

# Resource availability impact on reproduction of Bean beetles (*Callosobruchus maculatus*)

In this study, our main objective is to examine how resources availability affects the number of eggs laid per bean and survival rate of bean beetles across a gradient of resource availability

G.E. Fimreite, I. Lerum, M. Metic, H. E. Paulsen  
University of Bergen

## Introduction

- The bean beetle (*Callosobruchus maculatus*) (Photo 1) is an excellent laboratory organism as the adults do not require food or water and their adult lifespan is between 10 and 14 days which they spend mating and laying eggs (Beck and Blumer, 2014).
- Its development is highly dependent on controllable variables, humidity, temperature, substrate and population strain (Messina and Slade, 1999), that can be changed to manipulate generation time (Beck and Blumer, 2014).
- In this experiment we proposed two hypothesis:
  - (1) With increasing number of beans, the number of eggs per bean will decrease.
  - (2) With decreasing number of eggs per bean, survival rate of larvae will increase.

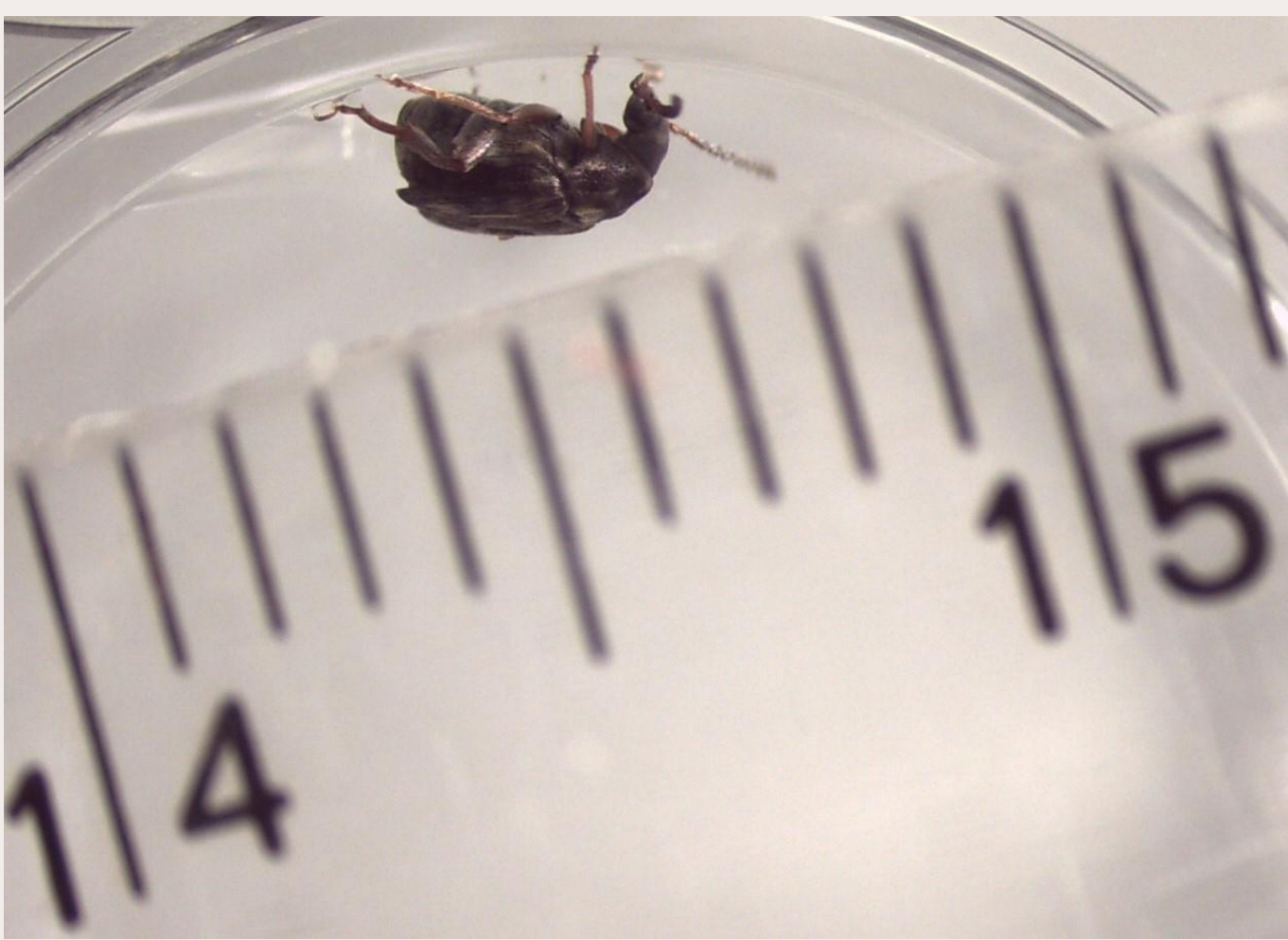


Photo 1. Bean beetle (*Callosobruchus maculatus*)

## Materials and Methods

- Week 1 – we have placed one pair of bean beetles in four petri dishes, each with different number of beans (*Vigna unguiculata*). We then repeated this process for five different temperature treatments, while humidity stayed the same.
- Week 3 – after two weeks incubation, adult females have laid eggs that we then counted with special attention to how many eggs were laid on each bean.

- Week 5 – after another two weeks, laid eggs have hatched, and we have then counted how many individuals have emerged.
- In our calculations, we have used only one temperature treatment.

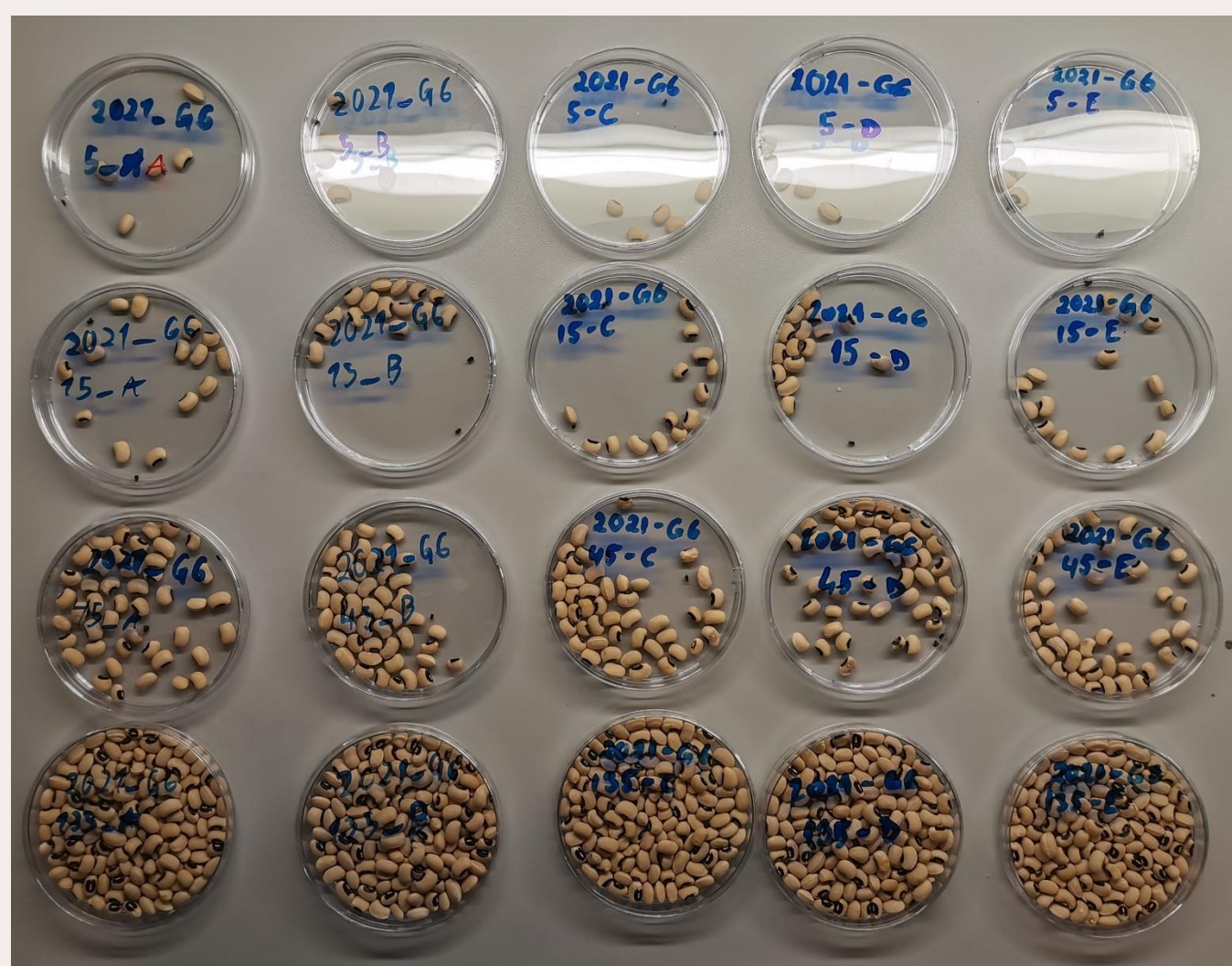


Photo 2. Experiment setup with different number of beans per dish for different temperature treatment.

## Results

- There is a negative correlation between number of beans and number of eggs per bean, where in cases with larger number of beans, the number of eggs per bean would decrease (Fig.1).
- The survival rate of the larvae decreases with an increase in the number of eggs per bean (Fig. 2). The prediction of the intercept did not yield a significant result, but the overall relationship did.

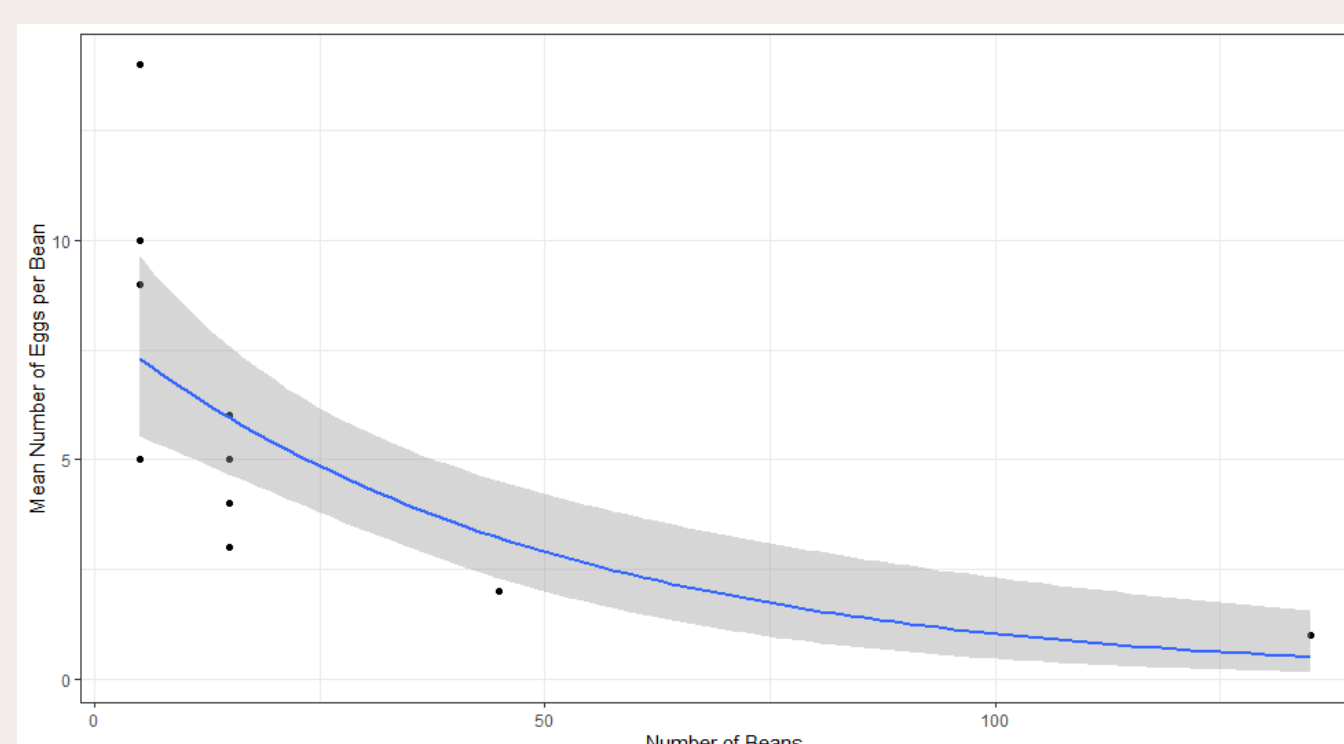


Fig. 1. Relationship between total number of beans per dish and mean number of eggs per bean.

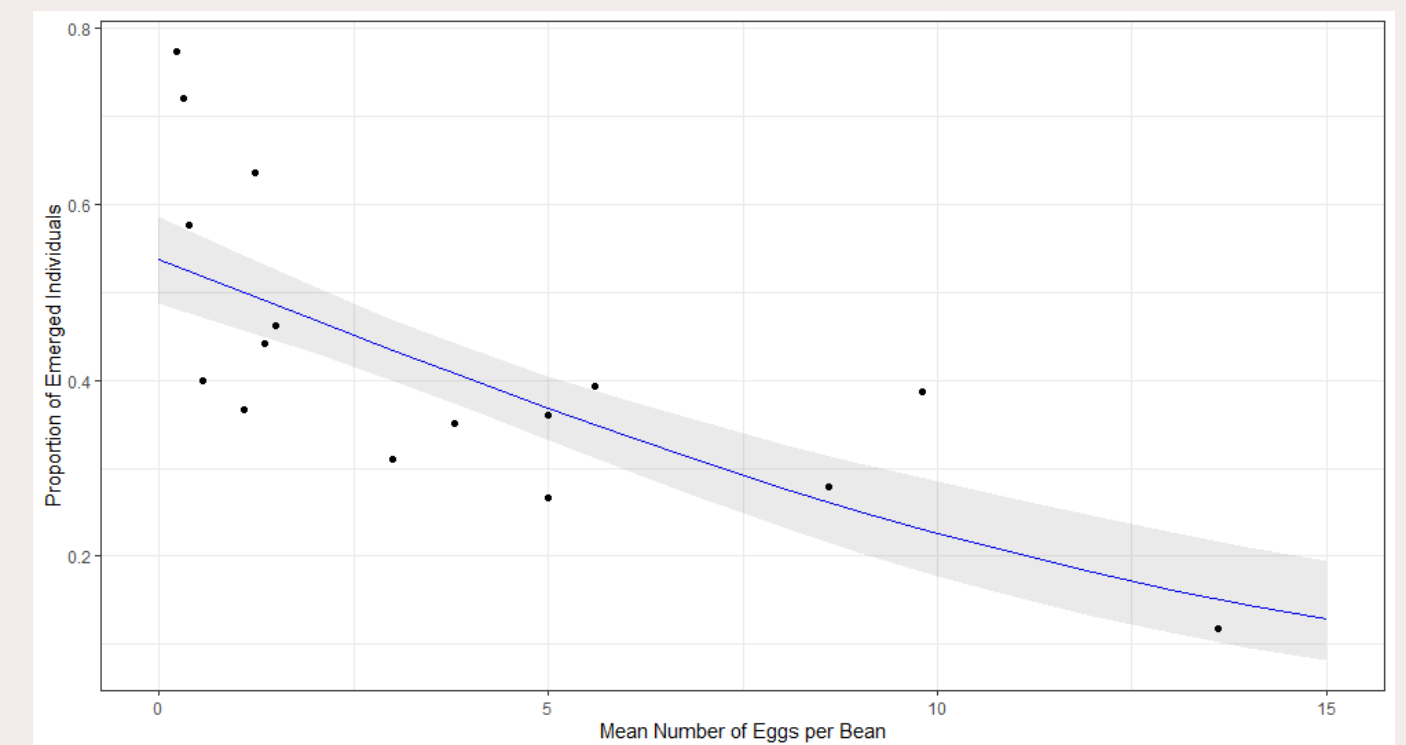


Fig. 2. Relationship between mean number of eggs per bean and proportion of emerged individuals.

## Discussion

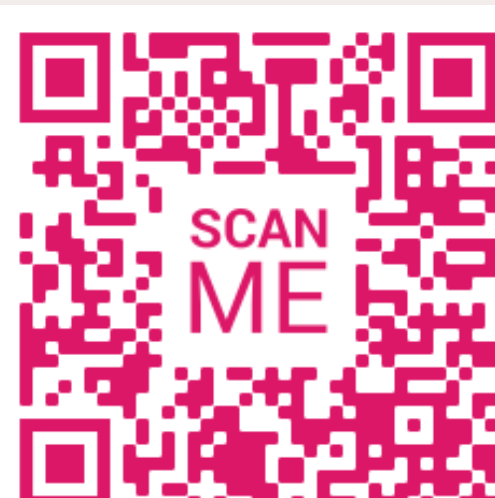
- Results show that there is negative interaction between larvae.
- Survival rate of emerged individuals, where there was higher competition and less resources available is smaller than in dishes where there was less competition and more available resources.
- Whether the observed interaction is a contest or scrambled competition can't be determined by this experiment.
- There is a possibility to make future experiments on this by looking at the body size of the evolved beetles, that also makes it possible to look at the correlation between the body size of the survivors and the number of eggs per bean.
- Future experiments may include smaller steps between the number of beans in each petri dish and go to a higher number than 135 beans per dish.

## References

- Beck, C.W., Blumer, L.S., 2014. A Handbook on Bean Beetles, *Callosobruchus maculatus* – Bean Beetles. URL <https://www.beanbeetle.org/handbook/> (accessed 10.13.21).
- Messina, F.J., 2004. Predictable Modification of Body Size and Competitive Ability Following a Host Shift by a Seed Beetle. *Evolution* 58, 2788–2797. <https://doi.org/10.1111/j.0014-3820.2004.tb01630.x>

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UNIVERSITY OF BERGEN

