Exploitative Interactions: Predation, Herbivory, Parasitism, and Disease Chapter 14





Introduction

- **Exploitation:** Interaction between populations that enhances fitness of one individual while reducing fitness of the exploited individual.
 - * Predators kill and consume other organisms.
 - Parasites live on host tissue and reduce host fitness, but do not generally kill the host.
 - Parasitoid is an insect larva that consumes the host.
 - * Pathogens induce disease.

http://www.youtube.com/watch?w







ww.colbertnation.co Wasps on a hornworm – insides are gone!!!

Complex Interactions

There are parasites that alter host behavior
 They're pretty cool!!!





http://www.youtube.com/watch?v=f5UzztCns-Y

http://www.youtube.com/watch?v=4PB4SjX8QkA

http://www.youtube.com/watch ?v=vMGhttp://www.youtube.com/watch?v=EtwlatedOSUXMw

More examples!

The rabies virus increases saliva production and makes the infected host aggressive. When a rabid animal bites a host the virus is spread via saliva in the wound.

• *Toxiplasma gondii* causes infected rodents to specifically lose their inborn aversion to cat pheromones. Infected cats in turn spread toxiplasma through their droppings. People infected with toxiplasma also exhibit behavioral changes, particularly a decrease in "novelty seeking".

http://www.youtube.com/watch?v=nEyIZLQewX8

http://www.youtube.com/watch?v=5qHNoTZMz6w&NR=1

• Grasshoppers infected with the hairworm (*Spinochordodes tellinii* Placeome more likely to jump into water where the hair worm reproduces. The parasite essentially makes its host suicidal to further its pwh animarologition. Mosquitoes that drink plasmodium-infected blood initially become more cautious about finding another victim, giving plasmodium time to replicate. Once the plasmodium is infective, mosguitees become more dikely to ingove to vand suight and essentiavior night anakepte chosts entoredikely to ingove to vand suight and essentiavior sinfaberda with a viranive the bayion of the trematode uses contrating an offer likely to pheaten by birds, which the trematode uses as a host for the next stage in its life cycle

Parasites That Alter Host Behavior –

- Plants are not safe!! Rust fungus *Puccinia monoica* manipu host mustard plants (*Arabis* spp.).
 - Puccinia infects Arabis rosettes and actively dividing meristemic tissue.
 - Rosettes rapidly elongate and be a cluster of bright yellow leaves.
 - Pseudo-flowers are fungal structures
 - Attract pollinators for reproduction

Arabis lifespan is cut short Cannot form seeds







Parasitism affecting Competition! The presence/absence of a protozoan parasite (*Adeline tribolii*) influences competition in flour beetles (*Tribolium*).

- Reduces density of *T. castaneum* but has little effect on *T. confusum*.
- *T. castaneum* is usually a better competitor, but with *Adelina*, *T. confusum* becomes strongest competitor.
 Correct Te Mediate Adelina, *T. confusum* becomes strongest
 Correct Te Mediate Adelina, *T. confusum* becomes strongest





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Population dy Predator-prey, host-paras

- How do these relation
- · Predator prey: abur

Is it clear that the lynx alone caus snowshoe hares??? That's what r

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Other factors to think about

- It's very easy to say it's only predation by the lynx
 - * Food supply of hares more hares = less food!
 - * Predation by other organisms
 - * Other possibilities???



What they found!



8 year study!!! It's an interaction between hares, their food supply, and their predators!

Model Behavior

In the absence of environmental factors, some laboratory models have shown that predator-prey cycles would still occur!

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These laboratory populations showed reciprocal oscillations of host and parasitoid numbers that continued for 112 generations, or 6 years.





Number of generations

Bean weevil pst faboratopy



Refuges

- What are refuges?
- To persist in the face of exploitation, hosts and prey need refuges.
 - * *Didinium* quickly consumed all *Paramecium* and went extinct. (Both populations extinct)
 - Added sediment for Paramecium refuge.
 - Few Paramecium survived after Didinium extinction.

In normal populations immigration would most likely occur!

http://www.youtube.com/watc h?v=HIHihxqqXOE



Other "refuges" besides spatial ones -Protection in Numbers

- Living in a large group provides a "refuge."
- Wide variety of organisms employ predator satiation defense.
 - Prey can reduce individual probability of being eaten by living in dense populations.
- Periodical cicadas *Magicicada spp.* emerge as adults every 13-17 years. Densities can approach 4x10⁶ ind/ha (2.5 acres). As nymphs, feed on fluid in roots.



http://www.youtube.com/watch?v=tjLiWy2nT7U

Predator Satiation by Periodical Cicadas

- Williams estimated 1,063,000 cicadas emerged from 16 ha study site.
 - * 50% emerged during four consecutive nights.

* Losses to birds was only 15% of production.

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Size As A Refuge

- If large individuals are ignored by predators, then large size may offer a form of refuge.
 - * What do lions go after, the big elephants or the babies???
 - * In terms of optimal foraging theory, large size equates to lower profitability.
- http://videos.howstu ffworks.com/animalplanet/32786-jawsand-claws-2elephant-surgevideo.htm



Size as a Refuge – Other examples Pisaster ochraceus doesn't consume the largest Mytilus californianus





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Mayflies "standin up" to stonefiles protects them! By assuming a "scorpion" posture, ephemerellid mayflies may make themselves appear larger and reduce the probability of being attacked by predaceous stoneflies.



Ephemerellid mayfly

Ecology of Fear and Refuges

- The presence of predators can alter the behavior of prey to avoid high-risk locations.
 - * "the ecology of fear"
- increasing wolf populations in Yellowstone National Park have affected their prey's distribution
 - Elk are more vulnerable to wolf attack in riparian habitat and have reduced their foraging in this habitat.
 - * Riparian trees have a refuge!







Can you think of any other potential refuges for organisms besides...

- Spatial
 Predator satiation
- 3. Size
- 4. "Fear"

http://www.youtube.com/watch?vEFBEDd7abCAg

What about time???

Diel vertical migration!

