Environmental Science Institute
THE UNIVERSITY OF TEXAS AT AUSTIN

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Nest Recognition in the Harvester Ant, *Pogonomymex barbatus*

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LENGTH: 2 – 3 class periods

GRADE LEVEL: High School, 9 – 12

SOURCE OF THE LESSON:
Laboratory Experiments in Biology: Structure and function of Organisms Manual

TEKS ADDRESSED: 3A, 3E

BACKGROUND
Many animal species use chemical signals released into the environment as means of communication between individuals of that species, called pheromones. Pheromones occur in a wide variety of animal groups, but they are best known among insects. In this group of animals they function as sex attractants, a means of identifying the members of a colony or caste, and as trails for foraging patterns in soil.

It is suspected that harvester worker ants, if given a choice, would recognize and demonstrate a preference for their own home soil. To test the suspicions, students will test the null hypothesis that there are no differences between two variables, sets of variables, or populations. The variables in this investigation are the soil samples being presented to the ants. The null hypothesis students will test states that the ants demonstrate no preference for their own soil when presented a choice between home soil and soil from foreign nest or just another non-nest soil sample. If the null hypothesis holds true, the ants display no soil preference when provided two different types of soil. The ant is expected to spend roughly 50% of her time on one soil sample and 50% on the other soil sample. If the null hypothesis can be rejected with quantitative time data, it would lend support for an alternate hypothesis. Although the null hypothesis may be rejected, the alternative hypothesis is not proven.

Students use petri dishes marked to delineate separate regions for the placement of different types of soil. They will be testing ants' preferences for their own next soil versus the nest soil of another colony of ants and the ants' preferences for their own nest soil versus soil that is not part of any nest. By calculating the percentage of time over a given period that ants spent on each soil sample, students will obtain quantitative data that can be evaluated for statistical significance.

OBJECTIVES:

1. To test and reject the null hypothesis that harvester ants display no preference for their own nest soil, using a quantitative and unbiased procedure.
2. To observe the behavior of members of an animal species that forms very complex social organizations.

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NOTE TO TEACHER

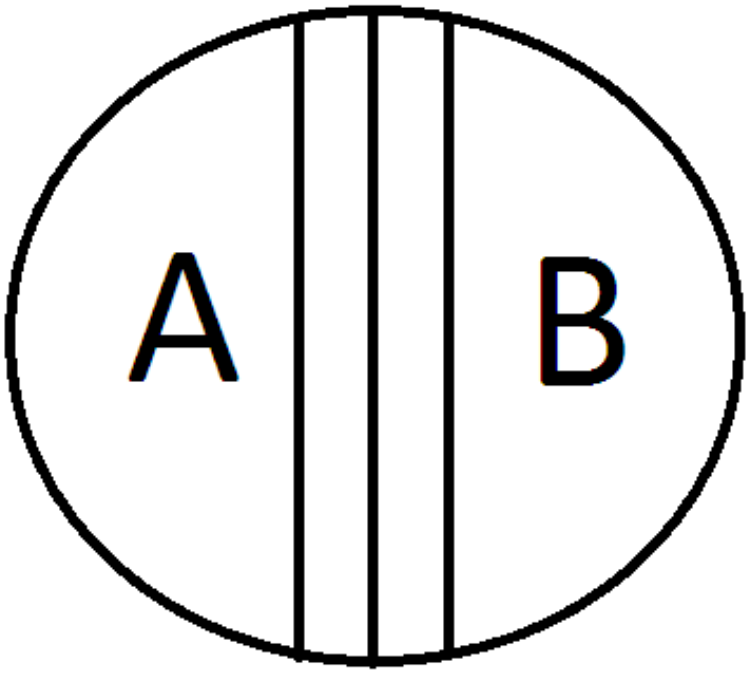
In order to avoid biases in this experiment, the soil samples will not be identified by the location where they were obtained. Students will be making observations of the amount of time that an ant spends on each of two different soils samples in a petri dish. There will be 4 containers of soil available for testing; these will be numbered 1 through 4. Two of these will contain the ant's own nest soil, one will contain foreign nest soil, and one will contain non-nest soil. A new or washed petri dish must be used every trial to ensure that no pheromones are present from the trial before.

CONDUCT ANT PREFERENCE TESTS

1. Students should get in groups of four. Two students should be in charge of the first set of trials and the other two should be in charge of the second set of trials.
2. For the first set of 5 trials, students will be observing an ant's activity when its own nest soil and foreign nest soil are the two types present in the dish.
3. For the second set of 5 trials, students will be observing an ant's activity when its own nest soil and non-nest soil are the two types present in the dish.

COMPILE DATA FOR ANALYSIS

This experiment is based on time data, so students must pay close attention to the location of the ant. Only one ant should be place in the petri dish per trial. Below is a sample table.



Set up for two soil samples for ant preference test.

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Ant Preference Test Results

Own Nest Soil vs. Foreign Nest Soil						
Trial #	**Soil # in Sector A**	**Soil # in Sector B**	**Total time ant spent in Sector A**	**Total Time ant spent in Sector B**	**% of total time ant spent in A**	**% of total time ant spent in B**
1						
2						
3						
4						
5						
Own Nest Soil vs. Non-nest soil						
Trial #	**Soil # in Sector A**	**Soil # in Sector B**	**Total time ant spent in Sector A**	**Total Time ant spent in Sector B**	**% of total time ant spent in A**	**% of total time ant spent in B**
1						
2						
3						
4						
5						

IDENTIFY THE SOIL SAMPLES

Base on their data, students may make predictions on the nature (own nest, foreign or non-nest soil) of the different soil types.

POOL CLASS DATA

By providing students with a larger amount of data, students will be able to further support or reject their hypotheses and predictions.

SAMPLE DISCUSSION QUESTIONS:

1. What are the nature (own nest, foreign or non-nest soil) of the different soil types? What influenced your choice?
2. Why did ants prefer certain soil over the other?
3. It is assumed that ants will spend the majority of their time on home soil but what if they didn't? Why might the ants deviate from their normal behaviors?
4. Does this experiment model reflect what occurs in the real world? Why or why not? What are its merits and limitations?

ASSESSMENT

Students will be graded on their data and their answers to discussion questions.

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GOING FURTHER

The queen is the only reproductively active female; the workers are sterile females who labor to raise the offspring of the queen that are destined to become queens. There are some male ants in the colony, which are fertile. They will leave the colony at some time and mate with fertile females (queens) from other colonies.

All of the female ants are diploid while males are haploid. When a male ant mates with a queen ant, each of the resulting female offspring receives the same genetic information from the male parent because each gets a copy of the entire haploid male genome. Each of the female offspring receives only one copy of the female parent's genome, because she is diploid. Therefore, female siblings in colony share 100% of the genetic information they received from their male parent. The female siblings share, on the average, 50% of the genetic information they received from their female parent. Thus, on the average, female siblings have 75% of their entire genome in common. Because of this large proportion of genes that the workers share with their fertile female siblings (future queens), the workers can propagate their genes indirectly by helping the queen rear these ants.