Public Health Pests and Disease Vectors

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Outline

• Definitions
• Spiders, scorpions
• Bees, wasps, ants
• Beetles, moths
• Cockroaches, flies
• Lice, fleas, true bugs
• Ticks, mosquitoes

Public Health Pests

Disease Vectors

• Summary
Important definitions *

- **Arthropod** – segmented body, exoskeleton, jointed appendages and mouthparts (90% animals)

- **Parasite** – organism living on or in a host
  - Ectoparasite lives outside the host
  - Endoparasite lives inside the host

- **Host** – organism where the parasite feeds

- **Pathogen** – organism that causes disease

*Defined by the Torre-Bueno Glossary of Entomology*
Important definitions *

• Vector – intermediate host carrying a pathogen

• Mechanical transmission – pathogen does not replicate in vector; accidental spread (i.e., legs)

• Biological transmission – pathogen replicates inside vector and transmitted to hosts by excretion (i.e., feeding, defecating)

• Reservoir host – organism that carries a pathogen but does not display disease symptoms

* Defined by the Torre-Bueno Glossary of Entomology
The insect blueprint

• 3 body segments:
  – Head = thinking, sensory
  – Thorax = locomotion
  – Abdomen = digestion and reproduction

• 1 pair of antennae
• 3 pairs of legs
• Usually 2 pair of wings as adults
• Ex. grasshopper, honey bee, butterfly, aphid
The arachnid blueprint

• 2 body segments:
  – Cephalothorax = thinking and locomotion
  – Abdomen = digestion and reproduction
• Antennae absent
• 4 pairs of legs
• Wingless
• Ex. spider, tick, mite, scorpion, harvestmen
Public Health Pests

1. Venomous bites or stings
   - Painful swelling, itching, skin blistering,
   - Allergic reactions, trouble breathing
   - May require hospital visit, seldom fatal

• Ex. spiders, centipedes, scorpions, bees, wasps, ants
Hobo spider

- Funnel-web spider, swift running
- Live in building cracks, under debris
- Bites cause necrotic lesions
- Habitat elimination to reduce risk
Public Health Pests

2. Nuisance, sanitation problems
   – Annoying, spoil food, damage structures
   – Ex. beetles, earwigs, termites, ants

3. Urticating hairs, wing scales and cast molts
   – Develop dermatitis, hives, lung problems
   – Ex. Dust mites, moths, spiders
Red flour beetle

• Flat, shiny and reddish-brown
• Feed on damaged kernels, moist grain (>12%), grain dust or flour
• Found in stored grain, food plants, homes
• Remove infested food source
• Use careful sanitation in homes
• Fumigation may be considered
Disease Vectors

- Organisms that transmit pathogens
  1. Mechanical transmission (i.e., legs)
     - Cockroaches spread food poisoning
     - House flies transmit bacillary dysentery
Disease Vectors

2. Biological transmission (i.e., replicates)

*Arthropods capable of ingesting pathogens and vectoring disease to humans and other vertebrates*

(AKA blood sucking pests passing disease to US!!)

- Lice, fleas
- True bugs
- Ticks
- Mosquitoes
Lice (Phthiraptera)

- Permanent ectoparasites of birds, mammals
- 3,000 species; wingless
  - Chewing lice attach to hair and feathers
  - Sucking lice are blood feeders
  - Specialized legs adapted for grasping
  - Host grooming causes mortality
Louse-borne disease

• Pediculosis in humans – head, body, pubic
  – Poor hygiene and sanitary conditions
  – Close personal contact
  – Severe itching
  – Scarred, hardened skin
  – Difficult to control
  – Reinfestation is likely

• Typhus, trench fever, relapsing fever

(1929-1945)
Fleas (Siphonaptera)

• Ectoparasite of birds, mammals
• 2,500 species; piercing sucking mouthparts
• Wingless, bilaterally flattened
• Excellent jumping hind legs
Flea-borne disease

- Attracted to CO$_2$, body heat
- Can be host specific
  - Range of host “neediness”
- Black Death: Bubonic Plague
  - Oriental flea carried by black rats
  - Killed 1/3 of Europeans (1347 – 1352)!
- Typhus, tapeworms
True bugs (Hemiptera)

• Soft bodied insects, 2 pair of wings
• >90,000 species, very diverse group
  – Aquatic, natural, agricultural, urban
• Piercing sucking mouthparts
  – Aphids, cicada, chinch bug, box elder bug
  – Water bug, leaf-footed bug, stink bug, pirate bug
Kissing bugs (Reduviidae)

- Temporary ectoparasite
- Typically feed on small mammals
- Bite around face and lips
- Can transmit Chagas disease
- 16-18 million people infected
Bed bugs (Cimicidae)

- Temporary ectoparasite, wingless
- Feed on humans, birds, bats
- Eggs laid in furniture/wall cracks
- Can survive months without food
- Attracted to CO$_2$, body heat
“Sleep tight, don’t let the bed bugs bite!”
Ticks (Arachnida: Araneae)
Ticks (Arachnida: Araneae)

- Ectoparasites on vertebrates
- Barb-like mouthparts imbed into skin
- 800 species
- All stages, both sexes need blood
Tick-borne disease

• #1 vector for human illness in the U.S.
• #2 vector for human illness worldwide
• Prevention is emphasized
  – Lyme disease* is most common in U.S.
  – Rocky Mountain spotted fever*, Texas fever, Colorado tick fever*, Ehrlichiosis*, Tularemia, Tick paralysis, Relapsing fever
Symptoms of tick-borne disease

• Initially flu-like
  – Fever, headache, nausea, jaw pain, light sensitivity, muscle stiffness, neck pain

• Can be more serious
  – Rash, double vision, numbness, insomnia, depression, weight loss/gain, paralysis
Mosquitoes (Diptera: Culicidae)

- 4,000 species; slender body, 1 pair of wings
- Excellent vectors of disease (#1 worldwide)
  - Malaria, filariasis, yellow fever, dengue fever, rift valley fever, dog heartworm
  - WNV, SLE, EEE, WEE, JE
Mosquito biology

- Piercing sucking mouthparts
- Feed on nectar, but females require blood
- Persistent biters, attracted to CO$_2$ and heat
Life cycle of the vector
Culex tarsalis is #1 vector of WNV in UT

- Very efficient vector
- Are most active July - September
- Mostly feeding at dawn and dusk
- Birds are preferred hosts
- Will feed on small and large mammals
Culex life cycle

- lay 100-300 eggs every 7-10 days
- lay eggs on water surface
- Egg $\rightarrow$ Adult takes 14 days ($70^\circ$)
- Polluted, standing water is preferred
- Water standing for $>4$ days is ideal
Life cycle of WNV

“Good” reservoir for WNV

“Bad” reservoir for WNV

Bird ↔ Mosquito

Horse → Mosquito

Human → Mosquito

Sparrow

Crow

Magpie

Raven
How can you reduce the risk?

• Eliminate standing water around the house
• Change water frequently
• Mosquito-proof homes
• Avoid peak feeding times
• Use repellent sufficient for activity
Summary

• Public Health Pests
  – Annoying, nuisance, allergies
  – Cause painful bites/stings
  – Not vectors of disease

• Disease Vectors
  – Relatively painless biters
  – Vector many different pathogens
  – Range of illness possible
  – Public health programs (UMAA!)
Thank you!!
Please fill out the evaluation,
your comments are appreciated.

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