Insects and People - Entomology 101
The Conflicts, the Players, and the Solutions
Economic Entomology

A Short History of the Human Species and Agriculture
- -a hunter/gatherer ancestry for most of our 200,000 years
- -Agriculture "the most important event in the cultural evolution of the human species" - H. Curtis 1983
- -Agriculture dates back to ca 12,000 - 18,000 years before present (ybp)
  - -Middle East; implements and storage containers
  - -wheat, lentils, chickpeas, dates
- -an agricultural based economy
  1. cereals that could be stored
     - -wheat in temperate Asia
     - -corn (maize) in New World Tropics
     - -rice in Southeast Asia
     - -sorghum in drier areas of Africa
  2. herbivorous herd animals for domestication

How did Agricultural Development Affect Human Society?
1. Hunter/Gathers
   - -mobile
   - -low fertility
   - -active involvement
2. Agricultural
   - -sedentary
   - -increased fertility
   - -fewer individuals involved

Recent Advancements in Agriculture
- -increased mechanization
- -improved crop plants
- -increased energy inputs

What About Insets?
- -Insects are direct competitors for resources
- -Insects destroy 20-30% of food and fiber we produce

Are Insects Inherently Pests?
- -Approximately 1,000 key pests worldwide
  - -200 key pests in the United States
  - -perhaps 30,000 or so secondary pests worldwide

- -Rating the pests
  1. subeconomic pests

2. occasional pests
3. **key**, perennial, or severe pests

Economic Injury Level (EIL)

Why do Insects Become Pests?

1. Ecosystem modification and Insect Population Numbers
   -r and K-selected species
2. Transportation
   "anthropogenic"
3. Human attitudes

What is a Pest?

Economic Entomology - Managing Pest Populations

1. Appeal to a higher power
2. Pesticides (Insecticides)
   -Homer, 1,000 BC, "pest averting sulfur"
   -Cato, 200 BC, mixture of bitumen (mineral pitch or asphalt)
   -Dioscorides, 40-90 AD, toxic nature of arsenic
   -Chinese, 900 AD, arsenic to control garden pests
   -1690, mixtures including tobacco (nicotine) used in orchards (botanicals - plant based materials)
   -1860's, formulations of inorganic materials being used
      -antimony
      -arsenic
      -mercury
      -selenium
3. Insecticides (the modern era)
   -late 1930's, WWII forced an exploration for synthetic materials
4. The story of DDT
   -DDT (dichlorodiphenyltrichloroethane)
   -first synthesized in 1873 by Othmar Zeidler
   -insecticidal properties discovered in 1939 by Paul Muller
   -a broad-spectrum, residual insecticide, low mammalian toxicity
   -Naples, Italy - 1944; used to stop an outbreak of typhus - 1.3 million people treated - saved thousands (many thousands) of lives
   -1948, Paul Muller awarded Nobel Prize
5. The demise of DDT
   -accumulated in fat cells - not excreted
   -"Bioaccumulation" in the environment
   -"Biomagnification" in living organisms
   -1962, Rachel Carson and the publication of Silent Spring
   -DDT "banned" in the late 1960's
   -1970, the establishment of the Environmental Protection Agency (EPA)

6. A pesticide is designed to kill
   -Some terminology concerning pesticides

-Broad spectrum vs. narrow spectrum
-residual vs. nonresidual
-LD50 and LC50

Economic Entomology - Methods of Managing Pest Populations

1. Chemical Control
    -Active Ingredient(s) (AI) and Inert Ingredients
    -Mode of action
    -Types of chemical pesticides
        -Inorganic
        -Organic
            -Natural
                -Oils
                -Botanicals
            -Synthetic organic pesticides
                -mammalian toxicity varies
                -most common today

    -Advantages of chemical pesticides
        1. can treat a problem while it is in progress
        2. action is rapid
        3. Chemical pesticides are (generally) economical
        4. Pesticides are easy to use
    -Disadvantages of chemical pesticides
        1. Development of resistance in pests
        2. Pest resurgence and possible pest replacement
        3. Effects on non-target organisms and the environment
        4. Risks to the user

2. Chemical Modifiers of Development and Behavior
    -began primarily in the 1960's
    -based on an understanding of hormonal activities in the insect
    -disrupt normal development in the pest individual
    -Insect Growth Regulators (IGR's)
        -juvenile hormone mimics
        -molting hormone mimics

3. Chemicals that Modify Behavioral Patterns
    -Pheromones, Allomones, Kairomones
    -disrupt intra- and interspecific activities
    -e.g., sex pheromones and mating disruption
    -used primarily to monitor pest populations

4. Sterile Insect Technique (SIT)
    -Began in the 1930's
    -best when pest populations are geographically isolated

-very costly, usually used on a large scale with governmental and governmental/private support
-sterile individuals are released into the environment in tremendously high numbers
-e.g., screwworm

5. Microbial control
   -insect pathology (study of insect diseases)
   -use of bacteria, viruses, fungi
   -Bacillus thuringiensis (Bt) is the most commonly used microbial (especially effective on lepidopteran caterpillars and beetle grubs)
   -often used for large scale spray programs
   -very low to no mammalian toxicity

6. Genetically engineered Plants (Animals??)
   -incorporate the genetic material (for pest control) from one species into a second species that does not have the trait.
   -transgenic plants (e.g., corn)
   -the toxin producing genetic material from TB has been incorporated into corn
   -how will the public (you!) perceive genetically engineered food

8. Biological control
   -insects are extremely important in controlling insects
      -predators; larger than prey, feed on many prey
      -parasites
      -parasitoids; smaller than prey, feed on one prey
   -may involve naturally occurring predators and parasitoids
   -may involve introduced predators and parasitoids
   -establishment of a "natural" situation

What does the future hold?
-Environmental concerns
-Health concerns
-Public perception