



Genetics and Light Affect Grouping Behavior in Red Flour Beetles

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Abstract

Although others may see beetles as pests, entomologists would say otherwise. These critters vary in sizes and can be found almost anywhere! Interaction amongst humans and animals within an environment can be pretty similar whether it is environmentally influenced or through genetic material. We often question if habits are done because of genes or because of what is going on around us. Although beetles do not seem interesting, they actually have their own way of socializing. Beetles do not really have the best vision, however they can socialize/communicate using pheromones. Chemical messages are chemicals integrated with behavior (Birch, 1976). Using red flour beetles from Manitoba, Canada (NDG) and Hudson, Kansas (Hudson) we can see how these beetles from two different areas interact amongst each other. Will there be a distinct isolation due to there strains and if so does this affect how they are within the same strain.

Purpose

The purpose of this research product is to analyze how beetles from two different strains interact amongst each other. After being placed in an enclosed environment with beetles from the same and different stage, we can further make conclusions.

Questions, Hypotheses, and Predictions

Question: Will these beetles be able to know that they are placed with a different strain? If so, will it affect their typical behavior?

Hypothesis: If the beetles are with each other long enough then they will end up being in clusters regardless of strain.

Prediction: The Hudson & NDG beetles will be with each other regardless since they are enclosed within the same environment

Study System

For This research we will be analyzing *Tribolium castaneum*, also known as the red flour beetle. They are approximately an 1/8 of an inch long following a brownish/red color with life spans of 3+ years. These beetles are found where grain is present where they are capable of colonizing food resources patches. Somewhere like the kitchen is a perfect place for these beetles to get all settled in & all forms of life cycle can be found in infested grain products. (Baldwin et al., 2003) From the Indo- Australian origin, when it is time for red flour beetles to reproduce it is mainly during a warmer time of the year but can also survive during the winter if in a protected area. (Smith and Whitman 1992). These fragile small insects have a mouthpart that is used for chewing so biting is nothing to worry of.

Methods and Experimental Design

Before conducting the experiment, Dr. Marshall allowed us to gain some practice by working with materials such as a petri dish, a very fine thin bristle and nail polish to paint the shell of the beetles so that we are able to distinguish the different strains. Once receiving sufficient practice, we were giving two different strains of beetles including NDG, and Hudson beetles. Starting off with a jar consisting of NDG, using a small piece of paper and petri dish approximately 20 beetles each were painted either teal or green and placed in separate petri dishes allowing them to properly dry.(Figure 1) The same was done for the Hudson beetles using the colors pink and yellow. The beetles of opposite strains were then placed into two mason jars (Figure 2) filled with blended crack wheat for a week allowing them to be in a enclosed environment so that they can adjust to being around the different strains.

After a week of allowing them to interact, there were three petri dishes with labels Trial1, Trial2, and Trial3. To ensure there were an even amount of beetles for each petri dish. The beetles that still had the paint visible were counted upon and then were averaged which can be found on table. During this part of the procedure, we would be able to record how the beetles interacted with either the same strain, the opposite, or a mixture.

Each group of beetles (pink, green, teal, and yellow) were placed evenly in the petri dishes.(Figure 3) Viewing how they were less active and in which groups they would be in, they were viewed early in the mornings no later than the 11 am. This allowed the observation to be much easier since they weren't as active in the morning.

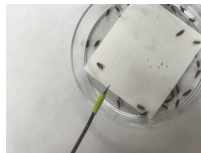


Figure 1



Figure 2

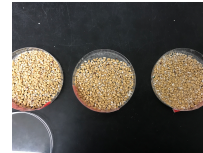


Figure 3

Results

Over the duration of the research, with observations being done early mornings, the minimal amount of cluster formed were two beetles. Within all three observations, it was recorded that the red flour beetles from Hudson, Kansas were the most active and displayed more locomotion than the NDG beetles once exposed to light. During the first observation, in all three trials, the beetles painted green (Hudson) were found in more than two colonies formed which was mainly consisted of teal beetles of the same strain. In the second observation the green and teal beetles were still the majority of the clusters however, there were at least 1 group of pink and green beetles in trials 1 and 2. The yellow was alongside a green beetle as well. In the 3rd observation, most of the colonies consisted of yellow beetles or green beetles.

Conclusions

After analyzing the results, I noticed that it was quite difficult to spot the pink or yellow beetles (Hudson) due to the fact that they were the most active. This made it difficult to see which group it had been resting with. The University of Florida's Entomology and Nematology research mentioned that the adults are attracted to light. There weren't any signs of movement when the petri dishes were slowly lifted but once placed on the microscope with some light exposure, the beetles showed excessive signs of movement. The NDG beetles were mainly together in the petri dishes and could be due to a chemical composition that isn't visible to the human eye.

Future Directions

If furthering on this research, some steps one would feel could be necessary is separating the beetles and only placing beetles of the same strain in petri dishes and seeing if they would form clusters regardless of genetic material or seeing if they would form with beetles of the same color. Having more beetles painted with the colors can help determine a more accurate grouping so incase a beetle is wondering there are more to be observed. Unfortunately because the light did play a role in their movement from rest, an option would be having the lab room with dim lights as well as lowering how bright the light is on the microscope.

References

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Acknowledgements

I thank Dr. Jeremy Marshall and Dr. Lindsey Hulbert for their help with this research project.