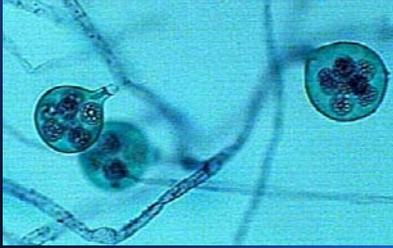


Saprolegnia: Amphibian Killer?



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Discussion Outline

What is *Saprolegnia*?

What does *Saprolegnia* do to amphibians?

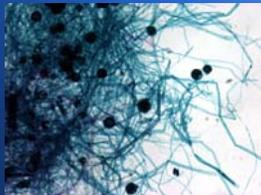
How is *Saprolegnia* connected to amphibian declines?

Why is *Saprolegnia* the most important factor affecting amphibians?

What is *Saprolegnia*?

Simple answer: water mold

More detail:
Saprolegnia is one of several genera of oomycetes ("egg fungi") which are important pathogens of plants, fish, and amphibians



What does *Saprolegnia* do?

Like any mold, *Saprolegnia* feeds on and breaks down organic matter
Primarily saprophytic, but can also be parasitic



What does *Saprolegnia* do?

Infests dead or compromised eggs, can affect entire egg masses
Can cause early hatching
Infests wounded individuals
Can kill juveniles



How is *Saprolegnia* connected?

Saprolegnia is cosmopolitan in distribution, and has been observed to affect a wide variety of amphibian species

Examples:

Blaustein *et al.* have observed significant mortality in *Bufo boreas* eggs as a result of *Saprolegnia* infestations (1994)

Kiesecker and Blaustein have documented embryo mortality in *Bufo boreas* and *Rana cascadae* in combination with UV-B exposure (1995)

How is *Saprolegnia* connected?

Examples, cont.:

Lethal *Saprolegnia* infections have been observed in *Rana sylvatica* and *Bufo americanus* (Gomez-Mestre *et al.*, 2006)

High mortality has been observed in *Rana arvalis*, *R. esculenta*, *R. temporaria*, *Bufo bufo*, and *B. calamita* in combination with low pH (Leuven *et al.*, 1986)

Infestations also observed in *Triturus vulgaris* and *Agalychnis callidryas* (Green, 1999; Warkentin *et al.*, 2001)

How is *Saprolegnia* connected?

Blaustein *et al.*, 1994

Have been observing *Bufo boreas* populations in Oregon since 1980

Unusually high egg mortality every year since 1989

Observed breeding activity at Lost Lake in 1992. Mold first appeared 2 days after laying, and over next 4 days infected entire communal egg mass.

Within one week 70% of eggs laid had died. 95% died overall.

How is *Saprolegnia* connected?

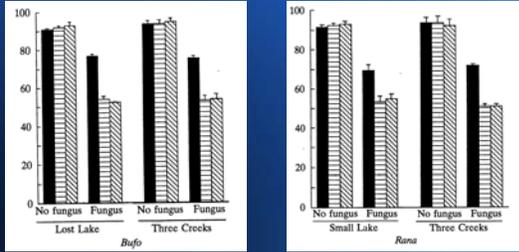
Kiesecker and Blaustein, 1995

Conducted experiments examining synergistic effects between *Saprolegnia* and UV-B exposure

Set up artificial pools at breeding sites in Oregon and placed clutches from *Bufo boreas*, *Rana cascadae*, and *Hyla regilla* in enclosures within pools

Three treatments: natural sunlight, sunlight filtered to exclude UV-B, and sunlight with a control filter

How is *Saprolegnia* connected?



How is *Saprolegnia* connected?

Gomez-Mestre *et al.*, 2006

Surveyed nine vernal pools in Lynn Woods Reservation, Massachusetts

Monitored clutches of *Ambystoma maculatum*, *Rana sylvatica*, and *Bufo americanus*

Found 7% of *R. sylvatica* clutches infested with mean mortality of ~30% (range 5-80%)

Found ~60% of *B. americanus* clutches infested with mean mortality of 25% (range 5-90%)

How is *Saprolegnia* connected?

Gomez-Mestre *et al.*, 2006, cont.

Also found that *R. sylvatica* hatched 13% earlier in response to mold infection, and *B. americanus* hatched 36% earlier.

Early hatching *R. sylvatica* embryos were more susceptible to predation from backswimmers. No increase observed in *B. americanus*, but only one predator tested.

Why is *Saprolegnia* important?

It's everywhere: Eastern and Western U.S., Europe, South America, etc.

It can cause significant mortality in amphibian egg masses, even up to complete loss of reproductive effort

It can increase mortality of injured adults and kill tadpoles (Blaustein *et al.*, 1994)

Why is *Saprolegnia* important?

It can cause egg masses to hatch early, which may protect them from the mold but leave them more vulnerable to predators

It has demonstrated synergistic effects with other significant amphibian threats, such as UV-B and acid deposition

It affects some species more than others, and can therefore disrupt competitive interactions (Kiesecker and Blaustein, 1999)

Works Cited

Blaustein AR, Hokit DG, O'Hara RK. 1994. Pathogenic fungus contributes to amphibian losses in the Pacific Northwest. *Biological Conservation* 67: 251-254.

Gomez-Mestre I, Touchon JC, Warkentin KM. 2006. Amphibian embryo and parental defenses and a larval predator reduce egg mortality from water mold. *Ecology* 87: 2570-2581.

Green AJ. 1999. Implications of pathogenic fungi for life-history evolution in amphibians. *Functional Ecology* 13: 573-575.

Kiesecker JM, Blaustein AR. 1995. Synergism between UV-B radiation and a pathogen magnifies amphibian embryo mortality in nature. *Proc. Natl. Acad. Sci. USA* 92: 11049-11052.

Kiesecker JM, Blaustein AR. 1999. Pathogen reverses competition between larval amphibians. *Ecology* 80: 2442-2448.

Leuven RSEW, den Hartog C, Christiaans MMC, Heijligers WHC. 1986. Effects of water acidification on the distribution pattern and the reproductive success of amphibians. *Experientia* 42: 495-503.

Warkentin KM, Currie CR, Rehner SA. 2001. Egg-killing fungus induces early hatching of red-eyed treefrog eggs. *Ecology* 82: 2860-2869.
