Environmental Science Institute
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Be a Myrmecologist

Elementary School Lesson Plan; may be adjusted for most age levels.

By Laura Robinette Sanders, Environmental Science Institute: 8/9/10

Adapted from the University of Kentucky's Department of Entomology
"The Secret Lives of Ants" by Stephanie Bailey, Entomology Extension Specialist: 7/7/95
Revised by Patricia Dillon 1/20/99 http://www.uky.edu/Ag/Entomology/ythfacts/allyr/ants.htm

Background Information: Even though ants are tiny, as a group they have a big impact on the natural world. More than 10 quadrillion ants live in the world. All together, ants have the largest biomass of any group of animals on the earth. They usually live together in groups called colonies, that can have as few as three or four ants or can have millions! An ant colony lives in a nest that could be underground, in hollow thorns, between rocks, in rotting trees, in leaves, and more. Ants are champion earthmovers--they move more earth than any other organism including earthworms (who are no slouches in the dirt-moving business, as you may know!). Scientists weighed the dirt one colony dug up and it weighed as much as six elephants!

Note to Teachers: All questions and investigations can be documented and recorded by students in science journals. An important science journal activity would also be to accurately draw the body of an ant with the parts labeled appropriately. TEKS are from §112.10. Implementation of Texas Essential Knowledge and Skills for Science, Elementary, Beginning with School Year 2010-2011.
§112.11 (Kindergarten): 1A, 2A, 2B, 2D, 2E, 3C, 4B, 9A, 9B, 10A, 10B
§112.12 (Grade 1): 1A, 2A, 2B, 2D, 2E, 3C, 4B, 9A, 9B, 9C, 10A, 10D
§112.13 (Grade 2): 1A, 2, 3C, 4B, 9, 10A, 10C
§112.14 (Grade 3): 1A, 2, 3D, 4A, 9, 10
§112.15 (Grade 4): 1A, 2, 3A, 3D, 4A, 9, 10
§112.14 (Grade 5): 1A, 2, 3D, 4A, 9, 10

DISCUSSION #1 – Introduction to Myrmecology

Ask the students: What is an entomologist? What is a myrmecologist? What is their job and how do they do their jobs? Where might they work? Where could they look to find these answers? In the library? On the internet?

(Answer from http://www.wisegeek.com/what-is-an-entomologist.htm: An entomologist is a scientist who focuses specifically on the study of insects. Given that the insect world is vast and incredibly diverse, most entomologists focus on a specific order or family of insects. Entomology is probably a very old science. Humans have had an interest in the insect world for centuries, thanks to agricultural pests and home invaders of the insect variety. Many prominent scientists including Charles Darwin and E.O. Wilson were also entomologists. There are a number of branches within entomology. Entomologists may look at insect behavior, morphology (or shapes and forms), nutrition, and ecology (or how organisms interact with their environment). An entomologist who focuses on ants is known as a myrmecologist. (Side note: Lepidopterists study butterflies, apiologists study bees, coleopterists study beetles, etc.)

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Can children/youth be entomologists or myrmecologists? *(YES!)*

Have students draw or tell what they think is going on underneath the soil in an ant nest. What jobs do they do? What do they do for fun? How many different types of ants are there and what makes them different from each other? What other questions might they have about ants? Perhaps construct a classroom chart that shows what is already known about ants and what the class wants to know about ants and how they can find out the information.

The following activities are investigations that could help answer possible questions the students have posed. Students may come up with modifications to these investigations based on their interests.

INVESTIGATION #1 - Ant Trails and Pheromones

Watch the ants coming and going in an outdoor ant colony. Encourage the students to form ideas about their movement:

- Do they seem to follow each other?
- How do they know where to go?
- What advantage(s) would come from following another ant?

Form hypotheses and test some of these ideas.
Here is an example of how to explore ideas about how the ants know where to go.

Observation: Many ants seem to be following the same path as the ant in front of them.

Question: How do they know where to go?

Possible Answers: They can see the ant in front of them; they know the way from having gone there before; there is some kind of signal on the trail that they are following; etc. (Try to think of as many ideas as possible here.)

Hypothesis (constructed from one or part of one "possible answer" from the previous step): The ants are following some kind of signal on the trail. If this is true, we would expect that if we change the direction of the trail, the ants will go in the new direction.

Test:

1. Place a small piece of paper over an existing ant trail.
2. Let ants relearn the trail over the paper, and
3. Then rotate the paper. What happens to the trail? What do the ants do?
4. Rotate the paper back. What do the ants do?

Conclusions: What conclusions can you draw from these observations?
It turns out that when ants find food, they secrete an invisible chemical called "trail pheromone" as they return to the nest. This trail leads directly from the nest to the food source. Other worker ants

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then follow the trail right to the food. Each worker then reinforces the trail on the way back. When all the food is gone, the workers no longer secrete trail pheromone and eventually the trail fades away. Younger students may enjoy pretending they are ants and making their own trails, using yarn, string, or pieces of paper to mark the trail for other "ants" to follow.
Student interest might lead to a more in-depth study of ***pheromones***-chemicals which are used to help ants (and other insects) communicate. Besides pheromones for **trail and territory markings**, there are

- **sex pheromones** which help males and females of the same species find each other over long distances,
- **alarm pheromones** (aphids, social insects) which warn the colony or group of danger,
- **primer pheromones** which influence caste development (who will be workers and who will be reproductives) and
- **aggregation pheromones** (bark beetles, cockroaches) that cause insects to group together in a suitable habitat, although they do not form a colony.

Farmers and fruit growers use sex pheromones to monitor for pests that would attack their crops. They place traps baited with a synthetic version of the sex pheromone for a particular pest insect near their crops. When adult moths, attracted by the scent and coming in to mate, are trapped, then the farmer knows to be on the alert to protect the crop.

A short article written by Dr. Rudy Scheibner of the University of Kentucky contains more information on using pheromones in agriculture (at URL: http://www.uky.edu/Ag/Entomology/ythfacts/allyr/pher1.htm).

You might want to make or purchase a pheromone trap, and set it up (out of reach) outdoors, then see what you catch. A commercial Japanese beetle trap, available from most lawn and garden shops, would illustrate the point--it contains a combination flower (food) and sex pheromone lure that attracts Japanese beetles from great distances! Check with the local county extension office to be sure that it's placed outside when the insects are likely to be active.

INVESTIGATION #2 - Seeing is Believing
Purchase an ant farm from a toy store or, if an old frame is available, find an ant colony to start an ant farm. Ant colonies are very common. Look in rotting logs or near streams. Dig the colony up and place them in a plastic bag to transport them to the classroom. Place them in the container. Give the ants several days to get settled. Feed them dead insects, peanut butter, yogurt and/or breadcrumbs.
Once the ants have become settled kids can start listing the ants' activities (e. g. grave builders, food gatherers, tunnel makers, egg-layers, soldiers, nursery attendants, etc.), and divide these into castes. Determine ratios or fractions of the colony doing each job. Compare and research ratios for human job categories at the library.

Discussion/portfolio topic: How are humans similar to and different from ants (and/or other insects)?

INVESTIGATION #3 - Strength of Ants
While watching ants coming and going from an outdoor ant nest, observe the size of food that foraging ants bring back to the colony. How many times their size can they carry? Discuss ways to determine a ratio of food size to ants, e. g. measure size (length) of particles versus ants or weigh them (particles

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are so light, they will not register on most available balances, although it may be fun to try to weigh them just to show that point). Compare their strength to that of a human being: we can pull about 60% of our weight, but ants can pull 50 times their weight. Look up facts about human strength in *The Guinness Book of World Records*.

INVESTIGATION #4 - Ant Traps

See if you can attract ants with different types of baits, such as oil-based (e. g. peanut butter), sugar-based (maple syrup or jelly), or protein-based (chunk of meat). Place the bait in an inverted medicine bottle cap, or dab some on a piece of masking tape. Do the ants prefer one type of bait over another? Record how many ants visit each bait in a given amount of time. Do different types of ants show up at different baits? What other insects are attracted to each bait?

DISCUSSION #2 – Closure

How would life be different if we were the size of insects--what would particular objects look like, what would we be scared of, who or what would we be in control of, and what obstacles would we have? In what ways do our lives seem to be like those of ants? Which answers relate to what has been learned about ants through the class' investigations? For fun, show part of the movie *Honey I Shrunk the Kids* video, and continue discussion or write responses in science journals.

Other potential discussion/research/investigation topic: Ants, unlike human beings, are cold-blooded animals--i.e. their body temperature follows the temperature of their surroundings. They do not maintain a constant body temperature as we do. How do they keep warm in winter and cool in summer? What advantages come from being cold-blooded? What disadvantages? What advantages and disadvantages are associated with being warm-blooded?

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