

Amphibian Parasites

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Lecture Outline

- Overview of different types of amphibian parasites
- Current information on mechanisms and effects of each type of parasite
- Future directions for research concerning amphibian parasites

What is a parasite?

- A parasite is a plant or an animal that lives on or inside another living organism (host). A parasite is dependent on its host and obtains some benefit, such as survival, usually at the host's expense

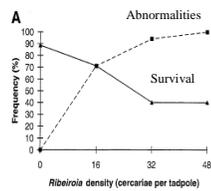
Types of Amphibian Parasites

- Metazoans (including trematodes and nematodes)
- Protozoans
- Endoparasitic mites
- Ectoparasites (including leeches and flies)

Trematode

Ribeiroia ondatrae

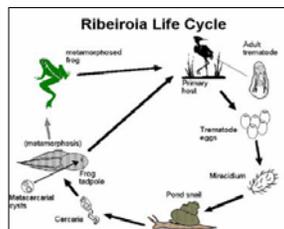
- Frogs were exposed to varying amounts of *Ribeiroia* cercariae (0, 16, 32, or 48)
- Malformations were found in 85% of frogs surviving to metamorphosis
- Frequency of abnormalities was positively correlated with parasite density
- Severity of abnormalities also increased with parasite density
- Few abnormal adult frogs were seen in study
 - Indirect mortality resulting from increased predation of frogs with malformations



Trematode

Ribeiroia ondatrae

- Cercariae of *Ribeiroia* encyst around limb buds
- Side effects are malformations including multiple extra limbs, skin webbings, bony triangles, and missing or partially missing limbs
- An important note: To induce malformations, *Ribeiroia* must encyst during the window of early limb development. Amphibians exposed after limb development is completed are unlikely to develop malformations



Trematode

Ribeiroia ondatrae

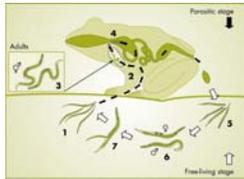
Two hypotheses to explain mechanism leading to amphibian limb malformations resulting from *Ribeiroia* infection:

- 1) Mechanical effect- parasite disturbs arrangement of growing limb cells, leading to abnormal limb formation/limb duplication
 - 2) Chemical effect- *Ribeiroia* produces a compound that stimulates or inhibits limb growth
- Additional stressors in combination with *Ribeiroia* may increase frequency of malformations
 - Pesticide exposure (reduced immune response)
 - Predation by fish (reduced activity)

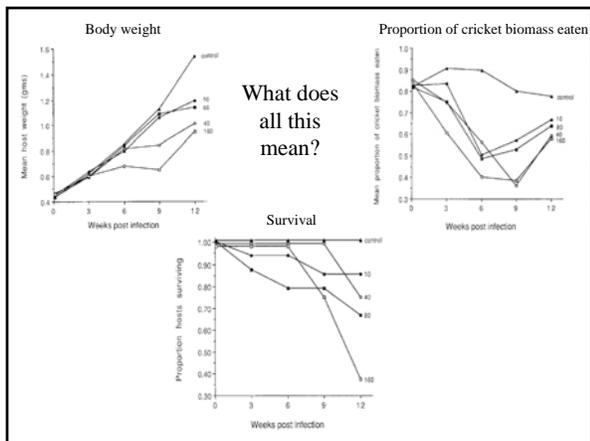
Nematode

Rhabdias bufonis

- Larvae penetrate the skin, molt in musculature, then migrate to lungs
- 80 toads were exposed and infected with various amounts of nematodes (0, 10, 40, 80, 160)
- The abundance of nematodes in lungs decreased over time naturally
- Toads were fed increasing amounts of crickets (initially fed 0.10g of crickets; by the end of the study they were fed 0.30g)



Oecologia (1992) 89:161-165



Results

Rhabdias bufonis

- Toads with different amounts of infection had different patterns of growth
- Mortality was correlated with worm density
- Toads ate progressively smaller amounts of crickets over time leading to parasite-induced anorexia
 - May allow toads to wait out infection if parasites are short-lived and if reduced activity is correlated with decreased chances of further infection
 - May result from interference with activity behaviors (foraging)
- Smaller toads were initially more susceptible to mortality, especially those introduced to higher numbers of parasites
- **Infected toads grew slower and had lower survival**

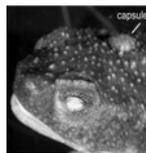
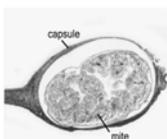
Protozoal Parasites

- Sporozoan *Charchesium sp.*
 - Known to cause clogging of the gills and spiracle in tadpoles
 - Results in developmental retardation and death
- *Apiosoma sp.*
 - Overcrowd and block gut tube
 - Can cause clogging of gills

Endoparasitic mite

Hannemania sp.

- Four stage life cycle (egg, larvae, nymph, adult) but only larvae affect amphibians
- Larvae burrow into the frog's skin forming red pustules behind eyes
- Effect on frogs is unclear
 - May kill frogs or serve as vectors for infectious diseases



Wohlmann et al., 2006

Ectoparasites

- Leeches
 - Common on amphibians that live in or enter water to breed
 - Can cause anemia from blood loss
 - Can secondarily transmit protozoa, bacteria, and viruses
- Flies (Diptera)
 - Lay eggs on bodies of Anurans
 - *Batrachomyia* larvae burrow under the skin of the back
 - *Lucilia* larvae move towards the anuran's head and enter body through eyes or nostril to devour the host

Future Directions for Research

- More detailed consideration of host size in future experiments is required to examine further its precise influence on parasite-induced mortality
