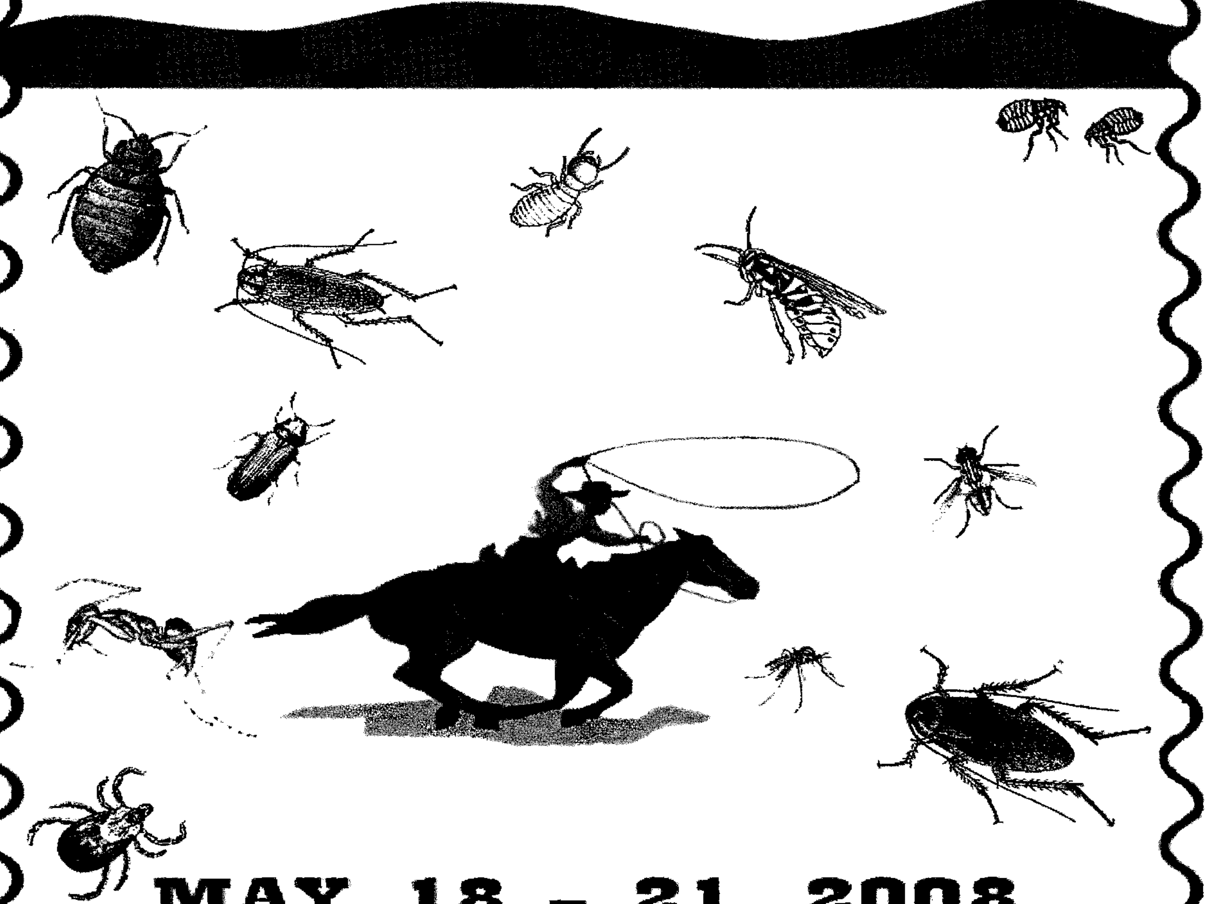
PROCEEDINGS OF THE 2008 NATIONAL CONFERENCE ON URBAN ENTOMOLOGY



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grades K-3, 3-6, 6-9, and 9-12 (www.soinc.org). The goals of Science Olympiad are to improve the quality of science education, increase student interest in science, and recognize outstanding achievement in science education. Science Olympiad events encompass various science disciplines, including biology, earth science, chemistry, physics, computers, and technology. Science Olympiad strives for a balance among events requiring knowledge of science facts, concepts, processes, skills, and application. Currently, 45 states plus Ontario, Canada are involved in the Science Olympiad program.

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NO TERMITE LEFT BEHIND: MEETING BENCHMARKS WITH INSECT SCIENCE

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In the United States, scientific literacy is recognized as a necessity not only for students destined for a career in research, but more broadly for all citizens in order to address the problems of day-to-day life (AAAS 1990). Understanding the scientific process and the nature of the world around us helps us to make informed decisions in all walks of life (Barab and Leuhmann 2002).

Scientific experiences included as part of the school curriculum help students transfer knowledge gained in class to real-world situations. Student engagement in local- or personal- based problems also engage student interest (Barell 2003). Providing students with authentic, place-based problems also represents the practice of science more completely, particularly as it relates to issues of immediate concern to most people. One such issue is the maintenance and upkeep of personal property against natural forces, including destructive subterranean termites.

In 2003, we initiated a program called "Educate to Eradicate" in public schools and communities throughout the state of Hawaii (Grace et al. 2007). This program combines research, education, and public extension seminars, with the dual goals of (1) suppressing subterranean termite populations and damage by increasing public awareness and implementation of preventative measures, and (2) increasing the scientific literacy (and termite awareness) of tomorrow's citizens and homeowners. To date, the curriculum developed in this program has been adopted in 191 classrooms in 37 schools on the islands of Oahu, Maui, and Hawaii; with nearly 6,000 students participating in the project.

Students participating in the project learn about classification and identification of insects, termite biology and life cycles, economic impacts and control efforts aimed at pests, and the nature of scientific investigation through a series of inquiry-based lessons that culminate in home inspection activities and public awareness projects that allow students to disseminate what they have learned to their families and communities. The lessons and the materials that we provide to teachers also facilitate relationships to other subject matter and curricular goals. For example, a lesson about social organization of the termite colony and the duties of each caste also allows the teacher to address the broader concept of interdependence. Teachers and students are also encouraged to take ownership of the curriculum through individual modifications and creative (and often humorous) projects.

Our curricula are based on the Hawaii Content and Performance Standards III (HCPSIII), and address benchmarks for each grade level (K-12). In a standards-based system of education, attention to benchmarks is critical to adoption. The lessons provided are inquiry-based, emphasizing self-discovery and construction of knowledge by the students. In a practical sense, the students thus not only become more aware of termites as significant pests, but as better observers and evaluators of information, they are themselves more capable of noticing termites and evaluating how to manage the situation. Such knowledge and skills are transferable to other challenges of life.

The Termite Jar lesson, in which students are presented with a jar containing damp sand, a cut piece of wood, and termites, is an example of a lesson that combines authentic scientific research and inquiry-driven instructional strategy. The activity is meant to incite interest in termites, introduce students to some of their visible behaviors and get students familiar with the first steps of scientific exploration, observation and questioning. This lesson builds content and skills knowledge about termites in students, who also gain scientific experience when they carry out the inquiry-based lesson. The authentic problem of the termite jar is grounded in ongoing research in university and industry laboratories, and is based on nationally-established research methods (AWPA 2006). The investigation of wood preference of termites has real world implications for the building industry, homebuyers and consumers of wood products. While supporting increased knowledge about and awareness of termites, the termite jar project also emphasizes scientific skills like observation, questioning and data collection and analysis. The value of systematic observation, organized data collection, and formulation of a hypothesis containing both a thoughtful prediction and a feasible explanation are part of the lesson.

This lesson is adaptable to a range of grade levels and aligned to national standards at each. Elementary students focus on observation and asking simple questions based on those observations. These questions can be used to design a simple termite investigation. Middle school students focus on the mental skills scientists use when they design an investigation based on their questions, focusing on topics like objectivity, replication, and careful collection of data. High school students engage in a full-scale investigation of wood consumption based on experiments conducted by University of Hawaii researchers.

The lesson is part of a larger sequence designed to increase student and parent (1) knowledge about termites, and (2) ability to apply scientific methods of thinking to protecting their home from termite attack. Students do not require any prior knowledge to conduct the activities, but through observation and questioning, they gain awareness and interest about the larger topics connected to their termite experiment such as plant-animal interactions, insect biology and behavior, and how to ask and answer scientific questions. The inspection survey that is the capstone of the program encourages students and their families to make the same kinds of observations employed in the termite jar experiment with respect to their home and surroundings. These observations employ the process and content knowledge gained by the students to solve real-life problems, truly demonstrating scientific literacy.

Acknowledgments

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EXCITING UNDERGRADUATES WITH SIX-LEGGED SCIENCE

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In the last ten years, the number of entomologists at Clemson University has decreased, mostly due to positions not being refilled after faculty retirements. Many of the most recent retirements have been teaching faculty with agricultural backgrounds. This created a void and a need for other entomologists at Clemson to add teaching to their appointments or increase their teaching loads. At Clemson, the general entomology course for non-majors (ENT 200: Six-Legged Science) and the general entomology course for biology majors and related sciences (ENT 301: Insect Biology and Diversity) are taught by Urban Entomologists with significant research and Extension appointments. A positive outcome of this situation has been the ability to share Urban Entomology research and Extension experiences with undergraduate students. If students have prior experience with insects, it is often with insects associated with the urban environment, an environment they know well. Urban Entomology provides a wealth of examples on which an instructor can build a foundation for student understanding of basic biological principles.

Since students already have a frame of reference, they learn more easily and can acquire information they can use in the future. In the classroom, many insect examples of morphology, ecology, reproduction, development and behavior can be illustrated with insects common and familiar in the urban environment. For example, silverfish, cockroaches and house flies can be used to discuss different forms of simple to complete metamorphosis. Termites, ants, and bees can be used to discuss eusociality. Cockroaches and grasshoppers are excellent models to explore typical insect external morphology and internal anatomy.