



# Effects of Genetic and Environmental Factors on Aggregation Behaviors of Red Flour Beetles

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## Introduction

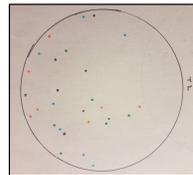
- Red Flour Beetles (*Tribolium castaneum*; Coleoptera: Tenebrionidae), are often used for ethological and food safety research due to an adept ability to colonize food sources.
- Red Flour Beetles and their relatives are a worldwide pest of stored products such as grains and are considered the most common secondary pests of all stored plant commodities throughout the world by the United Nations.
- Red Flour Beetles can live up to 3 years reproducing in a polygamous manner and can disperse through flight or cursorial movement.
- Important factors such as genetic makeup and interaction with the environment most certainly affect the beetles reproductive, colonizing, and feeding behaviors.
- The effects of these factors on the aggregational behaviors of these beetles is however extremely unexplored, and much more research is needed to better understand these important interactions.

## Objective

To determine the effects of genetic and environmental factors on aggregation behaviors of the Red Flour Beetle.

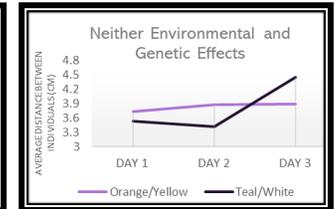
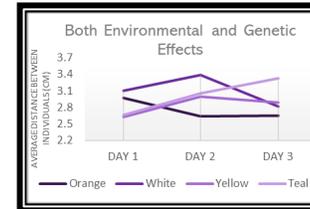
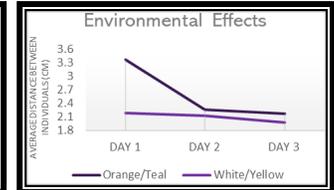
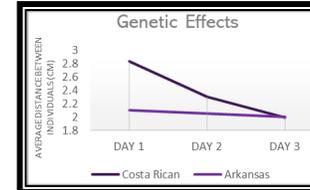
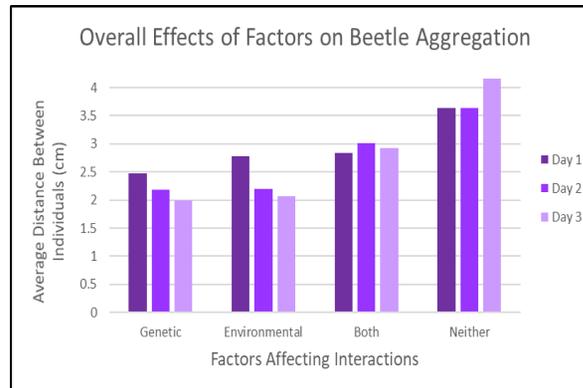
## Methods

- Two different genetic strains of beetles were used for this experiment labeled as CR-1 and Arkansas.
- These two different strains were assigned two colors each.
  - CR-1 → Orange/White
  - Arkansas → Yellow/Teal
- 25 beetles of each color in each genetic strain were streaked with nail polish of the perspective color for a total of 100 beetles painted.
- The beetles were then split from their genetic strains and put into two separate jars for approximately a two-week period.
  - Jar A → Orange/Teal
  - Jar B → White/Yellow
- After this two-week period, the beetles were separated by color and 7 beetles were selected from each color and put into a petri dish
- This process was repeated for two more dishes creating 3 dishes total, or 3 trials, with 28 beetles in each dish having 7 of each of the four colors.
- After 24 hours the petri dish size was mapped out and the beetle's location was tracked using visual identification and a marking technique over a 3-day period.
- The mapped location of each trials beetles on each day was then measured with a ruler.
  - 10 measurements of each category were taken.
  - Categories were separated into genetic connections (orange-white/yellow-teal) environmental connections (orange-teal/white-yellow), a combination of the two, or neither.



Day	Genetic	Environmental	Both	Neither
Day 1	2.5	2.2	2.8	3.6
Day 2	2.2	2.0	2.8	3.6
Day 3	2.0	2.0	2.9	4.1

## Results



## Conclusion and Future Directions

- In conclusion, trends were seen in relation to genetic and environmental factors on the red flour beetle's aggregational habits.
- Over the three-day period that the distances were tracked the beetles are seen becoming more aggregated with smaller measurements being recorded.
- Both genetic and environment had significantly less distance between individual beetles then neither factors signifying that they were in fact impactful and random dispersal was not happening.
- For future experiments two vital pieces would improve results and strengthen the conclusions made in this lab.
  - More beetles to increase the sample size, ideally an example sample size would be 120 beetles meaning that 40 of each color of beetles would be put into each petri dish.
  - The experiment would be carried out for 14 days to obtain a greater amount of measurements to analyze the effects more outstandingly.
- Different directions with this experiment include:
  - Developing or using a food safe chemical compound to test aversion levels using the same distance tracking method.
  - Using a different genetic strain of beetle to test differences and variability.
  - Running the experiment in a larger area or possibly using a different environment to better understand the levels of distance in relation to the aggregational behaviors.
  - Mimicking natural pheromones to attempt to disrupt reproductive habits of the beetles.

## Acknowledgements and References

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