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Behavior and development of red-eyed treefrogs during metamorphosis [poster]

Robin Greene
University of Victoria

Clay Noss
University of Florida

Tobias Lanberg
Boston University

James R. Vonesh
Virginia Commonwealth University, jrvonesh@vcu.edu

Karen Warkentin
Boston University

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Robin Greene[1], Clay Noss[2], Tobias Landberg[3], JamesVonesh[4] and Karen Warkentin[3]

[1]U of Victoria, BC (rgreeners@gmailcom); [2]U of Florida, Gainesville; [3]Boston U, MA; [4]Virginia Commonwealth U, Richmond

INTRODUCTION

Red-eyed treefrogs (*Agalychnis callidryas*) have substantial plasticity in egg and larval stages in response to predators (Warkentin 1995, 1999). Little is known about the transition from aquatic tadpoles to terrestrial metamorphs. We focused on behavioral and developmental changes during this critical transition.

QUESTIONS

Q1. What is the time course of tail resorption during metamorphosis?

Laboratory: Staged and measured tail resorption in 25 red-eyed treefrog tadpoles through metamorphosis.

Q2. Do aquatic and semi-terrestrial predators affect the timing of metamorph emergence?

Mesocosm experiment: Recorded timing of metamorph emergence from tanks with giant water bugs, fishing spiders, or no predators.

Q3. How do metamorphs behave after emergence?

Field: Conducted surveys and focal animal observations of metamorph behavior at Experimental Pond, Gamboa, Panama, using infrared video cameras.

RESULTS Q1. TAIL RESORPTION

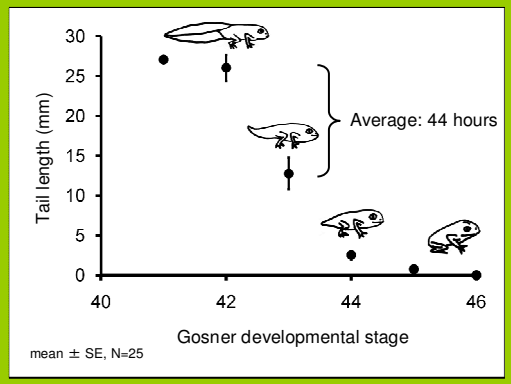

Figure 2: Tail length changes during metamorphosis.

What this means:

•Large developmental changes over a short time during transition from aquatic to terrestrial life.

• Majority of tail is absorbed between stage 42-43.

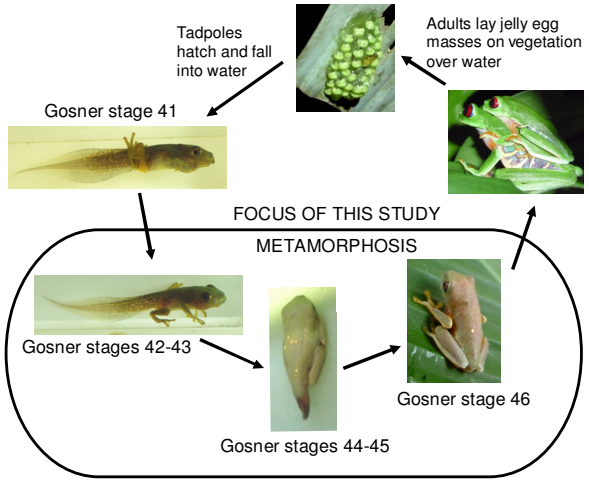

Figure 1: Red-eyed treefrog Lifecycle

Q2. PREDATOR EFFECTS ON EMERGENCE

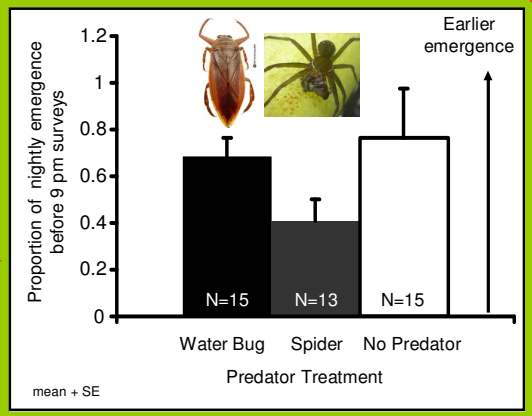

Figure 4: Predator effect on timing of metamorph emergence. One-way ANOVA with data arcsin transformed: p=0.167. t-test comparing the two predator treatments: p=0.059.

What this means:

•Sample sizes were small, but data suggest that metamorphs may delay emergence when metamorph-eating spiders are present.

•Metamorphs may emerge earlier in treatments without predators and with water bugs, an effective aquatic predator of larvae and metamorphs developing legs.

Q3. METAMORPH BEHAVIOR

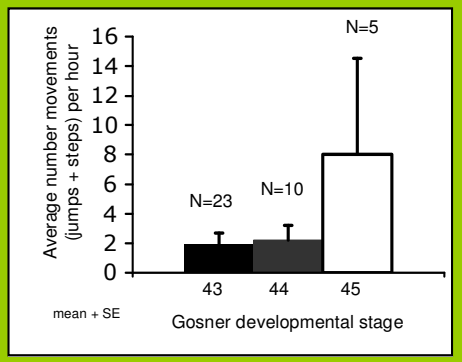

Figure 3: Metamorph activity levels. These were the first field observations of metamorphs.

Field observations:

•Stage 43 metamorphs found in vegetation in pond. Stage 44-45 metamorphs found up to 2 m away from pond (more active as tail resorbed).

•Metamorphs held long tail curled up when walking.

•Common postures and behaviors: body raised and water conserving, head bobbing/turning and reaching/stretching.

CONCLUSIONS

- Metamorphosis is an important and drastic life history transition between aquatic and terrestrial life styles.
- Metamorphs may become more active and move farther from pond as tail is absorbed.
- Majority of tail is absorbed very quickly. Large changes in tail length and muscle control (locomotion capabilities) may occur in only a couple hours. Metamorphs may delay emergence when fishing spiders are present if a couple hours of tail resorption increases survival.
- Metamorphs may emerge earlier if water bugs are present to decrease mortality in aquatic environment.

References

Gosner, K. L. 1960. A simplified table for staging anuran embryos and larvae, with notes on identification. Herpetologica, 16(3):183-190.

Warkentin, K. 1995. Adaptive plasticity in hatching age: a response to predation risk trade-offs. PNAS 92(8):3507-3510.

Warkentin, K. 1999. The development of behavioral defenses: a mechanistic analysis of vulnerability in red-eyed tree frog hatchlings. Behavioral Ecology, 10(3):251-262.

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