An Ask A Biologist Activity for at Home or in the Classroom

Written by David W. Shanafelt
Illustrated by Sabine Deviche

Contents

About the Author

Dr. David W. Shanafelt is a researcher at the National Research Institute for Agriculture, Food, and the Environment (INRAE), one of national research organizations in France. He works on problems in ecology and economics, including the management of natural resources, ecosystem services, and forests.

Fly Trapping Trials

askabiologist.asu.edu/experiments/fly-trapping-trials

Experiment Overview

Have you ever seen small black flies buzzing around your houseplants and wondered what they were? These are most likely fungus gnats (also known as fungus flies). They're not harmful to humans or pets, but they can be super annoying, especially when there's a lot of them. In this experiment, you will be using different kinds of liquid traps to catch fungus gnats and to test whether certain kinds of traps work better than others.

Fungus gnats are tiny insects (about 1/8th of an inch long) in the genus Bradysia. They look like fruit flies, but they're not the same. Fungus gnats reproduce in the moist topsoil of houseplants. It takes three to four weeks for them to complete their life cycle from egg to larvae to pupae to adult. The larvae feed on the fungi, algae, decomposing plant matter, roots, and leaves on the soil surface and in the top layer of soil.

Fungus gnats are not dangerous to people or pets - they don't carry or spread diseases. But they can be annoying when they buzz around your house. When there are a lot of them, fungus gnats can also hurt the growth of your plants, especially young houseplants that are not big enough to handle larvae feeding on their roots.

There are many different ways to catch and kill fungus gnats. One technique is to use liquid traps. The goal is to lower the gnat population. But there are many different types of liquid traps. Is one better than the others? Let's find out!

Materials

- Several small jars or open containers
- A small spoon
- Dish soap
- Sugar
- Vinegar, lemon juice, and any other liquids that might "smell tasty" to fungus gnats
- A research notebook or the experiment worksheets

Procedure

Before you begin

We will be running an experiment to test how different traps work to catch fungus gnats. To do this, we will set out traps near spots where fungus gnats live and count how many are caught per day in each trap. You will use your scientific notebook to record everything about the experiment such as how it is set up, what you think will happen, what you find, and how you could change the experiment in the future. If you don't have a scientific notebook, that's ok! We have a worksheet for you to fill out instead.

Step 1: Find a field site. For this, you'll need to find a spot where fungus gnats live. Fungus gnats reproduce in the moist topsoil of indoor plants, so check around your plants. Describe your field site in your research notebook.

Step 2: Set up the treatment traps. Fill all but one of the jars ½ full of vinegar, lemon juice, or any other liquids that might smell tasty to fungus gnats. For the traps with vinegar, also add a small spoonful of sugar. Then fill each jar ¼ full of water and add two to three drops of dish soap. Stir the traps to dissolve the dish soap (and sugar, for the vinegar trap). The dish soap breaks the surface tension of the liquid in the trap, so that if a fungus gnat likes the smell and lands on the surface of the solution, it will sink and drown. In your research notebook or on your worksheet, record the different treatments you used.

Step 3: Set up the control jar. Fill the last jar or container ¾ full of water. Add two or three drops of dish soap and stir until the soap is dissolved in the water. This will be our "control". A control is a test with no treatment. The control is meant to show what happens when the treatment does not affect the number of gnats caught. In your research notebook or worksheet, describe your control.

Step 4: Make a prediction and hypothesis. A prediction means guessing what you think will happen in the experiment. Do you think that one kind of trap will catch more fungus gnats than another? Your hypothesis explains why you think you will see certain results. Write down your predictions and hypothesis.

Step 5: Set the traps around the plants in your field site. If possible, the traps should have the same "environmental conditions" or temperature, light, and humidity. We want everything about the traps to be the same except the treatment. That way, if one trap catches more gnats, we know it's because of the treatment and not something else. Describe the environmental conditions around your traps.

Step 6: You have officially started the experiment! In your research notebook or on your worksheet, write down the day and time that you finished setting everything up.

Step 7: Run the experiment for 1-2 weeks (or more, if you like). Each day at about the same time, count the number of fungus gnats caught in each trap (including the control trap). Record the day, time, and number of gnats caught in each separate trap in your research notebook. Then remove dead fungus gnats with a small spoon. If you need to add water or change the solutions, repeat Steps 2 and 3, and be sure to write this down in your notes.

Tip: Be sure to keep notes of any unexpected results during your experiment. For example, you might catch some other insects besides fungus flies in your traps. Drosophila flies look very similar to fungus flies, except that they have light brown bodies and red eyes. Fungus gnats have black bodies and black eyes. Drosophila flies are also a little bit bigger than fugus flies.

Step 8: Review your data. At the end of the experiment, make a table of your results if you aren't working on one already. Create a column for the day number and for each trap (including the control trap). Then, create a row to collect the data for each new day, like the example below.

On the first day in the table below, we caught 3 fungus gnats in the vinegar trap, 1 fungus gnat in the lemon juice trap, 2 fungus gnats in the soy sauce trap, and 1 fungus gnats in the control trap.

Next, find the total fungus gnats caught for each trap type. To do this, add up the number of fungus gnats caught each day for each trap type. Record this in your research notebook. In the example below, we caught a total of 10 fungus gnats with the vinegar trap, 7 with the lemon juice trap, and 6 with the soy sauce trap.

Day	Vinegar trap	Lemon juice trap	Soy sauce trap	Control
1	3	1	2	1
2	5	0	1	1
3	2	6	3	0
Total	10	7	6	2

Step 9: Now, analyze your results. Did one type of trap work better than the others for catching fungus gnats? Why do you think that this might be? And what could you do to make the experiment better? Write down the answers to these questions in your notes.

Step 10: (Optional) Communicate your results. Present your findings to the class. If there are several groups, did everyone get similar results? If not, what might explain the difference? You can choose additional formats and share your results. Some options might be: a newspaper or magazine article, illustrated infographic, scientific article, blog post, or social media post.

Teaching Tips

In this lesson, students will run an experiment over days or weeks to test different types of traps to see which catches the most fungus gnats. The objective is to help students understand the scientific method - how to set up an experiment, create and test a hypothesis, record information, and to think critically about their findings and how they could improve the experiment in future.

Time required

- **Setup:** 30–45 minutes.
- **Daily Activity:** 5–10 minutes per day to run the experiment and record data in your notebook or worksheet.
- **Conclusion:** 30–45 minutes to evaluate the results, record findings, present results to the class, and discuss differences between student groups.

Classroom set-up

The experiment works well if the classroom is set up with stations of indoor plants and traps, assigning each station to a small group of students. This makes the experiment more hands-on and interactive. At the end, students can compare their findings with other groups.

Before you begin

Make sure to have houseplants in your classroom or home a few weeks before you start the experiment to make sure fungus gnats are present for the experiment. Water your plants often to keep the top layer of soil damp to create a good environment for fungus flies.

Look up fungus gnats on the internet to see what you can learn about them. Fungus flies are about 1/8" long, have black bodies and black eyes, and belong to the genus Bradysia. They reproduce in the moist topsoil of houseplants, and have a three-to-four-week life cycle from egg to larvae to pupa to adult. Their larvae feed on the fungi, algae, and decomposing plant matter in the top layer of the soil.

A good place for students to record their observations is in their science notebooks. This will help students keep their thoughts and ideas in one spot. Below is an example of what an observation chart might look like. If your class does not have science notebooks, you can print out the experiment worksheets for students to use to record their data and notes.

Observations	**Question**
Gnat larvae eat decomposing plants.	Will gnats be more attracted to fruity smells?
Smellier liquids seem to attract more/fewer flies.	

Tips

Create a routine to check the traps every day around the same time. Encourage students to draw their observations and take their own notes. For example, students could sketch the experimental setup, fungus gnats, and how the traps work.

Extensions

Test different types of traps, either by testing different liquid solutions or using sticky card traps instead. Have students prepare a poster summarizing the experiment (the problem, their hypotheses and predictions, the experiment, and their findings) to present.

Objectives

Learn how to set up and run an experiment, to create and test hypotheses, to critically analyze and evaluate data to draw conclusions from the results, to take notes and record findings, and to write a basic scientific report with hypotheses, predictions, experimental setup, results, and evaluation.

Teaching R.A.F.T.

The writing piece of this experiment includes a RAFT assignment. This stands for Role, Audience, Format and Topic. RAFT helps develop students as more skilled writers and communicators of ideas. Both teacher and student alike can pick an audience to write for, a role, a format, and a topic.

In this case the topic would be flies and the trap trials. The students could chose to present their findings in a newspaper article and write for a larger public audience or they could write a formal scientific paper. Both ways would allow the students to communicate their main ideas from the experiment and their takeaways but allow students more freedom of expression.

Teachers could also choose to assign the R.A.F.T for a specific purpose. Asking students to write in a more academic tone would require the use of their scientific vocabulary.

See the link below for more information.
readwritethink.org/professional-development/strategy-guides/using-raft-writing-strategy

Fly Trapping Trials - Worksheet

Name: _____ Date: _____

What is your prediction?

What is your hypothesis?

What treatment traps are you using for your experiment?

Describe the environmental conditions of your field site (sunlight level, humidity, temperature, plants).

Describe your experimental setup. How close are the treatment traps to the plants?

Fly Trapping Trials - Worksheet

Record your data in the table below.

Day	Treatment 1	Treatment 2	Treatment 3	Control
Total				

Fly Trapping Trials - Worksheet

Once your experiment is complete, answer the questions below.

Did one trap work better than others to catch fungus flies?

Did you find any surprising or unexpected results from your experiment?

Did your results match your hypothesis? Why do you think this might be?

How could this experiment be improved in the future? What other treatments might you test?

Fly Trapping Trials - Worksheet

1. What is the "control" in our experiment?
    a. The vinegar trap
    b. The water trap
    c. The environmental conditions
    d. The field site

2. We ran an experiment in two places or sites in our classroom. The same traps were used at each site. The temperature at the first site was 75°F. The temperature at the second site was 50°F. The two sites have different:
    a. Hypotheses
    b. Environmental conditions
    c. Field sites
    d. Treatments

3. "The soy sauce trap will catch the most fungus gnats because they are attracted to dark and shiny things". What is this an example of? Pick the best answer.
    a. Observation
    b. Hypothesis
    c. Conclusion
    d. Data collected

4. What should you do every day during the experiment?
    a. Move the treatment traps to a new field site.
    b. Change the liquid in the traps to something new and random.
    c. Record the data in your scientific notebook.
    d. Sip each of the traps to make sure they haven't gone bad.

5. Why is it important to have a control in an experiment?
    a. It shows what happens when the treatment does not affect the number of gnats caught.
    b. After the experiment, it explains why our data matches (or doesn't match) our hypothesis.
    c. It makes it possible to test and compare multiple hypothesis at once.
    d. It helps you find out which environmental conditions had the biggest impact.