Insect Parasitism

1

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.

Chicken body louse

Chicken feather louse

2

Introduction

We will discuss:

- Insects that parasitize
  - ✓ Humans
  - ✓ Mammals
  - ✓ Other arthropods
- Symbiotic Relationships
- Parasite/Parasitoid/Predator interactions
- Endoparasites vs Ectoparasites

Sucking louse

3

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.

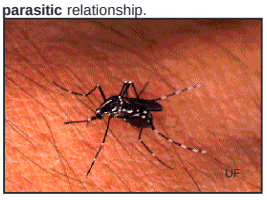

Ants tending aphids - NCSU

4

Relationships (Continued)

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

Relationships in which one species benefits at the expense of another is a **parasitic** relationship.



5

Parasitism

Insect Order	Percent Species	Stage	Host
Dermaptera	1	Nymphs, adults	Mammals
Psocodea: Mallophaga	100	Nymphs, adults	Birds, some mammals
Psocodea: Anoplura	100	Nymphs, adults	Mammals
Hemiptera	<1	Nymphs, adults	Mammals, birds
Neuroptera	4	Larvae	Arthropods
Coleoptera	2	Larvae, and/or adults	Invertebrates, mammals
Lepidoptera	<1	Larvae or adults	Insects, mammals
Diptera	12	Larvae or adults	Invertebrates, vertebrates
Siphonaptera	100	Adults	Mammals, some birds
Hymenoptera	50	Larvae, some adults	Arthropods

(Elzinga, 2000, pg. 244)

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.

6

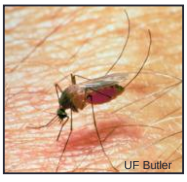
Endo- and Ectoparasitism

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.

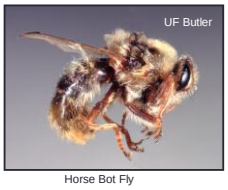
warble

(UF - Slansky & Kenyon, 1998).

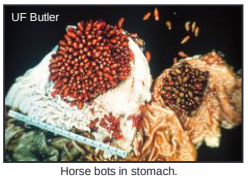
Endoparasitism Examples (Continued)

Horse bot fly (Gastrophilus spp.):

- Deposit eggs on forelimbs and head of horse.
- Horse licks its coat and hatching is triggered.
- The larvae 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.

Ectoparasitism Examples

Ectoparasites

Bedbugs:

"Don't let the bedbugs bite!"

- Feeds on vertebrate blood.
- Favor humans as a host.
- Feed at night.
- Emerge from harborages 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!

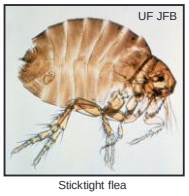
Video – Bedbugs Feeding

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.

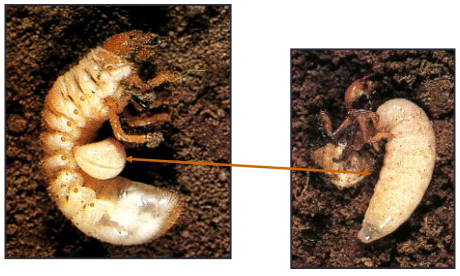
Some people are highly allergic to flea bites and others may not react at all.



Sticktight flea

Wasp Parasitism

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



13

Parasite vs Parasitoid

Parasitoid Examples:
Tarnished plant bug parasitoid:

Parasitoids are parasites that kill their hosts.

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

- 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.

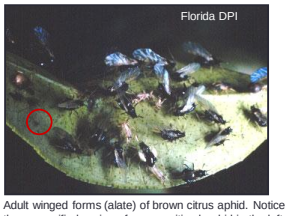
  - The tarnished plant bug is a pest of alfalfa.
  - The parasitoid was found in France by the.

14

Parasitoid Examples (Continued)

Aphid parasitoid:

- Aphids suck plant juices.
- Aphidiid 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).



Adult winged forms (alate) of brown citrus aphid. Notice the mummified casing of an parasitized aphid in the left central portion of the leaf near the mid-vein.

15

Parasitoid Terms

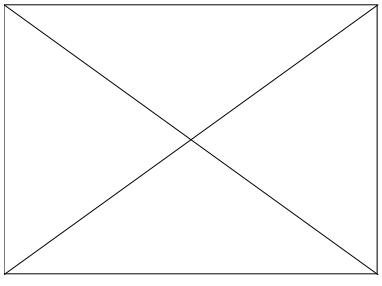
Hyperparasites can be a problem if they attack a parasitoid that is being used to control an insect pest.

For example a pteromalid wasp parasitizes aphid parasitoids. This hyperparasite probes aphids until it finds one that is infected with the braconid wasp. The pteromalid then lays an egg on the parasitized aphid and the larvae will eat the pupating braconid.

Braconid wasp

16

Video – Silk Thread Disappearing Act



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Please do not copy or distribute these clips.

17

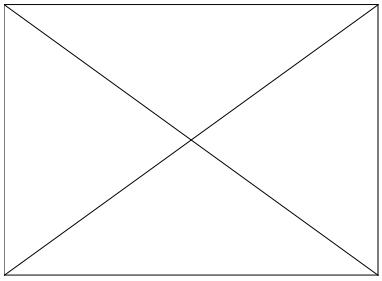
Gregarious Parasitoidism

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.

Parasitoid larvae emerging from a dead larva of the imported cabbageworm, Pieris rapae (Linnaeus)

18

Video – Parasitism of Caterpillars



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19

Multiple Parasitoidism

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

Southern green stink bug, *Nezara viridula* (Linnaeus), with attached parasite egg.

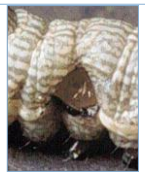
20

Parasitism Advantages – Thought Question

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?***



Parasitoid exit hole in a beet armyworm. Hole made by a wasp larva, Cotesia marginiventris (Cresson).
http://edis.ifas.ufl.edu/in280

21

Why Small – Thought Question

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?

22

Learning Game Placeholder

Learning Game: Choices

Title: Review Quiz

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.

24

References Cited

1. Elzinga, R.J., 2000. *Fundamentals of Entomology,* Prentice Hall, Upper Saddle River, New Jersey, 5th ed.

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4. University of Florida IFAS http://creatures.ifas.ufl.edu/ Accessed March, 2011.