Genetic Effects Influence Grouping Behavior in Beetles

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Abstract

We studied the behavioral patterns of Red Flour Beetles. They are a common pest of stored grain products. This experiment tested the grouping behavior of two strains of Red Flour Beetle to see if observed grouping behavior could have a genetic or environmental influence. We hypothesized that if different strains were closely associated for two weeks their environment would encourage them to demonstrate grouping behavior together. When observing the specimens we could not confirm the hypothesis. Beetles of the same line tended to group together while unrelated individuals did not tend to associate even after two weeks in the same jar. For these two strains, an environmental affect on grouping is not supported. This could potentially be used in further research on effective control methods and how to tailor them to specific strains.

Purpose

The purpose of this research was to investigate the environmental and genetic influences on grouping behavior in Red Flour Beetles.

Questions, Hypotheses, and Predictions

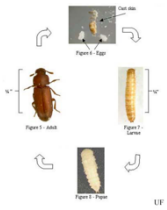
Question: Does environment or genetics effect grouping behavior more?

Hypothesis: If two strains of Red Flour Beetle are housed in jars together their environment will encourage inter-strain grouping behavior.

Prediction: The close association of the environment will have more of and effect on grouping behavior than genetics.

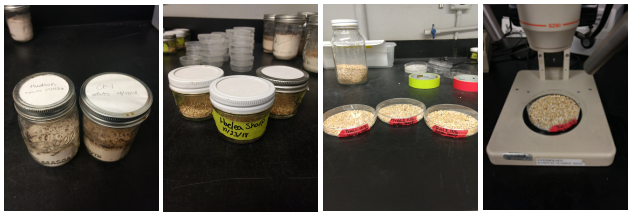
Study System

Tribolium castaneum, also known as the Red Flour Beetle, is a type of darkling beetle known for its status as a world wide pest. It commonly infests stored product such as flour, nuts, spices, and dried dog food. It prefers temperate environments but is hardy enough to survive cold winters in protected areas. It is spread worldwide and in America is more prominent in Southern areas. Adults grow to ⅛ of an inch. They may breed year round in warm temperatures. Their life cycle is 40-90 days with adults living up to three years. Eggs are microscopic and hatch in 5-12 days to begin feeding on whatever food they were laid in. Larva mature over 30-120 days from white pupae.



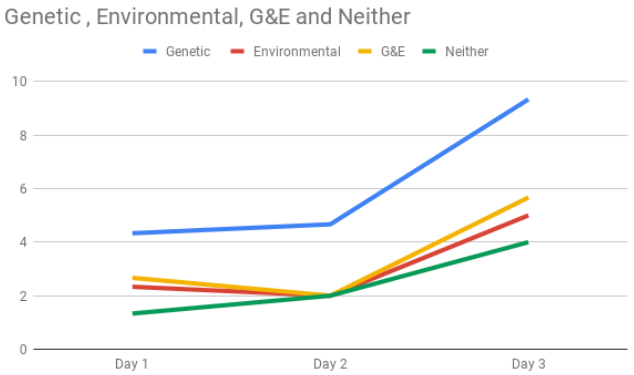
Methods and Experimental Design

Two strains of *Tribolium castaneum,* CR-2 (Costa Rica) and Hudson (Kansas), were separated into four groups. Two groups contained CR-1 and were painted with nail polish, one group was painted magenta the second was painted Teal. The third and fourth groups contained Hudson and were painted orange and white respectively. Two mason jars were filled with wheat and labeled A and B. Jar A contained a mixture of Hudson and CR-1 painted orange and teal. Jar B contained magenta and white painted individuals. They were left for two weeks to live in close association. On November 5 three petri dishes were prepared with a single layer of wheat. The jars were emptied and all beetles were separated by color. Six of each color was placed in each dish. November 6 8am: All three trials were inspected under a dissection microscope to investigate grouping behavior of the beetles. Nail polish colors of grouped individuals were noted. This was repeated on November 7th and 9th.



Results

From Day 1 groups tended to be more influenced by genetics. After day 2, the average number of associations became much larger. As the graph below shows, genetic effects were the main cause of group structure.



Conclusions

These data show that Hudson and CR-1 strains were unaffected by their environment and continued to tend to group with their own kind and not with each other. This information could be useful in determining how to better control these insects with attractants. The Hudson strain was particularly active in the mornings when groups were counted, eventhough most starins tend to be inactive during the morning.

Future Directions

I have a few questions that would require more research. Researching how these strains interact with other strains to confirm that genetics are a stronger factor in the grouping for a majority of the strains. If that is the case I would be interested in studying the differences in their genetics more closely. If strains become resistant to insecticides, genetically tailored control measures may be our next line of defense.

References

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