Medical and Veterinary Entomology

An eastern treehole mosquito, *Aedes triseriatus*, takes a blood meal.

Urbana, Illinois, USA

Alexander Wild Photography

Problems associated with arthropods

1) Psychological
2) Nuisance
e.g. Common bed bug, *Cimex lectularius*
3) Venoms/Allergens
e.g. Bee sting allergies
4) *Causes* of disease
5) Disease vectors

Psychological

- Entomophobia
  - Irrational fear of insects/arthropods
  - E.g. Arachnophobia (can also be myrmecophobia, acariphobia, etc.)
- Delusory parasitosis
  - Mistaken belief that insects are crawling on skin
  - The delusion can be terrifying and harmful. May not want to leave the house. Rash from self-injury.

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Allergic reactions

- Normal appearance
- Severe allergic reaction (anaphylaxis)
4) Insects as *causes* of disease

- Body and head lice (*Pediculus humanus corporis, P. humanus capitis*)
  - Pediculosis – often the only problem is itching

- **Myiasis**
  - Many flies can develop in living flesh
  - Livestock “Strike”
    - Screwworms in the New World
  - *“Maggot therapy”*

- The mite *Sarcoptes scabiei*
  - Burrowing activities cause scabies

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**Beneficial Myiasis**

*Maggot therapy*

- Necrotic tissue in part of leg
  - Healing well after maggot therapy

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**5) Insects as *disease vectors***

*Characteristics of an effective vector*

1. Distributed over human/reservoir range
2. Abundant
3. Vector survives long enough to spread disease
4. Spends a lot of time near humans
5. Feeding rate
6. Vector competence

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**Mechanical or Biological Transfer**

- **Mechanical transfer** – passive transport on mouthparts, legs or other body parts
- **Biological transfer** – specific association of vector, pathogen and host(s); *pathogen replicates within vector*
Mechanical transfer: Myxomatosis spread by mosquitoes when rabbit population densities are high.

Types of Pathogens
- Viruses
- Bacteria
- Fungi
- Nematodes
- Protozoa

Insects as disease vectors: Biological transfer

<table>
<thead>
<tr>
<th>Disease</th>
<th>Vector</th>
<th>Pathogen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chagas</td>
<td>Kissing bug, Triatoma infestans</td>
<td>Flagellate protozoan, Trypanosoma cruzi</td>
</tr>
<tr>
<td>African sleeping sickness</td>
<td>Tsetse fly, Glossina spp.</td>
<td>Flagellate protozoan, Trypanosoma brucei</td>
</tr>
<tr>
<td>Malaria</td>
<td>Mosquito, Anopheles spp.</td>
<td>Protozoa, Plasmodium spp.</td>
</tr>
<tr>
<td>Lyme Disease</td>
<td>Tick, louse, body lice, Pediculus humanus</td>
<td>Spiromechete bacteria, Borrelia spp.</td>
</tr>
<tr>
<td>Plague</td>
<td>Oriental rat fleas, Xenopsylla cheopis</td>
<td>Entamoeba bacterium, Yersinia pestis</td>
</tr>
<tr>
<td>Epidemic typhus</td>
<td>Body lice, Pediculus humanus</td>
<td>Bacteria, Rickettsia prowazeki</td>
</tr>
</tbody>
</table>

Mosquitoes and Human Disease
- Yellow Fever (Aedes)
- Dengue (Aedes)
- Rift Valley Fever (Aedes)
- Malaria (Anopheles)
- Arboviral complex (Culex)
  - Eastern equine encephalitis
  - Japanese encephalitis
  - La Crosse encephalitis
  - St. Louis encephalitis
  - West Nile virus
  - Western equine encephalitis

Mosquitoes in Florida
- Mosquito Database
  - [http://mosquito.ifas.ufl.edu/Mosquito_Database.asp](http://mosquito.ifas.ufl.edu/Mosquito_Database.asp)
- 80 species in Florida
The Adults - Feeding

- Males and females feed on sugars; **only females take blood meals**
- Females feed on mammals or birds (some feed on reptiles and amphibians)
- Attracted by long range (body odor and CO₂) and short range cues (temperature)
- Specialized mouth parts for penetrating the host cuticle, saliva releases anti-coagulants

Class Exercise on Medical Entomology

- Malaria
- Yellow Fever
- Trypanosomiasis
- Leishmaniasis
- Lyme Disease
- Chagas disease
- Typhus
- Plague

Next slides: more background information

Yellow fever

- Was a monkey disease endemic to Africa where it cycled between mosquitoes and monkeys.
- Harmful to humans
- Has killed many new world monkeys, too.
Malaria

- Malaria/Anopheles mosquito complex has influenced human evolution
- Malaria is a problem today in more than 90 countries, inhabited by a total of some 2,400 million people ~ 40% of the world’s population
- 300 - 500 million clinical cases each year
- 1 million deaths each year. The vast majority are young children in Africa, especially in remote rural areas with poor access to health services
- The causative agents in humans are four species of Plasmodium protozoa (single-celled parasites) – P. falciparum, P. vivax, P. ovale and P. malariae.
- P. falciparum accounts for the majority of infections and is the most lethal
- Malaria is a curable disease if promptly diagnosed and adequately treated – but has become resistant to drug treatments like quinine.

A closer look at Malaria

The plasmodium cannot survive cold temperatures (below 16°C) Would do fine in a human in cold temperatures, but not in a mosquito!
Typhus

Vector: Lice

Principle hosts: humans (though other mammals can contract it)

Napoleon and typhus

30% of the entire human population has been killed by outbreaks of the plague. It caused the Black Death of the 14th Century.

Plague

Vector: fleas

Primary host: rat