Pests and Pesticides

Chapter 7
Pests and Ecosystems

• Pests are unwanted plants (weeds) or animals (vectors)
• The most common type of vectors are insects (arthropods) and rodents
• Overpopulation, poverty, and lack of sanitation provide opportunities for vector-borne diseases
• Global warming and resistance make control of disease-carrying vectors difficult
Arthropods

- Arthropods
  - Jointed appendages
  - Exoskeleton
  - Segmented bodies
- Includes insects and arachnids
Insects

• Includes ants, bees, wasps, termites, flies, mosquitoes, cockroaches, fleas, lice, bed bugs, and kissing bugs
• Three segments (head, thorax, abdomen)
• Mouth, antennae, and eyes
• Carry pathogens on the body or in the digestive tract
• Pass through complete or incomplete metamorphosis
Flies

• Thousands of species
• Lay eggs on garbage and manure
• They hatch and reach the mature stage in 1–2 weeks
• Insert Fig. 7-1 here
## Types of Flies

<table>
<thead>
<tr>
<th>Nonbiting: houseflies</th>
<th>Biting: black flies, deer flies, sand flies, horse flies, stable flies</th>
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</thead>
<tbody>
<tr>
<td>Feed on waste materials</td>
<td>Require a bloodmeal</td>
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<tr>
<td>May pick up pathogens for salmonella, cholera, dysentery, typhoid, hookworm, pinworm, and whipworm</td>
<td>Carry bloodborne diseases such as African sleeping sickness, deerfly fever, and African eye worm disease</td>
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Control of Flies

• Keep flies away from food
• Screen porches and patios
• Cover open containers of trash
• Remove trash at least twice per week
• Use sticky fly strips
Mosquitoes

• 300 species worldwide
• House mosquitoes (*Culex*) carry encephalitis
• *Aedes aegypti* carry yellow fever
• Asian Tiger mosquitoes (*Aedes albopictus*) carry dengue fever, encephalitis, yellow fever, and West Nile
• *Anopheles* mosquitoes carry malaria
Control of Mosquitoes

- Mosquito eggs turn to adults in 5 days
- The female mosquitoes require a blood meal
- Drain stagnant water from ditches
- Remove trash cans, flower pots, wading pools, bird baths, pet dishes, clogged gutters, and other items that may contain stagnant water
- Mosquito traps and “dunks” can be used
Control of Mosquitoes (continued)

• When outdoors (especially during dawn or dusk) wear DEET repellent
  – Special precautions apply for children
• Do not wear perfume, hair spray, or deodorant
• Stay away from trees, bushes, or high grass
• Wear long-sleeved shirts and long pants
Cockroaches

• American (*Periplaneta americana*)
  – Also known as Palmetto bugs or “water bugs”
  – Brown to reddish brown

• German (*Blattella germanica*)
  – Pale yellowish brown with dark brown stripes on the head

• Oriental (*Blatte orientales*)
  – Dark brown or black, “sewer roaches”
Roach Control

- 600 days from egg to adult
- Prefer dark, moist environments
- Hide in cracks and crevices
- Feed on manure, decayed food, glue, etc.
- Carry disease on body or in intestines
- Aggravate allergies in infants and young children
- Keep food in containers, wipe up crumbs, keep kitchen and bathroom areas, dry, seal cracks
Fleas

- From an egg to adult within 3–4 weeks
- Carry pathogens (plague, typhus, tularemia, salmonellosis)
- Gain access to humans through pets or vermin (rats, prairie dogs, chipmunks, and squirrels)
Flea Control

- Keep grass mowed short
- Bathe animals in summer months and check for fleas
- Treat infested animals with flea powder or flea spray
Lice

- Lay eggs on hair or skin
- Eggs hatch and become adults in 10 days
- Feed on humans for 30 days
- Three types: head, body, and crab
- Transmitted by infected clothing, hair brushes, or direct contact with a person carrying lice
Control of Lice

- Report an infestation immediately
- Qwell and other medicated shampoos are available
- Nits must be removed from the hair shaft
- Wash clothing in hot water
- Put items that cannot be washed (stuffed animals, etc.) in garbage bags with the air squeezed out for several days
Bedbugs

• Seven species
• Feed on humans and warm-blooded animals at night
• Do not carry diseases, but make itchy welts
• Can live up to a year without a blood feeding
Kissing Bugs

- Found primarily in Mexico, Central America, South America, and southern United States
- Carried by rodents, armadillos, and opossums
- Carries the protozoan parasite *Trypanosoma cruzi*
- May cause severe inflammation, paralysis, and death in some people
Fire Ants

- Four species (red, black, Southern, and Tropical)
- Live in large colonies in dome-shaped mounds
- Can sting several times
- The bites are painful and some may develop an allergic reaction
Control of Fire Ants

- They reproduce rapidly
- Pour boiling water on the mound, or use fire ant bait or granular insecticides
- The phorid fly can be used to decapitate fire ants
Bees and Wasps

- Bees, yellow jackets, hornets, and wasps do not carry diseases
- Some people are allergic to them
- Insecticides should be used at night
- Wear protective clothing (hat, long pants, long-sleeved shirt, netting)
- Flashlights attract them
Termites

• Cause severe destruction to wood as noted by “mud tubes”
• Have a termite inspection before purchasing a home
• Use decorative wood chips and mulch sparingly in the yard
• Store firewood, lumber, and other wood debris away from the house
• Keep moisture away from the foundation
• Eliminate wood contact with the ground
Arachnids

- Includes spiders, tarantulas, ticks, mites,
  and scorpions
- Are carnivores
- Have one or two main segments: cephalothorax and abdomen
- No antennae or wings
- Eight legs, multiple eyes, book lungs, pedipalp, chelicerae
Spiders and Tarantulas

• The brown recluse spider is more active at night
  – The bite can be cytotoxic
• The black widow spider
  – The reaction depends on the area of the body bitten and sensitivity to the venom
Control of Spiders

- Most are harmless
- Remove old rotting wood and damp areas
Ticks

- Hard ticks (dog ticks, wood ticks, and deer ticks) and soft ticks (fowl tick and relapsing fever tick)
- Three visible components: palps, chelicerae, and hypostome
Control of Ticks

- Ticks are known for their disease-carrying capacity
- Ticks like grassy and wooded areas
- Keep grass cut short
- Wear long-sleeved shirts, long pants, and hats
Mites

• Develop from eggs to adults within 2–3 weeks
• Can be vectors for scrub typhus, rickettial diseases, hemorrhagic fever, and encephalitis
• Scabies burrow under the skin
• Transmitted by direct contact or animals (birds and rodents)
• Keep the home clean and vacuumed
Scorpions

- Venomous creatures found nearly everywhere
- Not all are deadly
- The venom produces severe pain, swelling, difficulties in breathing, muscle twitching, and convulsions
- Live up to 3–5 years
- They build nests in mulch and woodpiles
Rodents

• Mammals with teeth and jaws for gnawing
• Very destructive
• Most active at night
• They go where there is food
• They can be trapped or poisoned
Mice

- The house mouse (*Mus musculus*) produce 5–10 litters per year
- The deer mouse (*Peromyscus maniculatus*) is known to carry the hanta virus
Rats

• Roof rat or black rat (*Rattus rattus*)
• Norway rat or brown rat (*Rattus norvegicus*)
• Rats reach sexual maturity 3–5 months after they are born and can have 4–6 litters per year
• Rats can get just about anywhere and thrive where there is garbage and poor sanitation
• They carry diseases like plague, rickettsial pox, murine typhus, rat bite fever, lassa fever, salmonellosis, and trichinosis
Pesticides

- Five principal classes of pesticides:
  - Insecticides
  - Fungicides
  - Herbicides
  - Ascaricides
  - Rodenticides

- Five principal classes of pesticides:
  - Organochlorines
  - Organophosphates
  - Carbamates
  - Pyrethroids
  - Phenoxy herbicides
Pesticide Controversy

• They have harmful effects on birds, fish, animals, and humans
• There are long-term effects with repeated exposure in plants that manufacture the pesticides and those who use them
  – Farm workers
  – Aerial crop-dusting pilots
  – Professional pest control workers
• Pesticides are especially harmful to children
DDT and Agent Orange

• DDT was used during WW II to kill mosquitoes, body lice, and other disease-carrying vectors
• Agent Orange (2,4,5-T) was used in the Vietnam war as a defoliant
  – The most harmful agent was dioxin
• Both DDT and Agent Orange have been found in human breast milk
Insecticides

- Kill insects in different ways
- Organophosphates, organochlorines, and carbamates kill by acting on the nervous system of insects
- Some are contact poisons that penetrate the exoskeleton
- Some are stomach poisons that enter the intestinal system of biting and chewing insects
- Some are fumigants that enter the respiratory system of insects
- Some are desiccants that remove moisture from insects
Alternatives to Pesticides

• Plants that are toxic to insects but are not toxic to animals (e.g., chrysanthemum)
• Solution of dishwashing soap to water for small insects like aphids
• Natural predators can be used (e.g., mosquitofish)
• Integrated pest management (IPM) uses the most economical and least hazardous means to control pests
Fungicides

• Used to treat molds and crop rot
• Available in powders, dusts, concentrate, and granules
• Some are dangerous
• Do not inhale them
• It is best to water a plant from the underside
Herbicides

- There are two types: selective and nonselective
- Selective types kill broad-leafed dicotyledonous plants
- Nonselect herbicides kill any plant
- Herbicides work by preventing photosynthesis, inhibiting enzymes, disrupting cell membranes, or inhibiting root cell division
- Herbicides vary greatly in soil persistence
- Other dangers include “drift” and contamination of ground water and surface water
Alternatives to Herbicides

- Weeds can be pulled by hand
- Mulching keeps the weeds down and moisture in the soil
Rodenticides

• Consist of anticoagulants and non-anticoagulants
  – Anticoagulants include warfarin, pindone, diphacinone, and clorophacinone
  – Noncoagulants include zinc phosphide, cholecaliferol, and bromethalin

• Usually in grain-based baits or pellets

• They should not be placed where children or pets can get into them
Human Risk from Pesticides

- Pesticides can be inhaled, ingested, or absorbed
- The most harmful are organophosphates, which are toxic to the nervous system
- Acute poisoning calls for quick action
  - Determine the type and how much
  - Call Poison Control and follow directions
- Chronic health problems occur with repeated exposure over time
- Reproductive problems occur when exposed to endocrine disrupters
- Many are carcinogenic (lymphoma in farmers)
The Most Dangerous Insecticides

- Carbaryl
- Chlordane (banned by the EPA)
- Heptachlor (banned by the EPA)
- Lindane
- Mirex
- Parathion
The Most Dangerous Herbicides

- 2,4,-D
- 2,4,5-T (banned by the EPA)
- Alachlor
- Atrazine
- Nitrofen
- Trifluralin
Regulating Pesticides, Fungicides, and Herbicides

- Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA, 1996)
- Users must register the purchase of these products
- Users must pass a certification examination
- All pesticide workers must be registered or licensed by the EPA
Pesticides on Food

- An amendment to FIFRA, the Food Quality Protection Act (1996) provided for the EPA to set allowable pesticide residue levels for food
- The risk to children is the greatest
- The EPA also looks at
  - potential effects of endocrine disruptors,
  - potential teratogenic effects,
  - aggregate risk from all sources and routes of exposure,
  - as well as cumulative risks due to exposure
Wash your produce!

- Foods with the highest toxicity indexes for pesticides include:
  - Fresh peaches
  - Frozen and fresh winter squash
  - Apples
  - Grapes
  - Spinach
  - Pears
  - Green beans
  - Broccoli
  - Orange juice
  - Bananas
  - Corn