



Summer 2008 Newsletter, Volume 5, Issue 2

**THE ENTOMOLOGICAL FOUNDATION'S OUTREACH PROGRAM TO
STIMULATE INTEREST IN SCIENCE THROUGH INSECTS ..
WHO ARE WE REACHING?**

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The Entomological Foundation's outreach program provides educational materials to educators free of charge to encourage teaching science through insects. In 2007, support from Bayer USA Foundation and our generous funding partners enabled the Foundation to expand by 2800% the number of children reached by this program, resulting in greater access to and increased awareness of entomology among educators and children. In total, approximately 32,000 young people throughout North America and overseas were impacted by the program during 2007.

Approximately 96% of these children were located in the U.S. and 94% were in grades K-5. Forty-five percent of the requests for educational materials came from teachers working in a formal learning environment, while 37% were from educators working in informal learning environments such as 4-H clubs, science/environmental centers, and county libraries. Eighteen percent of the requests were from homeschools.

Educators requesting materials learned about the program in numerous ways, including education association and professional society publications (21%), colleagues and friends (20%), "surfing the web" (10%), and in-service training, educator listserves, and a variety of other communication channels such as marketing materials at science/environmental centers and libraries (49%).

Below are two examples of recent thank you letters received from educators:

I just wanted to drop a note that I received the materials today in the mail. They are wonderful. I love the poster of the ants and the bookmarks also. I have looked over the curriculum packet and I am impressed with the amount of info included. This is a curriculum that I will not have to add very much to. I wish that there were more programs like this that really are beneficial and helpful to my teaching. Thank you so very much, Kelley, WV

I wanted to let you know that I have put your digest to good use... The informative and interesting briefs about insects in Chapter 2 have become my daily introduction to class. Each morning I read one of the briefs... The key to insect orders in Chapter 1 has become our student reference guide as they practice classification. This is fun for the students and a necessary bit of background in anticipation of more involved exposure to taxonomy in high school... Students canvas their yards and bring in all kinds of bugs and then they are tasked with classifying them. Concentrating on being specific with Insecta really interests the kids and helps them get the idea of how taxonomy works. The bookmarks were a big hit. Kids I didn't have as students were coming to my room asking for one. They made my students feel really special because they got something neat. Thank you! Carol Shelley, Surfside Middle School, FL



RECIPIENT HIGHLIGHTS

RECOGNIZING EXCELLENCE AND ACHIEVEMENT IN EDUCATION AND INSECT SCIENCE

The Entomological Foundation's office is very busy each year answering calls, letters, and e-mails from students and educators requesting information on scholarships, fellowships, and research grants, or wishing to apply for a mini-grant or the Entomological Society of America's President's Prizes for Outstanding Achievement in Primary and Secondary Education. The Foundation wishes to thank our supporters who have made it possible for us to recognize outstanding students and educators. The following are excerpts from some of the letters received this year from the Foundation's 2007 award winners:



Winning the President's Prize for Outstanding Achievement in Secondary Education allowed me the luxury of attending the Entomological Society of America's national meeting to accept the award. The presentations and interactions with the presenters gave me many new ideas for lessons using insects. I returned to my eighth graders renewed, refreshed, and inspired by the knowledge and enthusiasm of so many people who work with insects. I am grateful for the funding that allowed me to attend the meeting, to buy materials for the new insect units; and to share my lessons at a National Science Teachers' meeting. Janice Hari, Urbana Middle School, Illinois

As a recipient of the Entomological Society of America teaching award, I want to express my appreciation for the society's recognition of elementary and secondary teachers across the nation. Those of us working with children do not often enough get included in the ranks of professionals outside of education. Attending the Entomological Society of America's meeting in San Diego was an honor and privilege for me which reinvigorated my teaching. Being acknowledged has validated my beliefs about science and children and the necessity for connecting them to the natural world. It is important for classroom teachers to make connections with scientists and researchers. We are the bridge between our students and the real world of science. This award has furthered those connections for me, my students, and my school community. Kate Weidenbach, Pratt Community School, Minnesota



I view this award (LaFage) as an honor as well as a responsibility to continue with research in the area of urban entomology. In particular, it is my sincere hope that my colleagues and I will continue to produce more information leading to an increased understanding of the current bed bug problem. This award encourages and supports our efforts to find improved strategies for control of this pest. Alvaro Romero, University of Kentucky



Receiving the Kenneth and Barbara Starks Plant Resistance to Insects Graduate Student Research Award has been a great honor. It has been an encouragement and scientifically motivational for me. I am very appreciative that there is an award like this available for graduate students working on plant resistance to insects. Philip Morton, Purdue University



EXPERIENCES FROM THE FIELD OF TEACHING

“Teaching Students how to Design an Experiment & Investigate Abiotic & Biotic Factors Affecting Arthropods”

By Janice R. Hari

2007 President’s Prize winner for Outstanding Achievement in Secondary Education

Students learn the scientific method in their science classes, but are rarely asked to demonstrate that they can implement the scientific method in a research project. Also, teachers often design most of the projects so students are not aware of the “nuts and bolts” of doing research. In this activity, students design and carry out a research project. The research project outlined investigates how plants and herbivores interact and how this relationship can be affected by other abiotic and biotic factors.

People often look at a plant-insect community and think about how herbivores affect plant health. In an ecosystem, however, each organism has the potential to affect many other organisms and abiotic factors may alter these relationships. For example, aphids not only affect plants, but plants may affect aphids, and temperature may modify the plant-herbivore relationship. By doing classroom experiments, it is possible to observe how biotic and abiotic factors affect aphid populations. This helps students see some of the complex interactions that take place in nature.

Background

Aphids on goldenrod are an integral part of grassland ecosystems. They are native to North America and are food for many insects, other arthropods, and some vertebrates, such as birds. A large, red aggregating species of aphid (*Uroleucon nigrotuberculatum*) inhabits the goldenrod (*Solidago canadensis*) complex in many parts of North America. A variety of factors can affect aphid populations. Important abiotic factors include temperature and humidity and biotic factors include the host plant (i.e. nutrient and defense levels) and predators. In this exercise the students investigate a few factors that affect aphid population size.

Objectives

Students will 1) learn how to design a research project and 2) learn about biotic and abiotic factors affecting aphid populations.

Materials

1) 2 goldenrod (*Solidago* spp.) plants per group; 2) red goldenrod aphids (*Uroleucon nigrotuberculatum*); 3) 2 fine-mesh bags per group; 4) 2 metal twist-ties per group; 5) 2 wooden skewers per group; 6) 1 predator per group; 7) microscopes or magnifying glasses; 8) computer with Excel.

Procedure

An initial class period should be used as an introduction to teach students how to design a research project and to give students time to do the research design. Introduce the plants and aphids during this period so students can see the initial research system and observe the plant-herbivore interaction.

Introduction Period

Step 1- Pick what to work with: Students are told that they will be given goldenrod and aphids and they will have to add other abiotic and biotic components to the system.

Step 2- Observe your system: Which biotic and abiotic factors, if added to the system, do you think will affect your plants and aphids? Prior student knowledge of predator-prey interactions and abiotic factors is necessary.

Step 3- Pick what you think are the most important abiotic and biotic factors affecting a plant-herbivore interaction.

Step 4- What questions do you want your research to address: Examples include: How do high and low temperatures affect aphids? Does aphid feeding negatively affect plants? How do predators limit aphid populations? Do predators eat more aphids at higher temperatures than lower temperatures?

Step 5- What materials and methods are necessary to address your research question(s)? What measurements or observation techniques are necessary for collecting data?

Setting up the Project – Second Class Period

My class chose to introduce predators and two temperature regimes to the plant-herbivore system because they thought these were the most important biotic and abiotic factors, respectively, affecting plant-herbivore interactions. The following methods are the approach we used to study our research system, but may need to be modified depending on what questions your students wish to address.

(Continued from page 3: “Teaching Students how to Design an Experiment”)

1. Divide the class into groups and assign each group a set of two plants and one of two temperature treatments (i.e. high or low temperature). Each group will put 13 wingless (apterous) adult aphids on each plant. One spider (or other predator, such as lady beetle) will be put on one plant (the other plant is a control, so it does not have predators). A mesh bag encloses the plant and arthropods and is closed with metal twist-ties. Wooden skewers can be used to hold the mesh bags upright and take weight off the plant.
2. Half the students put their plants in a low temperature environment whereas the other half put their plants in a high temperature environment. This could probably be achieved by placing one group in a greenhouse or under heat lamps and the other under regular lighting. Measure the temperatures of each environment.
3. After two weeks the students will count all the aphids on each of their plants using dissection microscopes or magnifying glasses and enter the data into Excel.
4. Data from the entire class will be combined and graphs made to represent which factors had the largest impact on aphid populations. Do predators reduce aphid populations? Did predators reduce aphid populations more in one temperature treatment relative to the other?

Summary

This project provides a framework that allows students to design a research project and study modifications of plant-herbivore interactions. The project is easy to perform. It took three 43-minute class periods: one for an introduction, another to set up the project, and a third to collect, analyze, and discuss data. It addresses multiple national and Illinois state standards, such as teaching students about the scientific method, abiotic and biotic factors, predator-prey interactions, food web interactions, and factors that limit population size. It was also an effective learning experience for the students and their level of motivation and enthusiasm was very high. The students had access to microscopes which could also take pictures. The microscopes connected to computers and allowed students to see the aphids in high magnification. They also enabled them to visually document the size of the aphid populations. Students were enthralled with clearly seeing an insect's body and getting to use this technology. This lesson can be modified to apply to multiple grade levels and locales. While goldenrod and goldenrod aphids may not be as readily available throughout the country as they are in east-central Illinois, other plants and aphids can be obtained. For example, pea plants and pea aphids (*Acyrtosiphon pisum*) can be purchased from on-line sources (<http://www.seedsofchange.com/>; www.berkshirebio.com). Predators can also be bought on-line (www.arbico.com; www.carolina.com). Since students design the project and pick the research questions, this inquiry-based learning is highly adaptable to suit the needs of you and your students.

Janice Hari is a 8th grade teacher at Urbana Middle School, Urbana, IL. The President's Prize for Outstanding Achievement in Primary and Secondary Education, funded by the Entomological Society of America, recognizes educators who have gone beyond the traditional teaching methods by using insects as educational tools. One winner is chosen from primary teachers (grades K-6) and one from secondary teachers (grades 7-12). The Entomological Foundation wishes to thank the Entomological Society of America for their support of this award.



(Vol. 5, Issue 2)

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