Exercise 5A
Behavioral Ecology

Adapted from *General Ecology Labs*, Dr. Chris Brown, Tennessee Technological University

Introduction

Physiological and behavioral ecologists study the ecology of individuals. An important question in both disciplines concerns ways in which organisms respond to abiotic factors in their environment. Today in lab we will study the influence of several abiotic factors on the behavior of terrestrial isopods, also known as pillbugs, woodlice, and roly-polys.

Terrestrial isopods are crustaceans, a group of arthropods (like insects or spiders) which also contains crabs, lobsters and shrimps. Many species of isopods exist, and they occur in most regions of the world. Terrestrial isopods can often be found in large numbers by turning over stones or logs. Most species are omnivorous, feeding on decaying plant or animal matter. They often possess repugnatorial glands that emit a noxious chemical that acts as a predator deterrent. Some, such as *Armadillidium* spp., can also roll themselves tightly into a ball when disturbed (and thus have the common name roly-poly). Other species, such as the common sowbug *Porcellio scaber*, do not roll up.

Isopods are one of only a few groups of terrestrial crustaceans. Like their aquatic relatives, they respire through gills that must remain moist. Thus, we might expect that terrestrial isopods would have the ability to respond to moisture levels, to help them find and occupy habitats that would allow them to breathe properly. It is this hypothesis that we will examine in lab today.

Lab Exercise 5A: Kinesis of Isopods

Methods

In this experiment, we will examine moisture preference using a simple habitat that provides the isopods an opportunity to choose between two moisture levels. Our experimental chambers will be plastic boxes with paper towels on the bottom. Half of one dry and the other moistened with water. The exact set-up will be described in class. Each group will select 10 isopods from the “Roly-Poly Hotel”. Place them into the center of the experimental chamber. After 6 minutes, record the number of isopods on each side of the chamber.

To analyze our data from this lab, we will use a Chi Square (χ^2) Goodness of Fit Test using class data. This test compares the actual choices made by our isopods to a null hypothesis that there was no difference between sides. For instance, the null hypothesis for our experiment would predict that half of the isopods would be found on the wet paper and half on the dry paper. A χ^2 test then compares our observed outcomes, or O_i to these expected outcomes, or E_i using the formula:

$$\chi^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i}$$

As an example, suppose we tested 40 isopods, and found after 6 minutes that 25 were on the wet side and 15 were on the dry side. If so, then O_1 = 25 and O_2 = 15. Our null hypothesis predicts <u>equal</u> numbers on both sides, and thus E_1 = 20 and E_2 = 20. Using the table below to calculate χ^2, we get:

Class	O_i	E_i	$O_i - E_i$	$(O_i - E_i)^2$	$(O_i - E_i)^2 / E_i$
Moist	25	20	5	25	1.25
Dry	15	20	-5	25	1.25
				χ^2 = sum	2.50

Critical Values for χ^2										
Hypothesis is supported								**Hypothesis is not supported**		
Differences Insignificant								**Differences Significant**		
df \ p	**.99**	**.95**	**.80**	**.50**	**.30**	**.20**	**.10**	**.05**	**.02**	**.01**
1	.00016	.0039	.064	.455	1.074	1.642	2.706	3.841	5.412	6.635
2	.0201	.103	.446	1.386	2.408	3.219	4.605	5.991	7.824	9.210
3	.115	.352	1.005	2.366	3.665	4.642	6.251	7.815	9.837	11.341
4	.297	.711	1.649	3.357	4.878	5.989	7.779	9.488	11.668	13.277
5	.554	1.145	2.343	4.351	6.064	7.289	9.236	11.070	13.388	15.086

We then compare our χ^2 to the critical value table (above). Degrees of freedom are determined by subtracting 1 from the number of classes (wet and dry = 2 classes, so df = 1). If our χ^2 value is greater than 3.84, our results are significantly different than the expected equal distribution of isopods, and we can reject the null hypothesis. However, since our χ^2 value in this example is less than 3.84, we <u>cannot</u> reject the null hypothesis, and so we say isopods do not show a preference for moister substrate.

Data Analysis

Class data	# isopods on wet side	# isopods on dry side
Group 1		
Group 2		
Group 3		
Group 4		
Group 5		
Group 7		
Group 8		
Group 9		
Group 10		
Total (sum trials)		

Classes	O_i	E_i	$O_i - E_i$	$(O_i - E_i)^2$	$(O_i - E_i)^2 / E_i$
Moist					
Dry					
				χ^2 = sum	

Questions

Do your results reject or fail to reject the null hypothesis?

Why might you see the results you did (that is, what are the biological reasons for your results)?

If the results differed from what you might have expected before the experiment, why might this have occurred?