



Survival Rate of *Tribolium* Beetles When Exposed to Extreme Diets

Nathan Stewart^{1,2} and Jeremy Marshall¹

¹Department of Entomology, College of Agriculture, Kansas State University

²Department of Agronomy, College of Agriculture, Kansas State University



Abstract

This research project was set up to determine the suitability of two extreme diets. Since this experiment only used basic extremes, some of the data were already known, or assumed, such as that a flour beetle can survive on a diet of wheat flour (Imura, 1991). In more detailed experiments on this subject, artificial diets can be made for more accurate data, as well as temperature regulation (Romo, 2016). Diet formulation for flour beetles is largely assumed to be just flour. However, the exact components of the diet, such as protein, carbohydrates, fatty acids, and other factors are never really taken into consideration unless testing exact diets specifically. By testing different levels of these factors in diets, we can raise beetles for testing more efficiently (Maner, 2013). I would like to see if any beetles will survive off of a food with no nutritional value, and if there will be enough nutrition for the beetles to start reproduction in any of the jars. This experiment showed that having nutritious food allows for greater survival than a food with no nutritional value. The small amount of good nutrients even allows for the start of reproduction of the beetles, while none was observed in the poor diet. The results from this experiment show the extremes of insect diets, and that it is important to create a good diet formula to ensure the proper growth and development of experimental insect colonies. By continuing testing of different diets, the process of rearing insects can become much more efficient.

Purpose

The purpose of this experiment was to show a basic difference in survival of *Tribolium* beetles when fed diets on the extremes of nutritional needs.

Questions, Hypotheses, and Predictions

Question: Will there still be beetles that are alive in the poor food source? Will there be any larvae in any of the samples?

Hypothesis: I believe that the samples with the good food will have a significantly higher survival rate than the samples with the poor feed.

Prediction: Based on the fact that the bad food has little to no nutritional value to sustain the beetle population, while the good food has enough nutritional value to support the population; therefore the good food will have more surviving beetles.

Study System

This project was built around flour beetles, or *tribolium* beetles. These beetles are found in flour. The beetles have the basic parts of most beetles, a head, abdomen, and thorax. However, these beetles rarely fly. The beetles are brown or brownish-red and are very tiny.

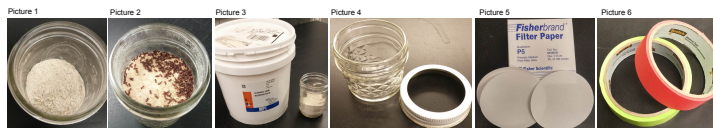


Methods and Experimental Design

At the start of this experiment, 6 small jam jars, with accompanying lids and filter papers, two different beetle foods, and flour beetles were obtained. One diet consisted of brown wheat with added yeast, and the second diet was Alphacel. The jars were separated into two sets of three for each diet and labeled Good Food 1-3 or Alphacel 1-3. After the jars were labeled, approximately 1 tsp of food was added to each jar, two large pinches and one small pinch. Twenty adult beetles were then added to each of the 6 jars. The jars were then covered with a filter paper, closed, then left alone for ~ 4 weeks. After the four weeks went by, the jars were opened, and the living beetles counted, and the data recorded.

Materials Used

- Picture 1: Amount of food used
- Picture 2: Adult Beetles
- Picture 3: The two foods used in the experiment
- Picture 4: Small jar and lid ring used for experiment
- Picture 5: Filter paper used as an air permeable jar cover
- Picture 6: Colored tapes used to label the different experiments



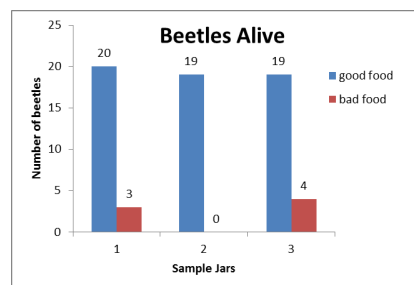
Procedural Steps

- Picture 7: Removal and transfer of beetles from rearing jar
- Picture 8: Completed jars
- Picture 9: Completed experimental set up



Results

The data recorded shows that the jars with the nutritious food had the higher rate of survival compared to the non-nutritious food ($t_2=13.63, df=4, P=0.000168$). Some larvae were found in all of the good food jars, but were not counted. No larvae were found in the Alphacel jars.



Conclusions

From the data recorded, it is apparent that when fed a nutritious diet, the flour beetles have a greater chance to survive and even reproduce. While there is a higher rate of survival with nutritious food, there was still some survival in the non-nutritious food. This is different than what was expected to happen. However, it is entirely possible that the beetles died soon after the data were taken, or that they had survived by eating parts of the other beetles in the jar with them, thus surviving for as long as they did without nutrients. This is important as it shows that organisms need certain nutrients to be present for consumption in order to survive.

Future Directions

If I were to repeat this experiment, I would run the same test with more diets at varying levels of nutrients, as this would show what nutrients are necessary in what quantity or quality, as opposed to the extremes of nutrients or no nutrients, which was what this experiment was. I would also like to extend the amount of time from the start of the experiment, and take more data from the length of time. This would allow for data to be taken from the same amount of time, as well as data from the next generation of beetles. Data from the next generation could be used to determine if nutrient requirements for adult beetles is different from beetle larvae.

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