Inbreeding Affects on Beetle Clustering

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Abstract

The Red Flour Beetle *(Tribolium castaneum;* Coleoptera: Tenebrionidae) is a common pest in many grain mills (Baldwin and Fasulo 2010) and found wherever grains or other dried foods are stored (Schröder 2008). The Red Flour Beetle "facilitates genetic analysis with ease of culture, a short life cycle, high fecundity and facility for genetic crosses, allowing efficient genetic screens (Schröder 2008)." This can allow for them to have a strong genetic code the longer that they are bred in the lab. So, for this experiment we will be trying to see what affect inbreeding has on the aggregation behavior in the Red Flour Beetle. The purpose of this experiment is to see how genetic background influences grouping behavior. Two different strains of *Tribolium castaneum* were used in this experiment. The one strain used was the Hudson Red Flour Beetle which originates from Hudson, Kansas. They have been bred in the lab for 10 years. The other beetle that was used is the NDG Red Flour Beetle, which originates from Manitoba, Canada and has been in the lab 30 years. After completing this experiment, our findings are that the Hudson are considerably more light sensitive than the Hudson and as soon as light hit them they become very active. There was a noticeably higher percentage of NDG beetles that would cluster together and when they clustered they only clustered with their own strain. This leads us to believe that the NDG beetles have stronger aggregation behavior due to the significant amount of time they have been in lab breeding, compared to the Hudson beetle. The inbreeding that occurred might of allowed for the beetles to develop a more similar genetic code that allows them to group together more easily.

Questions, Hypotheses, and Predictions

Question: How will the beetles' clustering be affected by their genetic background?

Hypothesis: Since the NDG are more inbreed, they are more likely to cluster back together even after being separated for a certain amount of time.

Study System

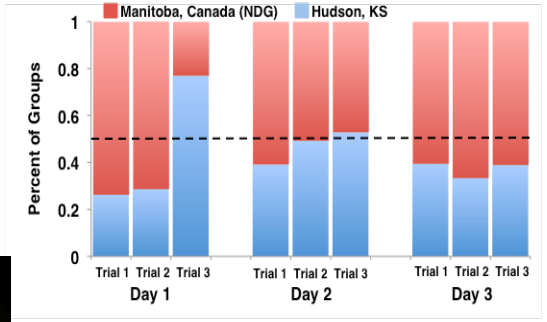
For this experiment, we used the Red Flour Beetle *(Tribolium castaneum;* Coleoptera: Tenebrionidae). This beetle originates from Indo-Australia and is often found in temperate areas all around the world. This is a hardy beetle that is known to survive cold winters if it has proper protected shelter. This is a small beetle that is about 1/8 of an inch long and although small, a healthy adult can live up to three years. The Red Flour Beetle is red-brown in color and its antennae ends in a three-segmented club. It also has wings that allow it to fly but they don't do so often. Red Flour Beetles feed on grain and are known to be a major pest in grain mills. These beetles are attracted to light and also like to cluster together.

Methods and Experimental Design

There will be two different strains of Red Flour Beetles *(Tribolium castaneum;* Coleoptera: Tenebrionidae) used in this experiment. The one strain used was the Hudson Red Flour Beetle which originates from Hudson, Kansas. They have been bred in the lab for approximately 10 years. The other beetle that was used was the NDG Red Flour Beetle *(Tribolium castaneum;* Coleoptera: Tenebrionidae), which originates from Manitoba, Canada and has been in the lab 30 years. First we will paint the bugs with nail polish. A group of NDG will be painted pink and another group will be painted teal. The other two groups will be of the Hudson and they will be painted orange and white. This will allow us to be able to differentiate which bugs are cluster together. After painting them, they will be separated into two groups, where they will stay together for two weeks to acclimate in large jars. Once the two weeks is up, we will separate the bugs into three petri dishes so that there is 12 of each color in each dish. After two days we evaluated how the bugs are behaving and clustering with each other for three alternating mornings. After observing the beetles we found that the NDG beetles were more likely to cluster together than the Hudson beetles. Also the Hudson beetles were much more active than the NDG beetles especially once light hit the petri dish. After noticing that the Hudson were so light sensitive we started observing them a little without the microscope to see if they were clustering at all.

Results

From this experiment we found that the NDG have a stronger aggregation behavior due to their extended amount of time in lab. This allows for them to have a more similar genetic code from inbreeding. We also found that the Hudson Beetle is significantly more light sensitive and when light hits it, it becomes very active.



Conclusions

After completing the experiment we have concluded that increased genetic similarity due to inbreeding may increase the aggregation behavior in this species. This means that genetic background likely plays a role in behavior and management.

Future Directions

The future direction of this project could be doing this in a larger scale, so more bugs and with a larger environment. My hope with doing this would show how accurate my findings are and see if the trends change or stay the same as we make population larger and environment larger. I also would like to see if I could figure out what causes the Hudson beetles to be so much more light sensitive than the NDG beetles and if the NDG beetle become more active if exposed to light for longer periods of light. Learning this could help with how to create new pesticides that are more effective on these beetles. After doing research on the red flour beetle I found that they have a lot of drug resistances and it is difficult to get rid of them. So, knowing their behavior and ways to prevent resistances in them, could help with getting rid of pest infestations of this beetle. So things that I would change is I would use a different nail polish or substance to tag the bugs. A lot of the bugs rubbed off their nail polish and some even were weakened by the nail polish being on them. Something else I would of done differently is taken data on clusters in the morning before light had hit the petri dish and clusters in the morning after light had hit the petri dish. That way I could get the most accurate data on who was clustering with who.

References

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