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ENVIRONMENTAL HEALTH

ECOLOGICAL PERSPECTIVES

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

Nonbiting: houseflies

Feed on waste materials

May pick up pathogens for salmonella, cholera, dysentery, typhoid, hookworm, pinworm, and whipworm

Biting: black flies, deer flies, sand flies, horse flies, stable flies

Require a bloodmeal

Carry bloodborne diseases such as African sleeping sickness, deerfly fever, and African eye worm disease

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

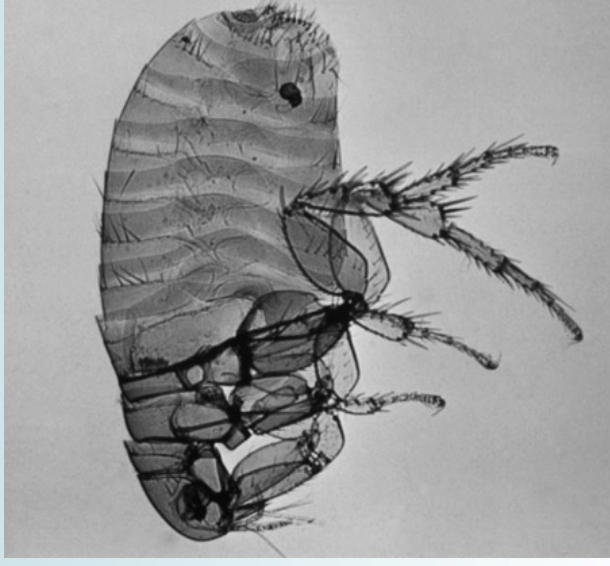
- **American (*Periplaneta americana*)**
 - Also known as Palmetto bugs or “water bugs”
 - Brown to reddish brown
- **German (*Blattella germanica*)**
 - Pale yellowish brown with dark brown stripes on the head
- **Oriental (*Blatte orientales*)**
 - Dark brown or black, “sewer roaches”

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)

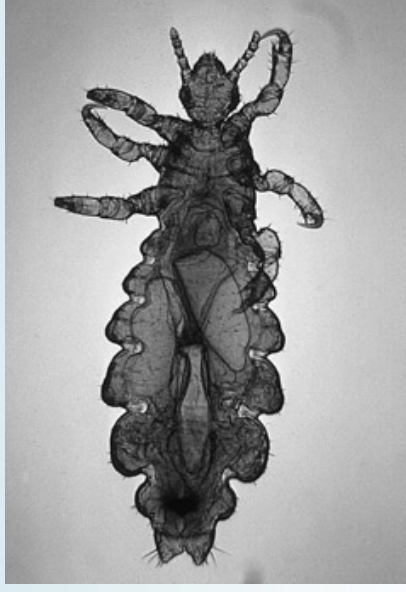


Flea Control

- 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, booklungs, 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 maniculatis*) 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

- Include:
 - 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-leaved 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