

Insect Parasitism



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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



UF JFB
Chicken body louse



UF JFB
Chicken feather louse

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Introduction

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



UF
Sucking louse

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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

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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.



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Parasitism

Insect Order	Percent Species	Stage	Host
Dermoptera	1	Nymphs, adults	Mammals
Mallophaga	100	Nymphs, adults	Birds, some mammals
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 sometimes grouped in the Order Phthiraptera or in the Order Psocoda.

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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.

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Endoparasitism Examples

Endoparasites – Yes, these are inside the host.

Tree squirrel bot fly:

Bot flies often lay their eggs on habitat substrates where mammals live. When these eggs hatch into larvae, the larvae enter a body orifice (eyes, mouth, nose, anus, or wound). They migrate for about a week through the host's body before choosing a site to settle under the skin. There they cut their warble pore through the host's skin (from the inside out). Rodent- and rabbit-bot flies rarely infest humans, but when they do, they may bore directly through a person's skin from outside in. At pupation time, the larvae crawl out of their mammalian host and drop to the ground to pupate. 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/files/squirrel_bot_fly.htm.



Endoparasitism Examples Continued

Horse bot fly:

The horse bot fly, genus *Gastrophilus*, has a slightly different life cycle than the squirrel bot. Adult bot flies deposit eggs on the forelimbs and head regions of a horse. As the horse licks his coat, this stimulates the eggs to hatch. The larvae burrow into the mucosal membranes of the horse's lips and gums and migrate to the stomach. Here the larvae feed, and may cause ulcers which can be fatal. Eventually the horse will pass the larvae through fecal matter. Once on the ground, they will pupate for 1-2 months.



Horse Bot Fly



Horse bots in stomach.

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Ectoparasitism Examples

Ectoparasites

Bedbugs:

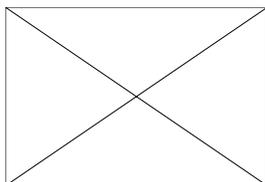
"Don't let the bedbugs bite!" Did your parents ever say this to you when tucking you in at night? Bedbugs are an insect that feed on the blood of vertebrates, particularly humans. They like to feed at night, and will crawl out of the seams of mattresses, or from cracks and crevices where they stay during the daylight hours. When they bite, bedbugs leave a welt similar to a flea or mosquito bite. Some people have a more severe reaction than others. Bedbugs are again a problem in the US. Pest control companies are recording large numbers of calls about bedbugs in homes, offices, movie theaters, schools, and hotels. Bedbugs have a sweet odor and leave behind blood spots when they feed. 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. Bedbugs live in cracks and crevices during the day, so can be hard to spot.

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!



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Video – Bedbugs Feeding

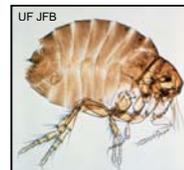


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Ectoparasitism Examples Continued

Fleas:

Fleas feed on mammals and some birds. They are flattened side to side which helps them navigate in between host hairs. They are also secondarily wingless. Flea larvae do not live on the host, but on the ground, bedding or other furniture. After pupating, the emerged adult jumps onto a host to feed on its blood. Some people are highly allergic to flea bites and others may not react at all.

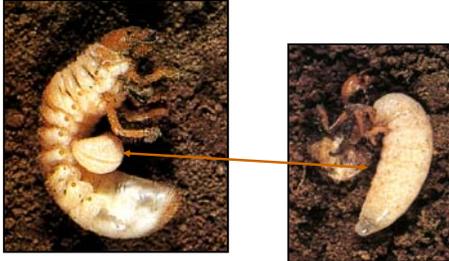


Sticktight flea

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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.



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Parasite versus 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*

Parasitoid Examples:
Tarnished plant bug parasitoid.

This wasp, from the family Braconidae, is laying an egg on a tarnished plant bug. The egg will hatch and the 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. This parasitoid originally lived in France, and was discovered by the USDA. The US government allowed it to be released in New Jersey to help control the tarnished plant bug that was causing problems with alfalfa crops. The parasitoid has now become well established in many northeastern US states.

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Parasitoid Examples Continued

Aphid parasitoid:

Aphids can suck a plant dry of its juices in a short amount of time. The adult aphidid wasps lay eggs on the aphids, where the larva will live for two weeks. Different than the tarnished plant bug parasitoid, this parasitoid, pupates within the host. Upon emergence it leaves behind just the aphid exoskeleton, or an aphid mummy as pictured here. This parasitoid is commercially available so that one can buy them and release the parasitoid to help control aphid populations.

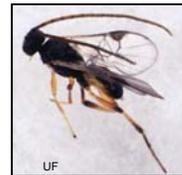


Adult winged forms (alatae) of brown citrus aphid. Notice the mummified casing of a parasitized aphid in the left central portion of the leaf near the mid-vein.

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Parasitoid Terms

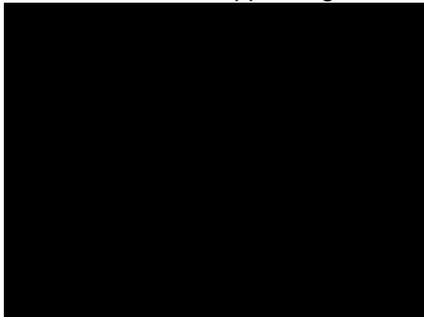
Hyperparasites can be a problem if they attack a parasitoid that is being used to control an insect pest. For example a pteromalid wasp parasitizes aphid parasitoids. This hyperparasite probes aphids until it finds one that is infected with the braconid wasp. The pteromalid then lays an egg on the parasitized aphid and the larvae will eat the pupating braconid.



Braconid wasp

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Video – Silk Thread Disappearing Act



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.

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Gregarious Parasitoidism

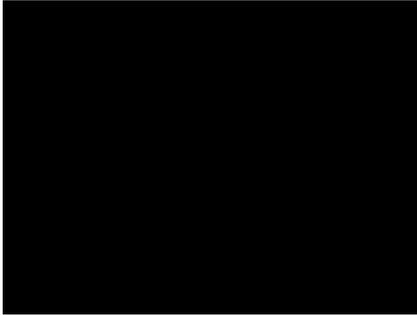
Sometimes several larvae of the same species develop in a single host, as shown in this picture of a cabbageworm parasitoid. This is called **gregarious parasitoidism**. The worm has several parasitoid cocoons attached. The larvae kill the caterpillar when they emerge from their cocoons.



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

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Video – Parasitism of Caterpillars



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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 parasitoid egg.

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Parasitism Advantages – Thought Question

You have learned about various examples of endo- and ectoparasites and parasitoids in general. Think about what advantages **an endoparasitoid may have over an ectoparasitoid? What about an ectoparasitoid over an endoparasitoid?**



Parasitoid exit hole in a beet armyworm. Hole made by a wasp larva, *Cotesia marginiventris* (Cresson).
<http://edis.tau.ufl.edu/in30/>

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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?



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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.



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References Cited

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