

Lecture 1

Course Overview and an Introduction to Insects

Overview

Handouts and additional information on the class web site provide the course overview. These materials include the course syllabus (lecture and lab), office hours and phone numbers for the instructor and teaching assistants, grading policies, and collection requirements.

This course, An Introduction to Applied Entomology, is designed to help students:

- gain a very introductory understanding of insect biology and taxonomy
- understand the importance of insects as pests and beneficial species in a variety of habitats
- recognize the benefits and drawbacks of a range of insect management practices and understand the components of integrated pest management
- learn how to identify the most important insects and related organisms that are pests in key groups of crops and other habitats

A First-Day Diversion ... "Stranger Than Fiction"

Although much of the course is "applied" in nature, a few minutes of the first lecture are devoted to the very different theme that "insects are neat." An interesting source of information to substantiate that claim is the chapter "Stranger Than Fiction" by J.H. Trosper (pp. 293-306) in the book *Insect Potpourri*, edited by Jean Adams and published by Sandhill Crane Press in 1992. Some interesting or thought-provoking portions of the chapter's contents include:

Insect diversity

- There are more (far more) than 1 million species of insects; they represent greater than 3/4 of all species in the animal kingdom.
- Less than 3 percent of all insects are significant pests.
- Of his investigations of natural biota, Louis Agassiz noted, "I spent the summer traveling; I got halfway across my back yard."

Insect morphology

- A single insect bears 3 pairs of legs, 2 pairs of wings, compound and simple eyes, and 2 antennae.
- The insect exoskeleton provides tremendous strength ... but the laws of physics make it size limiting, and despite Hollywood's greatest efforts, the insect that ate New York simply cannot exist.
- Insects are upside-down ... they have a dorsal heart and a ventral nerve cord.
- The insect respiratory system is comprised of holes (spiracles) in the abdomen and thorax, and tubes (tracheae) that allow outside air to reach locations next to body organs.
- Insects smell with antennae and taste with tarsal (foot) pads (and other organs).
- Their phenomenal features include stalked eyes, brightly colored hairs and spines, large horns, powerful jaws, and ovipositors adapted for spectacular uses.

Reproductive abilities

- Fruit flies: 25 generations per year
- Corn earworm moths: 2,000 eggs per female ... few in comparison with a termite queen
- Special adaptations reduce the role of males ...
 - parthenogenesis ... reproduction without fertilization of eggs
 - polyembryony ... many embryos (individuals) from a single egg
 - spermathecae ... sperm storage structures that allow extended fertilization after a single mating

Aquatic adaptations

- External gills
- Anal gills and anal expulsion/propulsion in dragonfly naiads
- Adaptations to carry air bubbles on the body surface of diving beetles

Sensory organs and communication

- Thoracic tympanae of moths ... for avoiding bats / sometimes they aid in attracting bats
- Stridulation ... the sound-producing process of crickets and related Orthoptera ... folk history says that the pace of a tree cricket's chirps tell the temperature ... Degrees (F) = 38 plus the number of chirps per 15 seconds.
- Compound eyes ... 30,000 facets in one compound eye in a dragonfly ... they sense movement and some color, but provide poor resolution.
- Bioluminescence ... In fireflies, flying males flash first; stationary females respond by flashing back. If the flash intervals are correct, the male flies to source to mate. Interspecific femme fatales imitate the flash interval of a nearby male, attract him by their flashes, then kill and eat him.

Pheromones and other semiochemicals (chemicals that carry a message)

- Bombardier beetles forcefully expel a hot and noxious chemical toward their predators.
- Monarch butterflies, lady beetles, and many other insects sequester toxic compounds that deter predators ... a benefit to the species, not to the first insect eaten.
- Mating and aggregation pheromones carry very specific messages over extended distances.

Phenomenal strength and mobility

- An average insect pulls 50X its weight; an average human pulls 0.9X its weight.
- Click beetles "snap" their "backs" to bounce into the air to turn over.
- Some flying insects have wing-beat frequencies of >1,000 beats per second; some fly at speeds greater than 50 miles per hour.
- A house fly flies at a speed of 300X its body length per second; a very fast human runs at 5X his/her body length per second.
- Monarch butterflies migrate south to Mexico; a single individual may cover 2,000 miles to reach a specific overwintering site ... a site that NONE of the butterflies in the migration have ever been to before.

Metamorphosis

- What a trick ... immatures adapted specifically for feeding and growth, in many orders completely different in form than the adult they will become; adults adapted for dispersal and reproduction ... in some groups adults do not eat at all.