Optimization of Black Soldier Fly reproduction using new odour attractant and egg collectors

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Introduction

The production and commercialization of *Hermetia illucens* larvae for feed purposes are of high interest due to the species' nutritive value, low environmental impact and high conversion efficiency. However, the reproduction of BSF in captivity is far from optimal and requires a high degree of biological knowledge.
The Danish Technological Institute (DTI) plays a key role in optimizing the rearing of *H. illucens* and in consolidating the insect production sector.

Aim

Optimization of *H. illucens* reproduction in captivity, with focus on improving fly density, increasing oviposition at specific sites (outside the cage) and hatchability by using newly developed odour attractant and egg collectors.

Methods

- **Cages**:L60xW60xH60cm (duplicates)
- **Abiotic factors**: T:27°C, RH: 60%, photoperiod: 14/10 (LED);
- **Densities**: A:1,000 flies/cage, B:1,350 flies/cage and C: 1,650 flies/cage;
- **Sex ratio**: F: 54% - M: 46%
- **Oviposition sites** (odour attractant and egg collectors): were placed on the top of the cages and replaced every second day for 6 days (figure 1a)
- **New harvesting method**:3D-printed food graded silicone (figure 1b) was spread directly on the hatching trays
- **Previous harvesting scrape method:** Eggs were scraped from cardboard plates before being placed on hatching trays.
- **Determining the weight of the eggs**: Egg collectors were weighed before and after being placed in the top of the cage and were used to determine the weight of the harvested eggs.

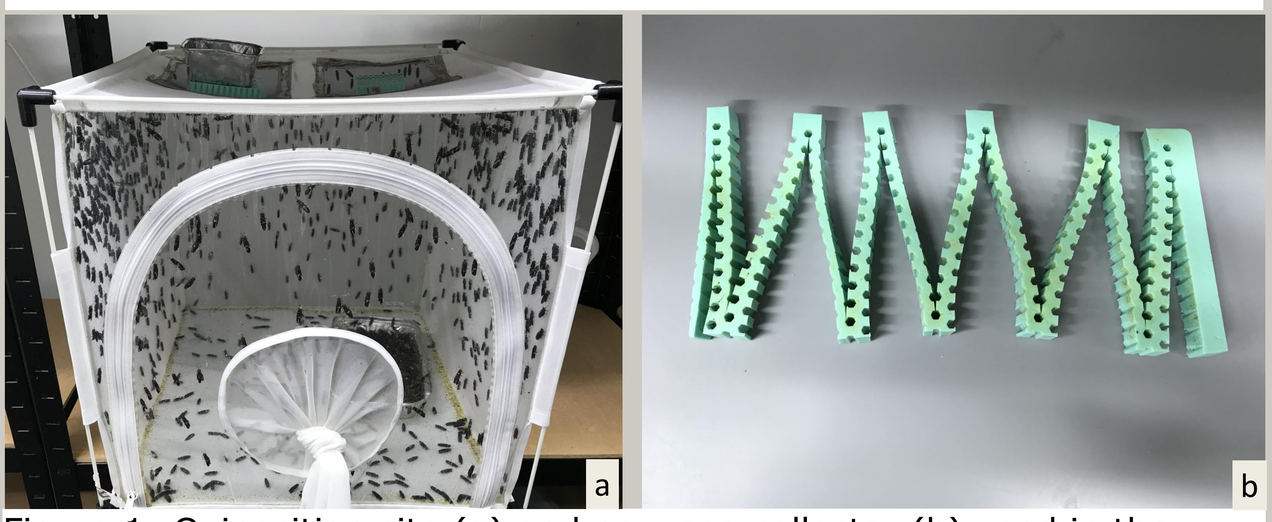

Figure 1: Oviposition site (a) and new egg collector (b) used in the experiment

Results

- **Effect of fly density on egg production**

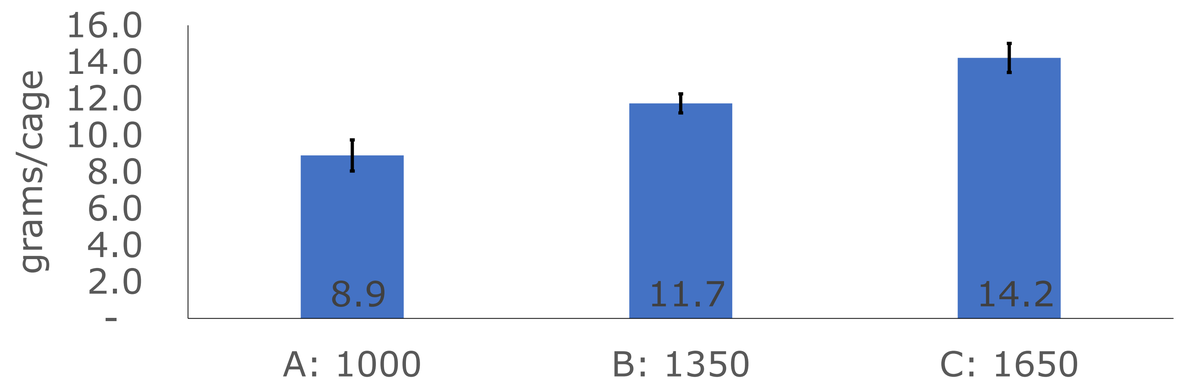

Figure 2: Total egg production of *H. illucens over* 6 days, maintained at different densities (avg±sd).

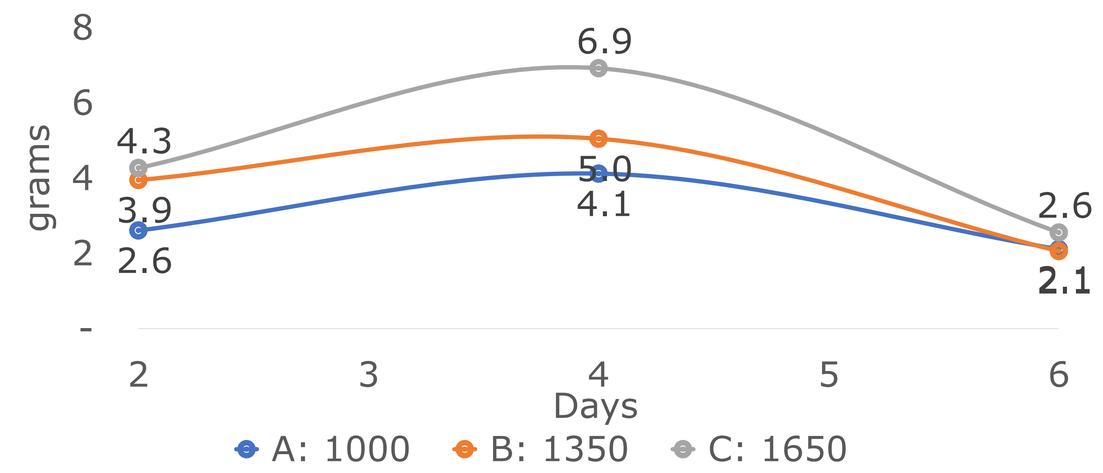

Figure 3: Production of *H. illucens* eggs over time, when maintained at different densities (avg).

- **Effects of odour attractant on oviposition**

Table 1: Eggs of *H. illucens* oviposited at specific sites and inside the cages (%)

Oviposition	Fly density		
	A: 1,000	B: 1,350	C: 1,650
Specific sites (%)	98.7	94.2	93.3
Inside the cage (%)	1.3	5.8	6.7

- **Effects of egg collectors vs. previously used scrape methods on hatchability rate**

Table 2: Hatchability rate of *H. illucens* eggs harvested in new silicone egg collectors and by the previous harvesting method (scrape method)

Harvesting method	Hatchability rate (%)
New egg collectors	80±5
Scrape method	56±4

Discussion and Conclusions

- The highest production of eggs was found to be related to the highest fly density. The egg production was found to increase from day 2 to day 4 before decreasing in day 6 for all density treatments.
- The oviposition of eggs at specific sites was very high for all treatments, while small rates of eggs were oviposited inside the cages. The results indicate that by using an odour attractant, the eggs of *H. illucens* can be harvested outside the cages, thus decreasing the overall costs and labor associated with the reproduction.
- The new egg collectors were found to have a higher hatchability rate compared with the previously used scraping method. This is believed to be associated with a decrease in egg damage due to handling as well as with a higher air flow across the egg clusters.

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