



Scared stiff: Effects of a nematode parasite on fearfulness in bess beetles

Anna Shattuck¹, Farran Smith², Andrew Davis²
¹Tulane University, ²University of Georgia



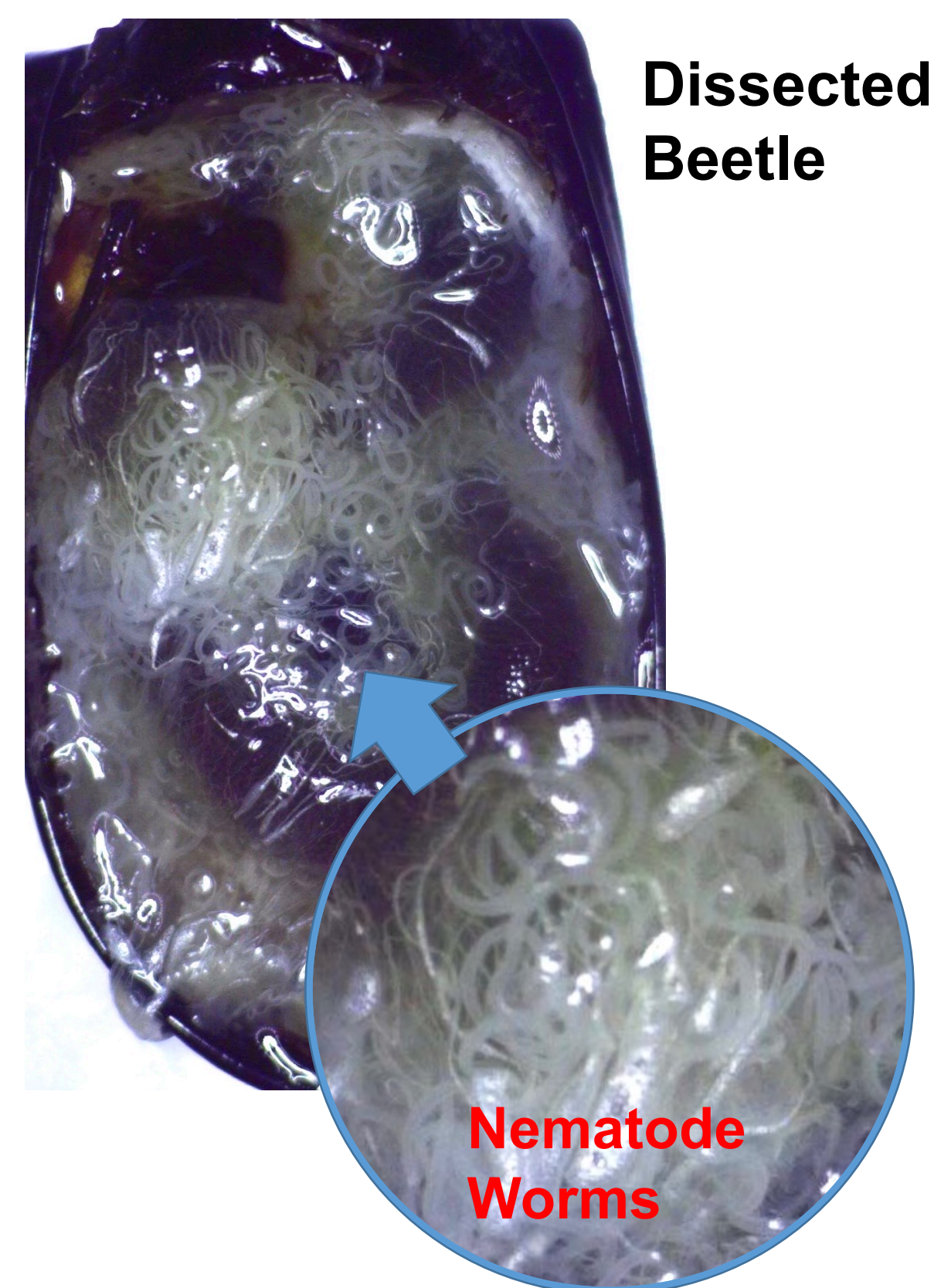
Anna Shattuck (*Homo sapiens*)

Background

- Freezing is a defensive behavior displayed by many animals when they encounter an extreme threat (a predator). There is little research on how parasites influence this behavior
- O. disjunctus* inhabits rotting hardwood logs throughout forests of the Eastern United States, and is commonly parasitized by a nematode, *Chondronema passali*, which inhabits the hemocoel cavity.
- Prior research in the Davis Lab showed parasitized beetles eat more and are more active, suggesting they are bolder, and may be less prone to freezing.

Methods

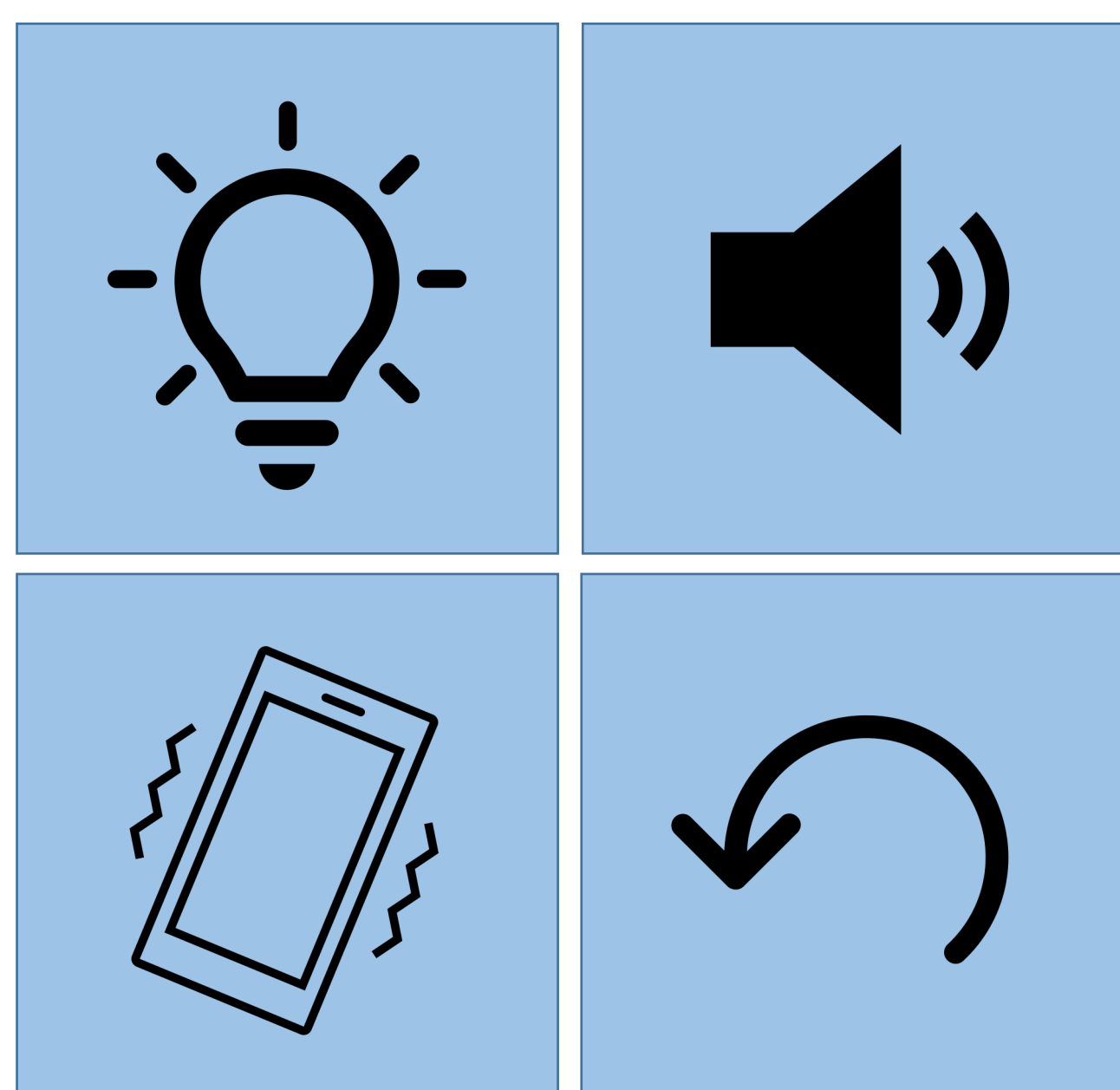
- The beetles were collected from various forested sites around Athens, Georgia.
- Over a 4-day period, each beetle was exposed to 4 different short-term stress treatments at random, and duration of freezing was recorded.
- After testing, each beetle was dissected to assess parasite load and sex.
- We used ANCOVA to examine how parasite load, sex, and body mass influenced duration of freezing.



Dissected Beetle

Nematode Worms

Stressors



The duration of freezing is defined as a period of time in which there is no body or leg movement.



Figure 1. Light exposure, sound exposure (banging), vibration, and disorientation (flipping beetle on its back) were used to induce freezing in the beetles.

Key Question: Do parasites influence fearfulness?

Our finding: Heavier parasite loads increase freezing durations in males and decrease freezing durations in females in response to a stressor. Freezing is a fearfulness indicator.

We were not expecting this sex difference!

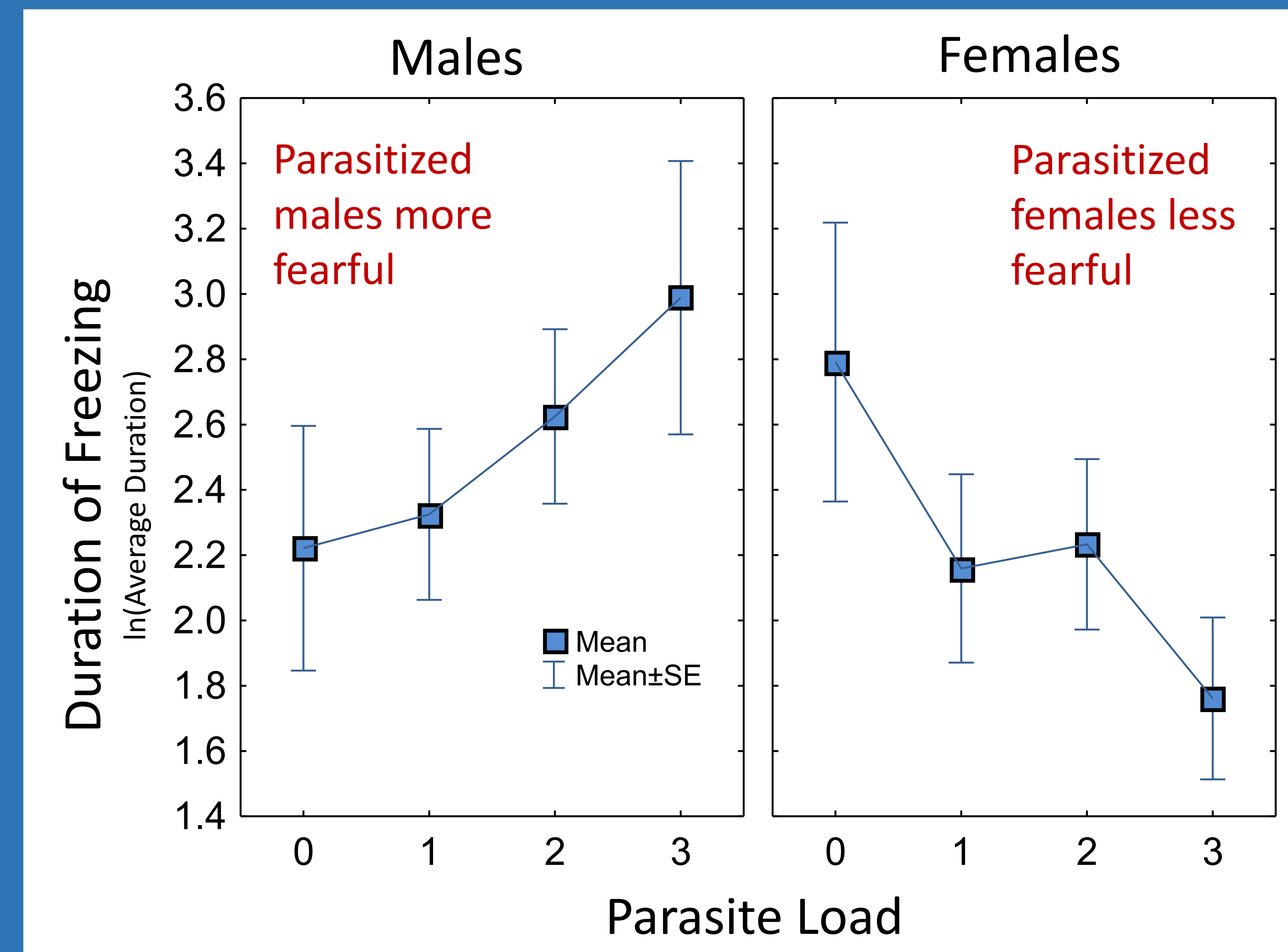


Figure 2. Average duration of freezing for *O. disjunctus* with different levels of parasite load.

Table 1. Example of nematode parasite rating scale used during dissections to determine parasite load.

Parasite Load	Worm Count
0	No Worms
1	1-10 Worms
2	11-100 Worms
3	100+ Worms

Results

- Of 161 beetles used across 4 freezing trials, 14% were unparasitized by *C. passali*.

Table 2. Sound and vibration induced the most freezing responses in the beetles while light induced the least.

Stressor	% of Beetles that Froze
Light	42%
Sound	67%
Vibration	67%
Disorientation	53%

- We suspected that females experienced greater energy depletion from parasites and egg laying, making them more motivated to move (forage). To test this idea, we conducted a follow up experiment below.

Follow up experiment examining effect of 2-day starvation

Table 3. Of the 22 beetles tested, all displayed freezing behavior before starvation. After being starved, only 4 beetles of the same 22 displayed freezing behavior (Chi-squared, $p < 0.001$). **Figure 3.** Photo of beetle in empty container for starvation trials.



(No food in container)

Result:	Freeze	Did Not Freeze
Before Starvation	22	0
After Starvation	4	18

Conclusions

- Parasites affect fearfulness, but not in a straightforward way.
- Female beetles might be less prone to stressors because they are hungrier.
- Fearfulness is tied to hunger and further investigation needs to be done to elucidate this relationship.

Acknowledgements

We thank the organizers of the REU program and the NSF for making this experience possible. A special thanks to our beetle collecting team and to our beetles. We want to acknowledge that this research was performed on the unceded, traditional, and ancestral territory of the Creek, Yuchi, and Cherokee Nations.



Scan Me →

Check out videos of beetles playing dead!



Odum School of Ecology
UNIVERSITY OF GEORGIA

