

SPOTS ON THE WHITE PICKET FENCE?

OBJECTIVE(S):

1. Determine if house flies can feed on gelatin of various colors.
2. If flies feed on gelatin of various colors, could they be responsible for the discoloration of the white picket fence?

ARKANSAS SCIENCE CURRICULUM FRAMEWORKS:

Grades 7-8

Strand 1: Nature of Science-

- Standard 1: Characteristics and processes of science.
- N.S.1.7.1. Interpret evidence based on observation.
- N.S.1.7.2. Analyze components of experimental design used to produce evidence.
- N.S.1.7.4. Construct and interpret scientific data using graphs.
- N.S.1.7.5. Communicate results and conclusions from scientific inquiry.
- N.S.1.8.3. Formulate a testable problem using experimental design.
- N.S.1.8.5. Suggest solutions to real world problems by analyzing scientific data.
- N.S.1.8.6. Formulate inferences based on scientific data.
- N.S.1.8.7. Communicate results and conclusions from scientific inquiry.

Grades 9-12

Strand: Nature of Science-

- Standard 10: Students shall demonstrate an understanding that science is a way of knowing.
- NS.10.B.4 Summarize the guidelines of science:
- *explanations* are based on observations, evidence, and testing
 - *hypotheses* must be testable
 - understandings and/or conclusions may change with additional empirical data
- Standard 11: Students shall design and safely conduct scientific inquiry.
- NS.11.B.1 Develop and explain the appropriate procedure, controls, and variables (dependent and independent) in scientific experimentation.

- NS.11.B.4 Gather and analyze data using appropriate summary statistics.
- NS.11.B.5 Formulate valid conclusions without bias.
- NS.11.B.6 Communicate experimental results using appropriate reports, figures, and tables.

NATIONAL SCIENCE EDUCATION STANDARDS:

Content Standards, Grades 5-8, Grades 9-12

Science As Inquiry

Abilities necessary to do scientific inquiry.
Understanding about scientific inquiry.

History and Nature of Science

Nature of science.

SCIENCE PROCESS SKILLS:

Observations will be made by students.

Inquiry and hypothesis testing.

Data will be collected (counting fly specks).

Students will analyze their results (organization).

Conclusions will be made (inferring, interpretation, communication).

INTRODUCTION (CONTENT/BACKGROUND):

Flies belonging to the family Muscidae are often referred to as **SYNANTHROPIC** flies since they often are in close association with humans. They exploit foods and habitat created by agriculture and other human activities. One important fly species is the house fly, *Musca domestica* L. (fig. 1). It can breed in latrines, household garbage, manure and animal bedding.

Flies feed freely on human food and are often pests at picnics. Flies have **SPONGING MOUTHPARTS**. To feed, they open their **LABELLA** and press it against the substrate. If food is not liquid, the fly releases saliva (enzymes). By repeatedly opening and closing their labella, solid foods liquefy. The suspension is drawn up into the mouthparts by the **PSEUDOTRACHEA**. A **CIBARIAL PUMP** inside the head sucks up the liquid.

Since flies only take in liquid food, they defecate and vomit frequently when they land on surfaces. They will leave fecal and vomit spots, a common indicator of fly activity.

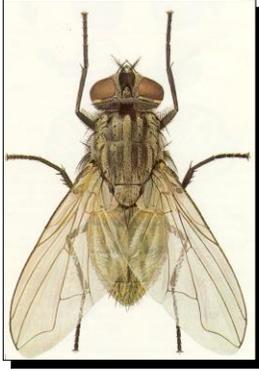


Fig. 1. An adult house fly (Axtel 1981).

MATERIALS LIST:

(Each group)

House flies (can be purchased from Carolina Biological Supply).
4 Petri dishes (three containing gelatin, one empty)
Gelatin – various colors [red (works best), purple, green and blue].
Filter paper to fit the Petri dishes
Sharpies
2 Gel ice packs (frozen)
Forceps

House flies can be purchased from Carolina Biological Supply, Inc. When you receive flies from the company, they will be in the pupal stage (the stage before adult).

IMPORTANT: You will not be able to do this experiment on the day you receive your shipment from Carolina Biological Supply (unless you order adult flies). Allow for approximately 5 days for your flies to emerge into adults. Place the pupae in a dish and place the dish in a cage that is well ventilated. Pupae do not need food since they do not feed. Flies should emerge into adults in about 3 days.

Once adults emerge, you will have to keep them alive. Feed them sugar (one Petri dish full) and place a cup of water (~8 oz) (with a paper towel placed in the cup). The paper towel will prevent the flies from drowning. When you are ready to do this experiment, place the flies in a freezer for 5 minutes to allow the flies to slow down. This way you can transfer flies to smaller dishes.

PROCEDURES:

1. Two days before the experiment, prepare the gelatin. The gelatin must be made ahead of time to allow a proper set and dryness. Make the gelatin as according to the directions on the box. But make the recipe by decreasing the amount of water.

2. Gelatin recipe (jigglers): Add 150 ml of hot water to one box of gelatin (your favorite flavor: cherry, lime, orange or color of your choice).
3. Pour the dissolved gelatin into the bottom of Petri dishes. Let stand for two days before you do this experiment. Leave uncovered to increase drying. You want to have the gelatin be relatively hard and not wet.
4. If the gelatin is prepared for you, start here. You should have 2 Petri dishes in front of you. One Petri dish will have the various colors of gelatin. The second dish will be empty. In the Empty dish, place a clean, unmarked filter paper into the dish.
5. Each group will receive a dish containing approximately 15 flies. Set the dish containing the flies on one of the ice packs. Place the other ice pack on top of this dish. After about 5 minutes, you should see the flies slowing down (not flying, slow movements).
6. As soon as the flies look dead (they are still alive, but have slowed down their metabolism), place the flies (carefully using forceps or your fingers) into the dish containing the gelatin (best to grab them by their wings). Make sure you place the top back on the Petri dish to prevent the flies from escaping. An elastic band placed around the dish works well to prevent flies from escaping.
7. Within a few minutes, the flies should be active again, feeding on the gelatin. These flies have been deprived of sugar for the last 24 hours, making them extra hungry!! You should notice them feeding on the gelatin within a few minutes.
8. Place the dish at room temperature for 12 – 24 hours allowing the flies to feed on the gelatin.
9. After 12-24 hours, place the Petri dish containing the flies on the frozen gel packs. Let the flies cool down. Once they have slowed down and do not fly, place them into the Petri dish containing the filter paper.
10. Allow flies to defecate and vomit for 12-24 hours.
11. After 12-24 hours, examine the filter paper and answer the key questions below.

KEY QUESTIONS:

1. What colors are the fecal and vomit spots?
2. How many spots were made?

3. On average, how many spots did each fly make?
4. How many spots were made per hour?
5. What color of gelatin works best for this experiment?
6. Could flies be responsible for the multi-colored spots on the fence?

EVALUATION/ASSESSMENT:

Observations will be made by students.

Students will make clear observations of the problem at hand.

Inquiry and hypothesis testing.

Students will provide a set of hypotheses for the problem at hand.

Data will be collected (measuring, graphing).

Students will follow instructions.

Students were successful with creating their gels and standard curves.

Students will analyze their results (organization).

Students will answer the above questions.

Conclusions will be made (inferring, interpretation, communication).

Students will be able to determine if flies were responsible for the multi-colored spots on the picket fence.