

# Amphibian Parasites

Nikki Maxwell  
University of Tennessee  
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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

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## 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

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## Types of Amphibian Parasites

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

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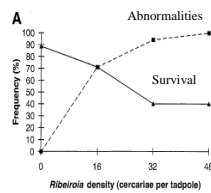
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## Trematode

### *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




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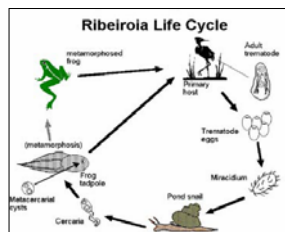
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## Trematode

### *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




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## 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)

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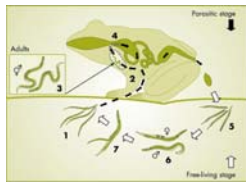
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## Nematode

### *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

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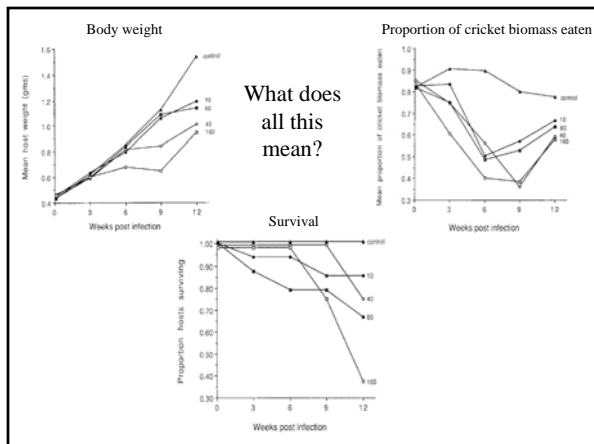
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## Results

### *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**

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## 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

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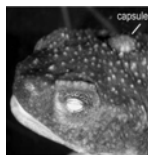
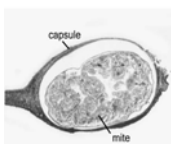
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## Endoparasitic mite

### *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

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## 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

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## 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

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