Biology 103

Environmental Preference in Isopods
(Order Isopoda, Class Crustacea, Phylum Arthropoda)

Objectives
1. Practice designing a controlled experiment.
2. Learn how to analyze data using the proper statistical test.
3. Learn about terrestrial isopods.

I. Introduction

There are thousands of species of crustaceans, most all of which are aquatic. In the Order Isopoda, however, there are a few thousand species of terrestrial crustaceans commonly known as roly-polies, sowbugs, pillbugs, or wood lice. This order differs from other crustacean orders in that the most anterior legs are not modified into larger claws (iso = same; pod = appendage). Pillbugs and sowbugs are often found under logs and rocks in woods or in other shaded places. They eat decaying plant material and thus as scavengers they play an important role in the cycling of nutrients. In turn, they are eaten by many other organisms, including spiders, toads, and centipedes.

Most are gray, with 7 pairs of legs. Sowbugs do not curl up into a ball when disturbed. Pillbugs curl up into a ball when disturbed. One genus of pillbugs is *Armadillidium* (root words mean "little armadillo") You may want to use the dissecting scope for observation of these organisms. How many segments ? How many antennae ? Can you tell a male from a female ? The female has a pouch called a marsupium on the ventral side in which she carries her fertilized eggs as they develop.

Terrestrial isopods are harmless and do not cause economic damage, nor do they bite. However, some people considered them pests if they congregate around homes, decks, and greenhouses. (Powell, 2000).

One characteristic of living organisms is that they respond to stimuli. The actions taken in response to stimuli are behavior. Nearly all natural behavior of an organism is related to its basic needs, including feeding, reproduction, survival, and maintaining homeostasis. Thus, an animal's respons to various stimuli can be relatiod to its basic biological needs. By studying an organism's behavior, we can learn more about its niche. The niche of an organism is a product of the sum of the behaviors (such as those resulting in habitat preference) that it engages in that contribute to its survival and reproduction.

II. Methods:

Animal behavior can be studied under laboratory conditions. In the lab, the experimenter can create two environments which differ only by the variable being studied. Thus, any differences seen in behavior can be attributed to the manipulated environmental variable. One assumption of such laboratory studies, is that the organism's behavior in lab is indicative of its behavior in nature. This assumption can, and should, be tested by observation of the organism in its natural environment.

With these isopods, habitat preference can be studied by using a "choice chamber." The "choice chamber" will consist of a pair of modified Petri dishes, which will allow us to give the isopods a choice

between two different environments. The two Petri dishes are attached, with an opening between them that allows the isopods to move from one environment to the next.

Each dish can have different environmental conditions. You can manipulate the environment in each dish, and see which dish/environment the isopods prefer.

Certain questions must be answered in the preparation of your experiment. Discuss these in small groups and be prepared to share your thoughts with the class.

The Independent variable is the variable you are actually studying or manipulating. These values are chosen before the experiment starts. What are some possible independent variables you could study ?

Dependent variables are what you will measure. Define what you will measure and exactly how you will measure it.

Choose one of the independent variables above. If this is your independent variable, what would be your Control treatment ?

What would be your Experimental treatment?

Variables that should be held constant. What things need to be kept the same for every treatment you measure? What will you do to make sure they are constant? (The only thing that should vary is the independent variable.)

When we try to determine whether a specific variable has an effect or not, we often design the experiment to test what is known as the **null hypothesis.** The null hypothesis is a hypothesis that states that the treatment in question has no effect; i.e. that there will be no difference in the control and experimental groups. In other words, that there is not a statistically significant difference between the two treatments

State the null hypothesis in relation to your experiment. I.e. if the organisms have no preference for one environment over the other, what should their distribution be in the two chambers.?

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What is an alternative hypothesis?

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Predictions (i.e. deductions) Deduce what should happen in this particular experiment, if your null hypothesis is true. In other words, what results would support your null hypothesis? (You are making a deduction here, based on your hypothesis -- that's why this approach to learning is sometimes called hypothetico-deductive reasoning as in Module 1.2 in Campbell et al.)

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What results would refute your null hypothesis?_____

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Replicate your experiment. Replicates are always better than a single sample, which could give erroneous results and we'd never know it.

Data table. Draw a data table on paper to record the data you will get from your experiment.

III. Results

Record your results in a data table.

Describe your results in words. Do not make any conclusions, just describe your results.

Consult your "Graphs and statistics used in General Education Biology" to determine the proper statistical test to use in analyzing your data. Perform the test. Remember you want to test the null hypothesis, to see whether it is supported or not supported.

IV. Conclusions and discussion

Here you say whether the results support the null hypothesis, the alternative hypothesis or neither. Some questions you may address here include, but are not limited to these below:

1. Was your result significantly different from the null hypothesis?

2. Which experiment showed the biggest significance, yours or the class as a whole?

3. Now that you're done with the experiment, what are some potential sources of error -- did you control for them or not?

4. How are your data supported by information you have from other sources ?

5. How could your repeat or extend this study to make it more convincing.?

Further questions for discussion:

Describe the niche of the pillbug. You may want to confer with the rest of your class and find out the results of their experiments to help you do this.

Why would natural selection favor the behavior you found?

How does this behavior contribute to the animal's fitness ?

Do you think this behavior is learned or instinctual? How could you test your hypothesis about whether the behavior is learned or instinctual) ?

References

Campbell, Neil; Reece, J.B.; Mitchell, L.G.; Taylor, M. R. 2003. Biology: Concepts and Connections, 4th Ed. Module 1.2, Modules 18.12, 18.13, Ch. 37 . Benjamin-Cummings.

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