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# Fruit Fly (*Drosophila melanogaster*) Preferences for Different Kinds of Fruits

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This exercise investigates the fruit fly's preference for certain fruits. The fruit used to start the population of fruit flies can be modified to any fruit the student wishes. I normally recommend pineapple as the fruit to start the population of fruit flies as fruit flies seem to infest acid fruits more than non-acid fruits. All the fruits used in this experiment are available all year round in south Texas. This exercise was designed for majors and non-majors as well as for first-semester general biology students, who have had little experience in lab or in writing a lab report. This exercise prepares students to analyze a complex lab problem, write a formal lab report, interpret data, and make graphs.

**Keywords**: rearing fruit flies, fruit fly preferences, fruit fly behavior

## Introduction

One of the most interesting parts of this exercise is that, though time-consuming to set up, it takes no specialized equipment. Preparation for the lab starts with beginning the fruit fly population or main colony. This will take 5 to 7 days; less time if the temperatures are warm.

Students who partake in this experiment generally do not have well developed laboratory skills; for some this is their first exercise in collecting and interpreting quantitative data. While I provide the students with a plausible hypothesis, the introductory remarks can be modified to allow students the opportunity to choose their own hypothesis and determine what measurements they wish to make. If time and space are available, students may modify the experiment; choose their own fruits; and take responsibility for growing and maintaining the fruit fly population themselves. The experimental design of this exercise is extremely adaptable and simple.

Fruit flies commonly develop in overripe or decaying fruit and vegetable matter. They are minute, light brown flies with orange-red eyes and rarely are they found very far from the fruit bowl. Populations tend to build in late summer and they it is easy to breed them indoors.

Although associated with fruits, fruit flies also feed on yeasts. Feeding sites includes the moist residue that remains in the bottom of beer bottles or soft drink cans, as well as in other areas where moist organic matter allows for yeast growth.

# Student Outline

## Preference of Fruit Flies for Different Fruits

*Objective*

The student will develop a better understanding of the behavior of fruit flies and their choice of preferred fruits. This experiment will also introduce the student to the scientific method and how to conduct research and analyze the data, write up a simple report, and make graphs.

This experiment will provide an opportunity to help students understand how to conduct scientific research in behavioral biology. It will demonstrate the importance of sampling in biological research.

*Materials and Methods*

A suitable approach involves preparing a growth chamber for the rearing of fruit flies (Fig. 1). To start the fruit fly population students will need to place an overripe fruit in the rearing chamber and expose it to the fruit fly and after a few days (approximately 5) the fruit will become infected with larvae of the fruit fly. Once a population of flies has been developed, different types of ripe fruits (e.g. half of a mango, papaya, pineapple, grapefruit, or tomatoes) will be placed in the rearing chamber. The different fruits constitute the treatments that will be used to run an analysis of variance (ANOVA). After about 3-5 days (the longer the better, but not to exceed 7 days) the fruits will be removed and placed in individual rearing chambers (Fig. 2). As the fruit flies emerge they will be trapped in the glass vial at the top of the individual rearing chamber. These chambers will be checked daily at around the same time and the number of flies that emerge will be counted and recorded for each chamber to determine how many flies have emerged from each different fruit.

The use of four or more types of fruits should enable a conclusion to be drawn about the fruit most preferred by the fruit flies. However, within each type of fruit there will be differences arising from variables that cannot be controlled.

In smaller samples, these differences may mask the effect of the concentration of sugar or the acidity of the fruit used.


**Figure 1.** Preparation of the rearing chamber.

*Procedure*

1. Five to seven days before the laboratory assignment, obtain any type of ripened fruit, (e.g. mangos, papayas, grapefruits or pineapples). (The lab assistant will help you get started.)
2. Prepare a rearing chamber (a cardboard box of 2' x 3' x 1' as shown in Fig. 1) and place half an overripe pineapple in the box and let it stand for three to five days prior to initiation of the laboratory assignment. The ripened fruit will attract the fruit flies. (Vinegar or beer will also attract fruit flies).
3. After three to five days (depending on the number of fruit flies you see flying over the fruit), cover the box with a mesh net to keep the flies in the rearing chamber (box). (Do not allow the flies to escape.)

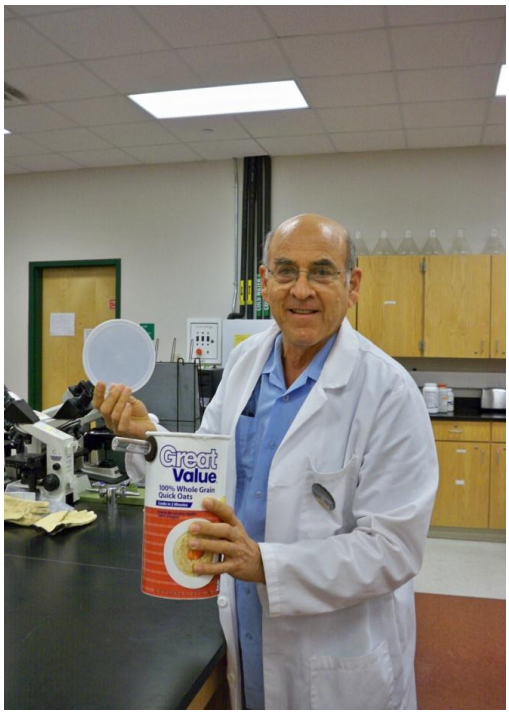


**Figure 2.** Preparation of individual rearing chambers

4. Remove the pineapple and place the different types of over-ripened fruits in halves or cut into sections to expose the fleshy tissues (e.g. mango, papaya, pineapple, half a grapefruit or half an orange, etc). Place the fruit sections in the inside of the rearing chamber and let the fruit flies lay eggs on the different types of fruits for at least 48 hours.
5. After two to three days (the longer you leave the fruits in the rearing chamber the more flies you will have), remove the fruits and place each different fruit (e.g. mongo, papaya, grapefruit, orange, etc) in an individual rearing container with the glass vial placed on top. (An empty two lb oatmeal round container is perfect for this project as seen in Fig. 2)
6. When the adult fruit flies emerge from the fruits, they will be attracted to the light source coming from the glass vial and will enter the vial.
7. Take daily counts of the number of fruit flies in each type of fruit, after doing so, dispose of the flies. (Always do this at about the same time of day.)
8. Make a graph of the emergence of the fruit flies for each type of fruit for at least five to seven days.
9. Do an analysis of variance on the emergence of the fruit flies using the fruits as treatments and sampling dates as replications.
10. If data is significant, do a Multiple Range Test on the ANOVA to determine which fruits are more preferred by the fruit flies.
11. Write up a technical report on the experiment including the following sections: Title, Introduction, Literature Review, Materials and Methods, Results, and Conclusions.

*Results*

Actual results of this laboratory assignment using pineapple as the original source for the fruit fly infestation was obtained during the spring 2010 semester at South Texas College, at McAllen, Texas and is presented in Table 1.

*Analysis of the Data*

Table 2 and Fig. 3 show the actual ANOVA conducted with the raw data. As can be seen there was significant differences in emergence of fruit flies among the various fruits used in the experiment.

The results of the ANOVA were then use to run a multiple range test on the different fruits which indicated that the results from grapefruit and mango substrates were different from those obtained from the papaya and the tomato (Table 3).

**Table 1.** Number of Fruit Flies that Emerged from Different Fruits during 7 Days after Infestation.

| Days Sampled | Mango | Papaya | Grapefruit | Tomato |
|---|---|---|---|---|
| 1 | 0 | 2 | 3 | 0 |
| 2 | 3 | 1 | 6 | 0 |
| 3 | 6 | 4 | 9 | 3 |
| 4 | 9 | 6 | 8 | 6 |
| 5 | 10 | 5 | 10 | 8 |
| 6 | 5 | 2 | 4 | 0 |
| 7 | 2 | 0 | 1 | 0 |

**Table 2**. Analysis of Variation.

| Source of Variation | Degrees of Freedom | Sum of Squares | Mean Squares | F table |
|---|---|---|---|---|
| Treatments | 3 | 66.71429 | 22.2381 | 8.1217** |
| Blocks | 6 | 228.71429 | 38.11905 | 13.9217** |
| Error | 18 | 49.28571 | 2.73806 | |
| Total | 27 | 344.71426 | | |
| CV 19.26% | | | | |

**Table 3.** Results of the Multiple Range Test (Fisher's F-Test)

| Fruits | Means |
|---|---|
| Grapefruit | 6.14 a |
| Mango | 5.29 a |
| Papaya | 3.00 b |
| Tomato | 2.43 b |

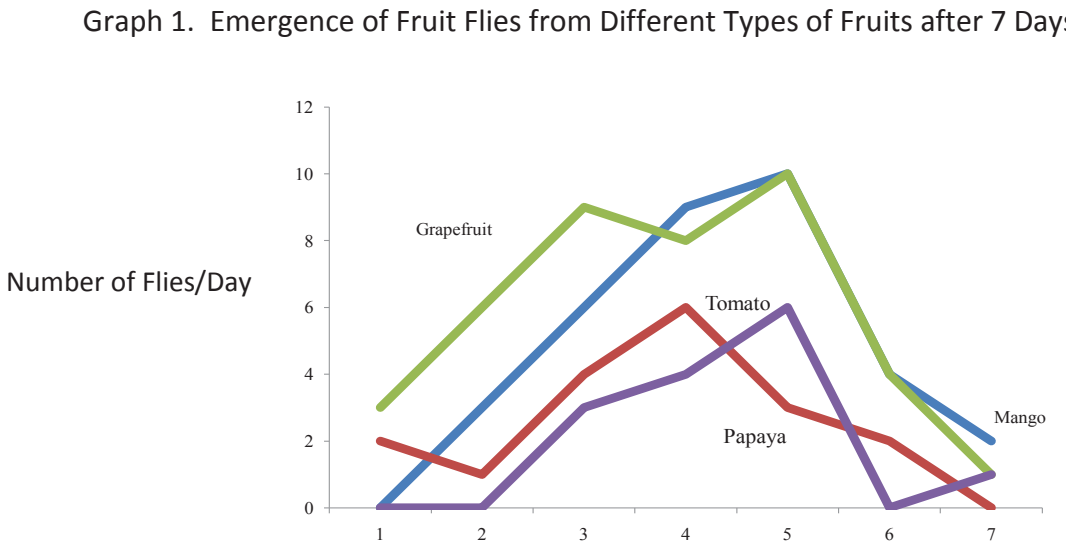


**Figure 3.** Emergence of Fruit Flies from Different Types of Fruits after 7 Days

## Notes for the Instructor

Approximate cost per student is 20 cents (US).

The following are suggested modifications to the laboratory assignment received after the presentation of this mini-workshop at the ABLE conference in June 2011 at New Mexico State University, Las Cruces NM:

1. Have students test only one fruit at a time. Compare the fruit tested to the original fruit used to start the fruit fly population to see if there is a difference between the two fruits.
2. Instead of using dates of samples as the replications, have four students use the same fruit type and then use these data as four replications. Have other students use a different fruit for their experiment and also perform four replications.

## Acknowledgements

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## About the Authors

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