Insect Parasitism

Objectives

1. Differentiate the three types of symbiosis.
2. Describe the different ways to classify parasites.
3. Discuss the costs and benefits of endo- and ecto-parasitism.
4. Differentiate between parasite and parasitoid.
5. Define hyper, multiple & gregarious parasitoids.
6. Explain why small is good.

Introduction

We will discuss:
- Insects that parasitize
  - Humans
  - Mammals
  - Other arthropods
- Symbiotic Relationships
- Parasite/Parasitoid/Predator interactions
- Endoparasites vs Ectoparasites

Symbiotic Relationships

Symbiotic relationships refer to interactions between two different species. In fact, when broken into its Greek roots, the word *symbiotic* means “life together.” Sym means “together,” and bio means “life.”

Mutualistic relationships are those in which both species involved benefit.

Parasitism

<table>
<thead>
<tr>
<th>Insect Order</th>
<th>Percent Species</th>
<th>Stage</th>
<th>Host</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dermaptera</td>
<td>1</td>
<td>Nymphs, adults</td>
<td>Mammals</td>
</tr>
<tr>
<td>Psocodea: Mallophaga</td>
<td>100</td>
<td>Nymphs, adults</td>
<td>Birds, some mammals</td>
</tr>
<tr>
<td>Psocodea: Anoplura</td>
<td>100</td>
<td>Nymphs, adults</td>
<td>Mammals</td>
</tr>
<tr>
<td>Hemiptera</td>
<td>&lt;1</td>
<td>Nymphs, adults</td>
<td>Mammals, Birds</td>
</tr>
<tr>
<td>Neuroptera</td>
<td>4</td>
<td>Larvae</td>
<td>Arthropods</td>
</tr>
<tr>
<td>Coleoptera</td>
<td>2</td>
<td>Larvae, adult</td>
<td>Invertebrates, mammals</td>
</tr>
<tr>
<td>Lepidoptera</td>
<td>2</td>
<td>Larvae or adults</td>
<td>Invertebrates, mammals</td>
</tr>
<tr>
<td>Diptera</td>
<td>12</td>
<td>Larvae or adults</td>
<td>Invertebrates, vertebrates</td>
</tr>
<tr>
<td>Siphonaptera</td>
<td>100</td>
<td>Adults</td>
<td>Mammals, some birds</td>
</tr>
<tr>
<td>Hymenoptera</td>
<td>50</td>
<td>Larvae, some adults</td>
<td>Arthropods</td>
</tr>
</tbody>
</table>

Note: Remember that Anoplura and Mallophaga are formerly in the Order Phthiraptera and currently in the Order Psocodea. The date of the reference determines the order name.

Relationships (Continued)

In commensal relationships, one species benefits but the other neither profits nor is harmed.

In insect parasitism, one species benefits at the expense of another.
Endo- and Ectoparasitism

There are two types of parasites you will be learning in this unit.

Endoparasites and ectoparasites

Endoparasites are parasites that live within the body of its host. Ectoparasites live outside the body of the host.

A female mosquito would be an ectoparasite because it lives off of blood by sucking it up from the outside.

Endoparasitism Examples

Endoparasites – Yes, these are inside the host.

Tree squirrel bot fly:
- Lay eggs on mammal inhabited substrate
- Larvae hatch and seek out orifices (eyes, mouth, nose, anus, wounds)
- Migrate through body
- Settle under the skin and cut a breathing hole
- Larvae exit for pupation

And, for those of you who are curious, there is a human bot fly (check YouTube for videos of this). To view more photos, please visit http://entnemdept.ufl.edu/creatures/misc/flies/squirrel_bot_fly.htm.

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Endoparasitism Examples (Continued)

Horse bot fly (Gastrophilus spp.):
- Deposit eggs on forelimbs and head of horse.
- Horse licks its coat and hatching is triggered.
- The larva burrow into the lips and gums.
- Migration begins towards the stomach.
- The larvae feed and create potentially fatal ulceration.
- The horse will then pass mature larvae in fecal material.
- Larvae pupate on the ground for 1-2.

Horse Bot Fly

Horse bots in stomach.

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Ectoparasitism Examples

Ectoparasites

Bedbugs: "Don't let the bedbugs bite!"
- Feeds on vertebrate blood.
- Favor humans as a host.
- Feed at night.
- Emerge from harborage in mattresses and other cracks and crevices.
- Hide during daylight.
- Leave bite welts similar to fleas and mosquitoes.
- Have a sickly sweet odor and leave blood spots.

If you suspect bed bugs in a place, pull back the bedding and check the seams of the mattress and box springs for small brownish spots.

VIDEO – Watch the bedbug video. A bedbug colony was discovered in a student's apartment near the UF campus. The apartment had a used mattress and a few unwanted inhabitants. See the piercing sucking mouthparts as they probe for a blood vessel. Then see the blood meal and the expulsion of excess water and blood at the conclusion of the feeding. Sleep tight!

Horse Bot Fly

Ectoparasitism Examples (Continued)

Fleas:
- Feed on the blood of mammals and some birds.
- Flattened side to side (helps navigation in host hairs).
- Secondarily wingless.
- Larvae live on the ground, bedding or other furniture, not on host.
- After pupating, the emerged adult jumps onto a host to feed.

Some people are highly allergic to flea bites and others may not react at all.

Video – Bedbugs Feeding
Some wasps are able to find and parasitize beetle larvae that live in the soil. The top picture to the right shows a wasp larva feeding on the side of a beetle grub. The bottom picture shows the same wasp larva after it has consumed the beetle and in the process grown much larger.

Parasitoids are parasites that kill their hosts.

Parasitoid Examples:
- Tarnished plant bug parasitoid:
  - This wasp (family Braconidae), is laying an egg on a tarnished plant bug.
  - Larvae will live inside the host for 7-10 days.
  - It then leaves its dying host to pupate in the ground.
    - The tarnished plant bug is a pest of alfalfa.
    - The parasitoid was found in France by the.

A quarter-inch-long parasitic wasp, Peristenus digoneutis Loan, prepares to lay an egg in a nymph of the tarnished plant bug, Lygus lineolaris US.

Parasitoid Examples (Continued)
- Aphid parasitoid:
  - Aphids suck plant juices.
  - Aphidid wasps lay eggs on the aphids.
  - Larva will live for two weeks.
  - This parasitoid pupates within the host.
  - It emerges and leaves the aphid exoskeleton (aphid mummy).

Gregarious Parasitoidism

Sometimes several larvae of the same species develop in a single host, as shown in this picture of a cabbageworm parasitoid. This is called gregarious parasitoidism. The worm has several parasitoid cocoons attached. The larvae kill the caterpillar when they emerge from their cocoons.
IMPORTANT NOTE:
Throughout the course units, you will be asked to view short video clips. Please understand that many of these video clips are copyrighted and are NOT to be used outside of this class and only may be used for this semester. Please do not copy or distribute these clips.

Video – Parasitism of Caterpillars

Multiple Parasitoidism

Another term to be familiar with is multiple parasitoidism, when two or more parasitoid species attack one host individual.

Parasitism Advantages

You have learned about various examples of endo- and ectoparasites and parasitoids in general.

What advantages does an endoparasitoid have over an ectoparasitoid?  
What advantages does an ectoparasitoid have over an endoparasitoid?

Why Small

Based on overall length, the smallest adult insect is a parasitic wasp, Dicopomorpha echmepterygis (Hymenoptera: Mymaridae). Males of this species are blind and wingless and measure only 139 µm (about 0.005 inches) in length. These tiny wasps are found in Costa Rica and are called fairyflies.

UF Book of Insect Records - http://entnemdept.ufl.edu/walker/ufbir/chapters/chapter_38.shtml

What are the advantages of being small?

Conclusion

Wow, who would have thought that organisms so small could do so much damage!

That concludes this unit.

You should now have a good grasp on the various insect parasites, how they affect different animals and their importance in controlling major agricultural pests.

