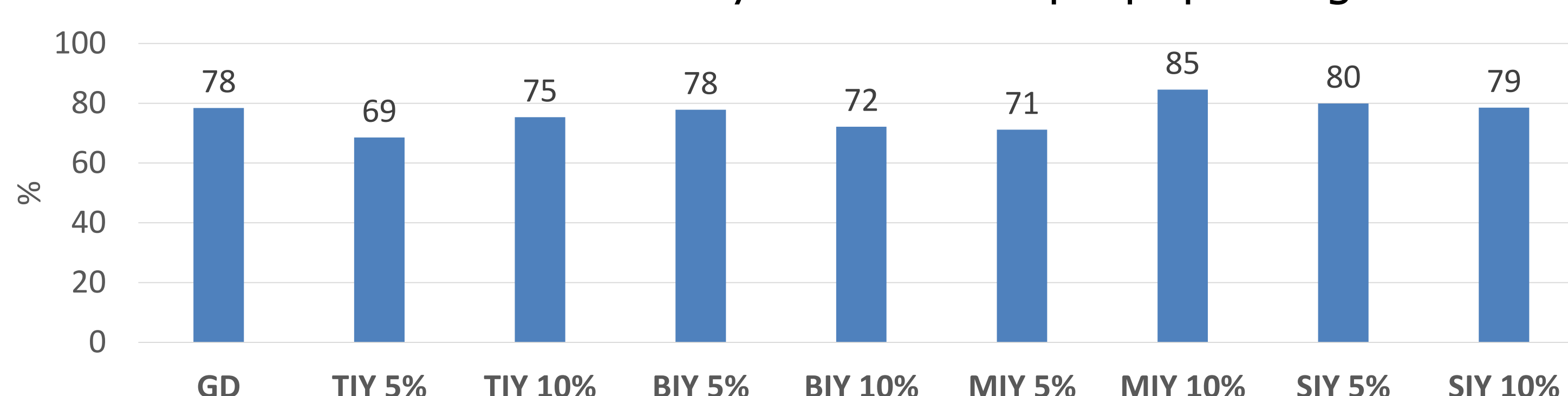


Figure 3: Survival rate (%) of *H. illucens* reared on Gainesville diet enriched with Lallemand's yeast products at 5% and 10% inclusion rates.

Effect of yeast inclusion on reproductive performance

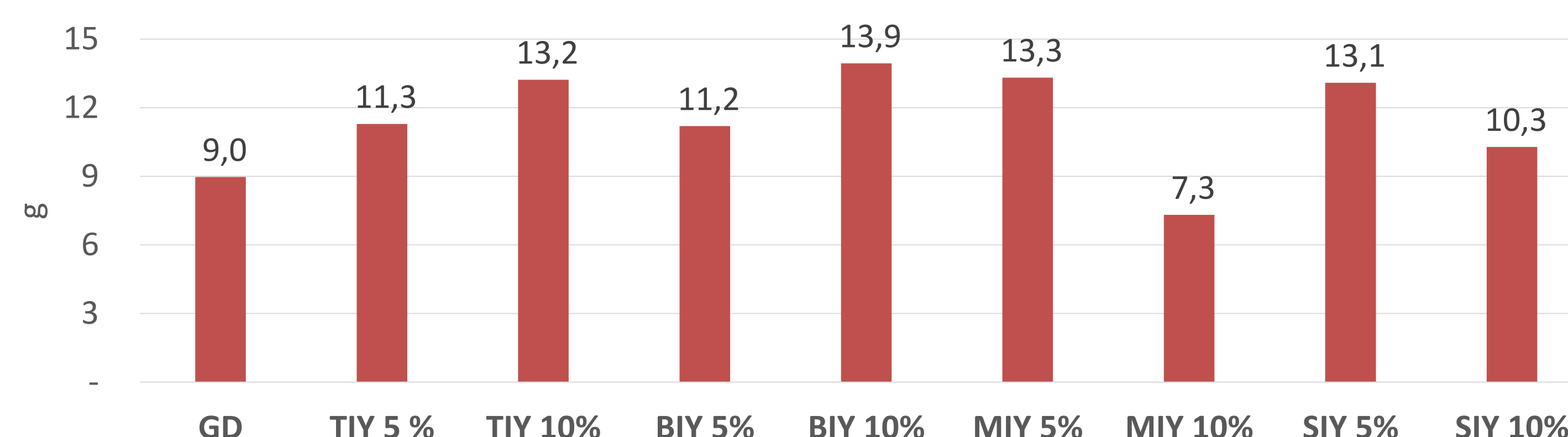


Figure 4: Egg production (g/cage) of *H. illucens* reared on Gainesville diet enriched with Lallemand's yeast products at 5% and 10% inclusion rates.

Discussion and Conclusions

- Overall the larvae were found to grow better as a result of enriching the Gainesville diet with Lallemand yeasts. The biggest larvae were obtained when the Gainesville diet was enriched with 10% of SIY and TIY with 29% and 35% weight increase at harvest, respectively. Moreover, the utilization of yeast as supplement to Gainesville diet resulted in bigger prepupae larvae when compared with the plain Gainesville treatment (Figure 2).
- Overall the survival rate was found to vary between 69% (TIY 5%) and 85% (MIY 10%). The control was found to have similar survival rates, as the yeast inclusion treatments, indicating that yeast inclusion did not result in higher mortality (Figure 3).
- These results indicate that the utilization of Lallemand's yeast products as supplement in *H. illucens* rearing can increase the larval performance without affecting survival rate.
- The egg production was found to increase when the Gainesville diet was enriched with yeast products, except for MIY 10%. Moreover, the highest egg production was obtained as a result of utilizing TIY and BIY yeast at 10% inclusion rates. (Figure 4)
- These results indicate that the inclusion of Lallemand's yeast products as feed supplement in *H. illucens* production could increase egg production.