

IT'S GETTING HOT IN HERE

HOW ARE BEAN BEETLES (*CALLOSOBRUCHUS MACULATUS*) AFFECTED BY TEMPERATURE AND RESOURCE AVAILABILITY?



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RESEARCH QUESTION

How do different temperatures and resource availability affect the emergence rate and the time at which bean beetles (*Callosobruchus maculatus*) fully emerge from black eyed beans?

HYPOTHESES

Temperature

Samples at temperature of $26^{\circ}\text{C} \pm 2^{\circ}\text{C}$, will have the highest emergence rate out of the studied samples, indicating optimal temperatures. Bean beetles in temperatures over and under optimal will have a lower emergence rate. Those at 21°C will have the lowest emergence rate out of the samples.

Resource availability

Due to intraspecific competition for resources during larval stage of *C. maculatus*' life cycle, samples with fewer resources available are expected to have fewer emerging individuals relative to the number of laid eggs.

METHOD

We have set up our experiment as shown in Figure 1. After the female individuals had died, we counted eggs in each petri dish. Following that we counted the number of emerged individuals every weekday for three weeks.

RESULTS

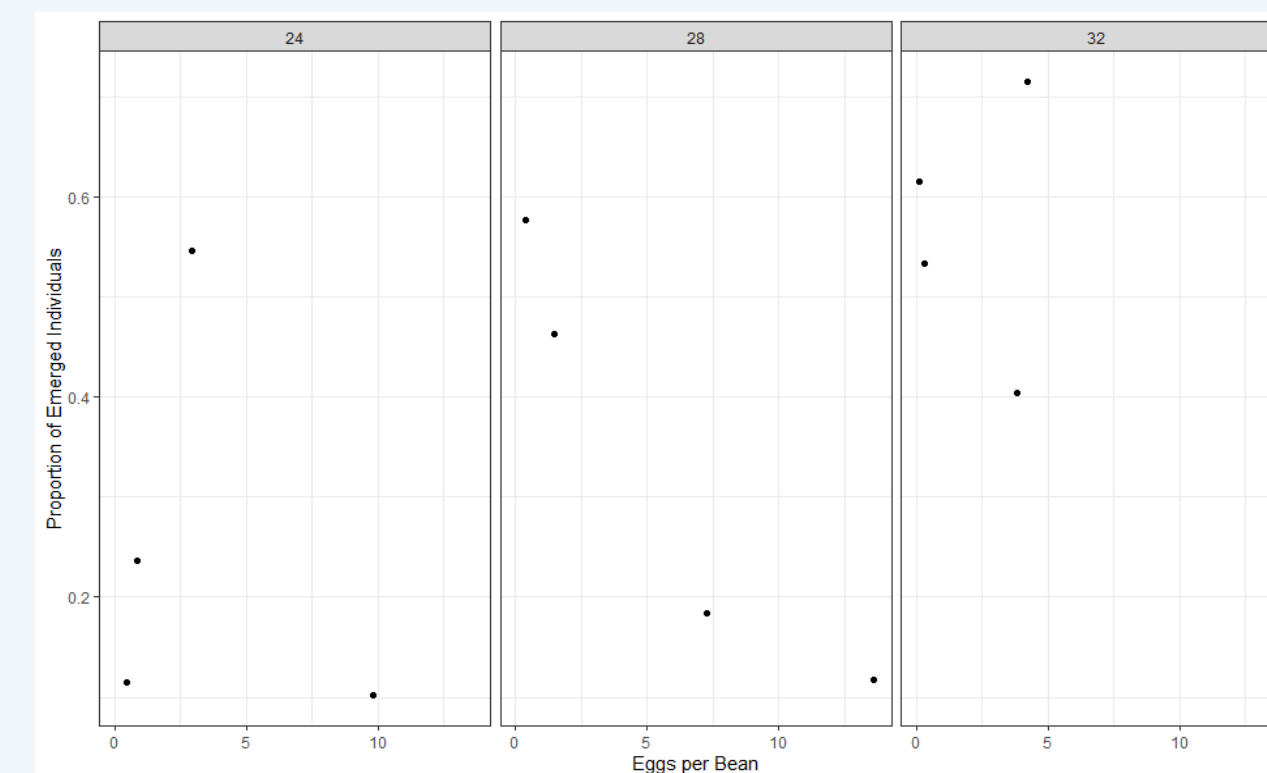


Figure 2. Proportion of emerged individuals against the number of eggs per bean at 24°C , 28°C and 32°C .

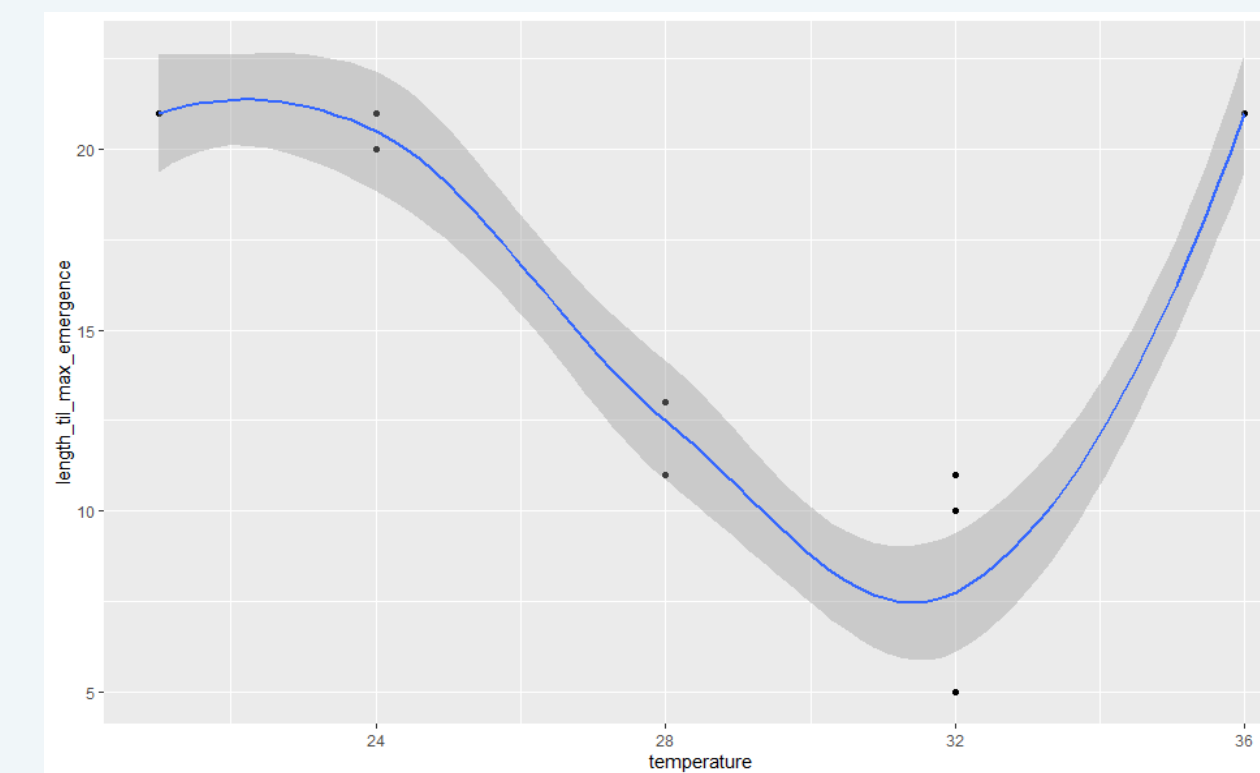


Figure 3. Shows the time it takes for the maximum number of individuals emerging against the temperature ($^{\circ}\text{C}$).

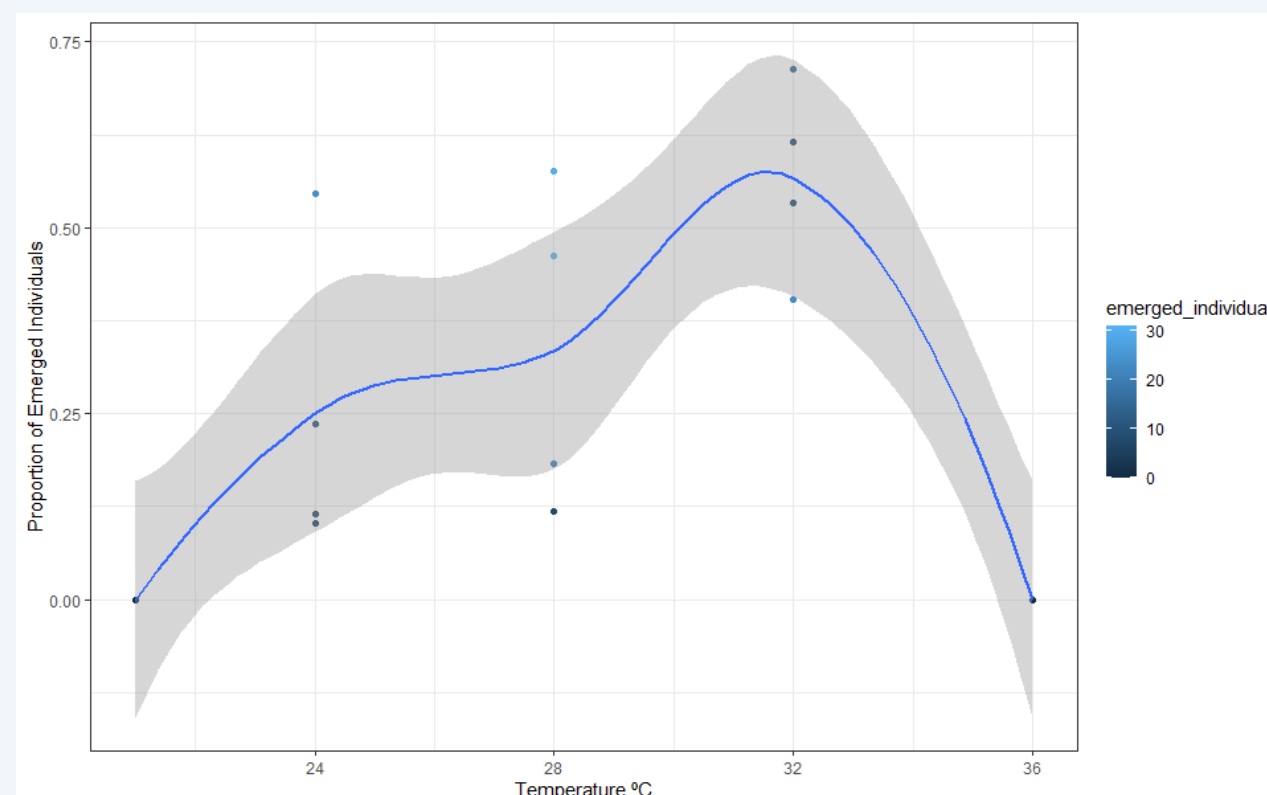


Figure 4. Shows the proportion of emerged individuals at temperatures of 21°C , 24°C , 28°C , 32°C and 36°C . Total number of emerged individuals is indicated by color. Higher the number of emerged individuals lighter the blue color.

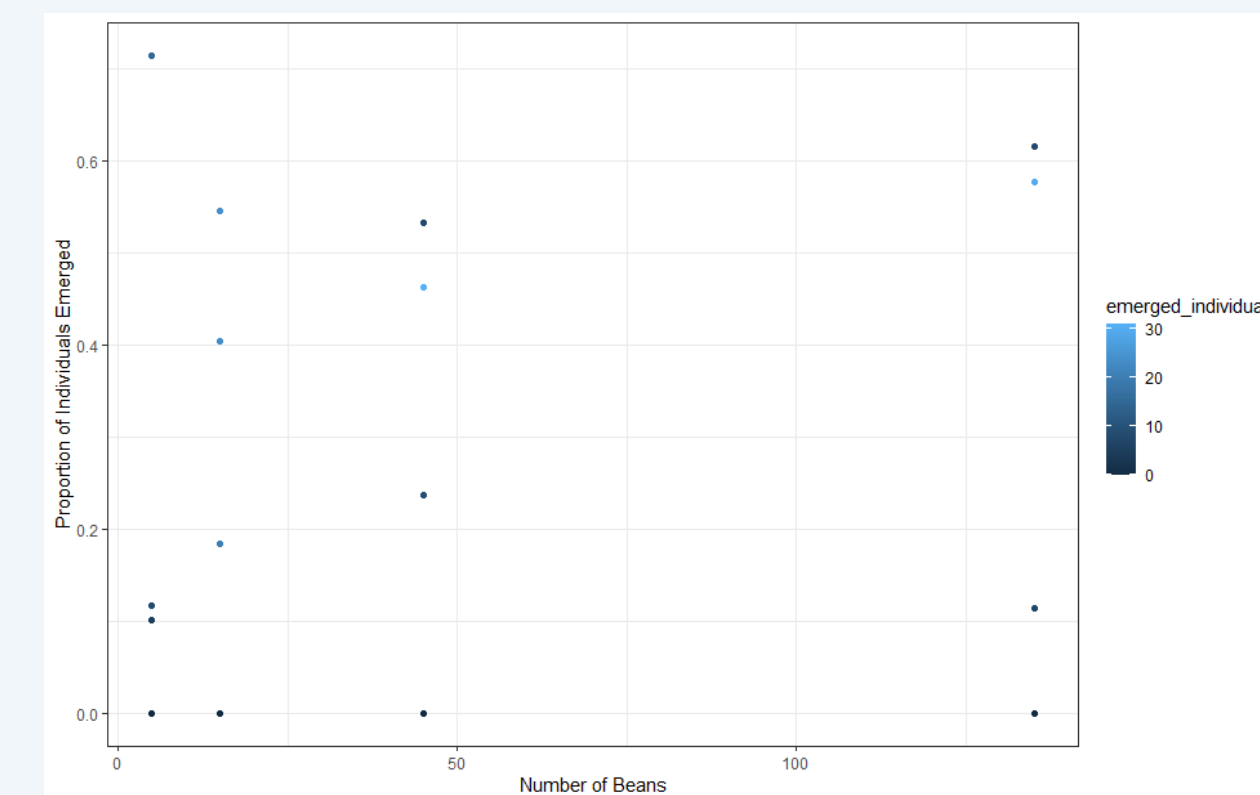


Figure 5. Shows the proportion of emerged individuals against available resources (number of beans). Total number of individuals in different resource availability is indicated by color. Higher the number of emerged individuals lighter the color.

CONCLUSION

- The fewer eggs per bean, the higher the emergence rate (Figure 2). This indicates **intraspecific competition** for the resources between larvae.
- The higher the temperature, the shorter the **time until emergence** due to the faster metabolism (except for at 36°C , which was too hot for the beetles to survive) (Figure 3).
- Highest **emergence rate** was at 32°C , although the highest total emergences was at 28°C , due to high number of eggs in those samples (Figure 4). Indicating that 32°C is the optimal or closes to the **optimal temperature** in our experiment.
- The **emergence** was not significantly limited by the overall number of beans. In samples with >15 beans there was a surplus of resources (Figure 5).

Ideas for further research

- How many beetles can emerge from the same bean?
- Study several generations for a more elaborated and accurate study
- Is there correlation between temperature and egg per bean ratio?

NJ: Writing – viewing/editing, Visualization, Conceptualization, Investigation **TO:** Writing – viewing/editing, Project administrator, Visualization, Conceptualization, Investigation **VS:** Writing – draft, Visualization, Conceptualization, Investigation **CS:** Formal analysis, Conceptualization, Investigation **FZ:** Formal analysis, Validation, Visualization, Conceptualization, Investigation

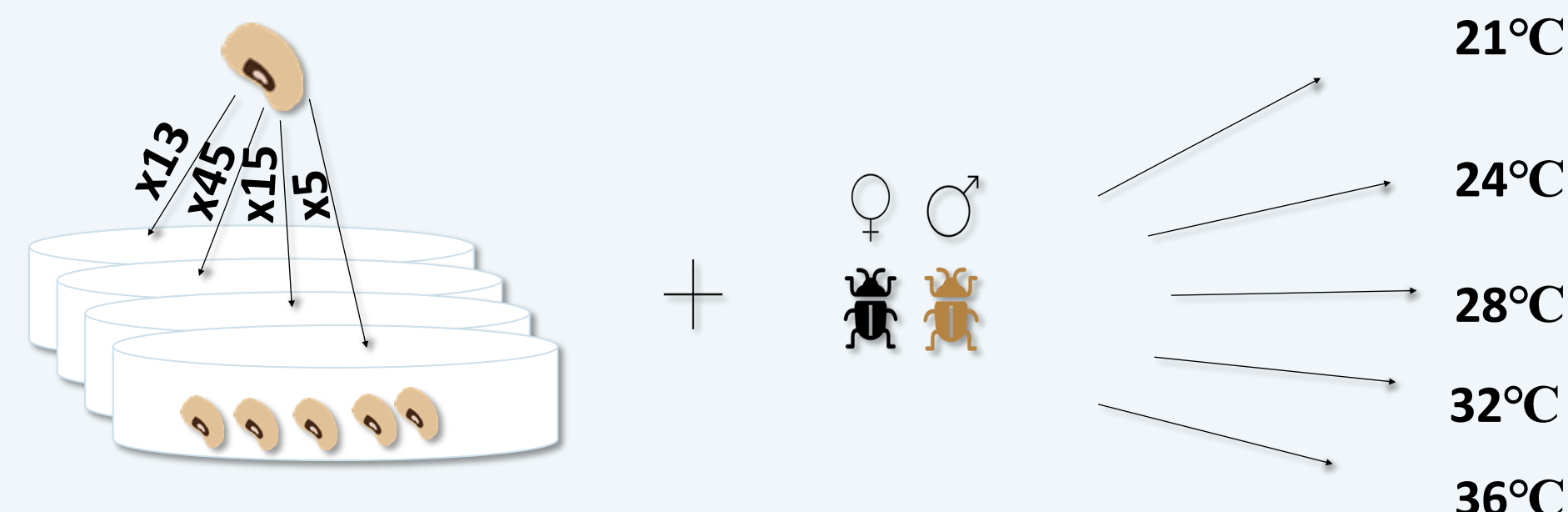


Figure 1. Experimental design. Four petri dishes containing different amounts of black eyed beans, one male and one female *Callosobruchus maculatus* specimen were put in to incubate at five different temperatures. Giving a total of 20 petri dishes.

