

DATA *Nugget*

Shooting the poop

Featured scientist: Martha Weiss from Georgetown University

Research Background:

Imagine walking through a forest in the middle of summer. You can hear birds chirping, a slight breeze rustling the leaves, and a faint pinging noise like rain. However, what you hear is not rain – it is the sound of millions of forest insects pooping!

If we look closer to see who is making all this **frass** (insect poop) you'll notice there are tons of caterpillars amongst the leaves. You might see caterpillars eating plants and hiding from predators. Some caterpillars might camouflage themselves, while others build shelters from leaves to avoid being seen. Others are brightly colored to warn predators that they have chemicals that make them taste awful.

The silver-spotted skipper is a caterpillar that lives in the forest. They have a variety of defense strategies against enemies, including building leaf shelters for protection. For these insects, the sight and smell of poop might alert predators that there is a tasty meal nearby. Usually caterpillars keep moving and leave their frass behind, but this species builds shelters and isn't able to keep moving because they need their shelters for protection.

Martha is a behavioral biologist who studies these insects. While raising silver-spotted skipper caterpillars in the lab, Martha noticed that they were making a pinging noise in their containers. Upon further observation, she discovered that they “shoot their poop”, sometimes launching their frass over 1.5m! Martha wanted to figure out why these caterpillars might have this very strange



A silver-spotted skipper caterpillar building its shelter by rolling a leaf



The completed shelter



A predatory wasp visits a shelter with caterpillar frass present.

behavior. Perhaps launching their frass is a way to avoid being found by predators.

To evaluate whether the smell of frass helps predators find and locate silver-spotted skippers, Martha conducted an experiment with a wasp predator that eats these caterpillars. She allowed two silver-spotted skippers to build shelters on a leaf and then carefully removed the caterpillars. She then inserted 6 frass pellets into one of the shelters, and 6 beads designed to look like frass but with no smell (control treatment) into the other shelter. She placed the leaf with the two shelters in a cage containing an actively foraging wasp colony ($n = 10$ wasps). She recorded how many times the wasps visited each shelter (control beads or frass) and how much time the wasps spent exploring each shelter. She expected wasps would spend more time exploring the shelters with the frass than they would the control shelters.

Scientific Question: Why do silver-spotted skippers launch their frass?

What is the hypothesis? Find the hypothesis in the Research Background and underline it. A hypothesis is a proposed explanation for an observation, which can then be tested with experimentation or other types of studies.

Scientific Data:

Use the data below to answer the scientific question:

| | | Shelters containing beads | Shelters containing frass |
|--|------|------------------------------|------------------------------|
| % visits made to each shelter | Mean | 30.3 | 69.7 |
| | SE** | 3.1 | 3.1 |
| % time spent on shelter and its leaf | Mean | 21.4 | 78.6 |
| | SE | 3.8 | 3.8 |

*The data table shows the response of wasp predators ($n = 10$) to shelters containing frass pellets or glass beads.

**Standard error (SE) tells us how confident we are in our estimate of the mean, and depends on the number of replicates in an experiment and the amount of variation around the mean. A large SE means we are not very confident, while a small SE means we are more confident.

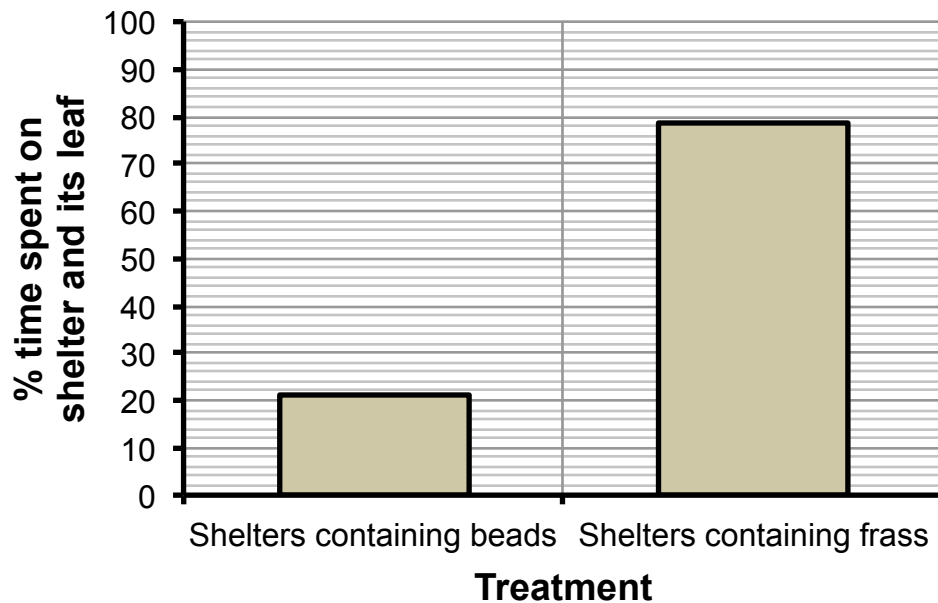
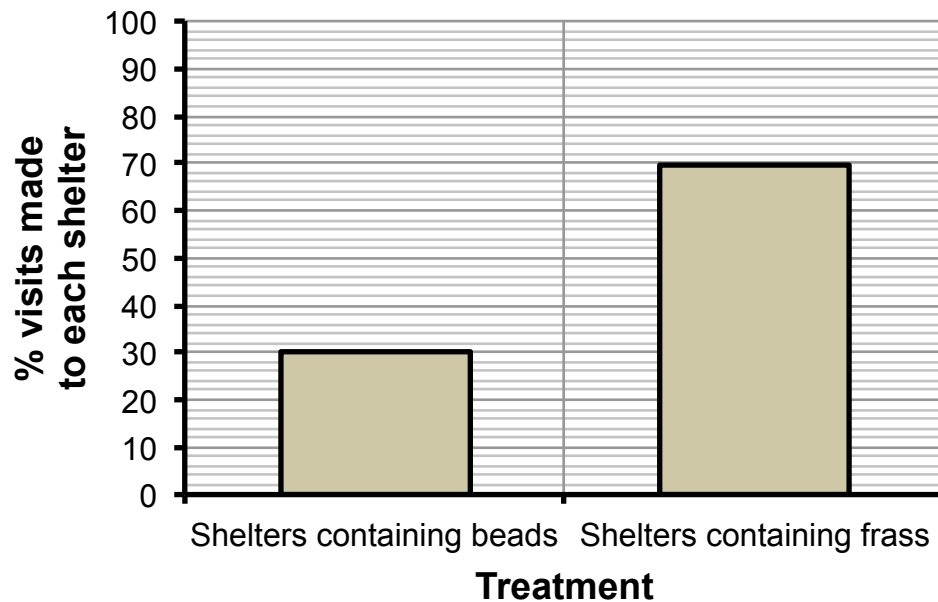
Name _____

What data will you graph to answer the question?

Independent variable(s): _____

Dependent variable(s): _____

Below are graphs of the data: Identify any changes, trends, or differences you see in the graphs. Draw arrows pointing out what you see, and write one sentence describing what you see next to each arrow.



Name_____

Interpret the data:

Make a claim that answers the scientific question.

What evidence was used to write your claim? Reference specific parts of the table or graphs.

Explain your reasoning and why the evidence supports your claim. Connect the data back to why it is important for caterpillars to avoid detection by predators, and the different strategies they use.

Name_____

Did the data support Martha's hypothesis? Use evidence to explain why or why not. If you feel the data were inconclusive, explain why.

Your next steps as a scientist: Science is an ongoing process. What new question do you think should be investigated? What future data should be collected to answer your question?