Tadpole density changes the relationship of red-eyed treefrog morphology and jumping performance [poster]

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Tadpole density changes the relationship of red-eyed treefrog morphology and jumping performance

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Introduction

As organisms develop, increased body size is often accompanied by shape changes that alter the morphology-performance relationship. Animals with different growth histories may also have different shapes at similar body sizes. We investigated the effects of larval growth history on the morphology and performance of red-eyed treefrog (Agalychnis callidryas).

Predictions: Tadpoles reared at low density will have larger body size and relatively longer legs than those reared at high density, resulting in higher absolute and relative jumping performance.

Experimental design

Red-eyed treefrog tadpoles were raised in 400 L mesocosms at three densities, each replicated 5 times:

- Low density: 5
- Medium density: 25
- High density: 50

Following metamorphosis, we measured mass, snout-vent length (SVL), tibiafibula length (TF), and tail length.

We measured jump distance to the nearest 2.5 cm and used the average of three jumps for each frog (n=227) in our analyses.

Results– morphology

As organisms develop, increased body size is often accompanied by shape changes that alter the morphology-performance relationship. Animals with different growth histories may also have different shapes at similar body sizes. We investigated the effects of larval growth history on the morphology and performance of red-eyed treefrog (Agalychnis callidryas).

Predictions: Tadpoles reared at low density will have larger body size and relatively longer legs than those reared at high density, resulting in higher absolute and relative jumping performance.

Experimental mesocosms in Panama

Results– jumping performance

Analysis of covariance (ANCOVA) for average jumping distance (n=227, R²= 0.63)

<table>
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<th>Source</th>
<th>DF</th>
<th>F ratio</th>
<th>P value</th>
</tr>
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<tr>
<td>Density</td>
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<td>3.93</td>
<td>0.021</td>
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<tr>
<td>SVL</td>
<td>2</td>
<td>9.46</td>
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<tr>
<td>Tibiafibula</td>
<td>1</td>
<td>43.4</td>
<td>&lt;.0001</td>
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<tr>
<td>Tail length</td>
<td>1</td>
<td>6.74</td>
<td>0.010</td>
</tr>
<tr>
<td>Mass * TF</td>
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<td>1.12</td>
<td>0.292</td>
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</table>

Fig. 1. SVL and mass are positively correlated, but for a given SVL, low density frogs have higher mass.

Fig. 2. SVL and tibiafibula are positively correlated in all three treatments.

Fig. 3. Longer TFls were correlated with longer jump distances, but for a given TF length, frogs from low density tanks did not jump as far.

Fig. 4. Jump distance increased with mass among frogs from high and medium density tanks but not low density tanks.

Discussion

Different larval densities change not only red-eyed treefrog morphology, but the morphology-performance relationship. Our results suggest a trade-off where low larval density increases body size and makes them relatively heavier and longer legged. The relatively long legs of these low density frogs may partially compensate for their disproportionately greater mass, but not completely since tadpoles reared at low density become frogs that do not jump as far for their size as tadpoles raised at lower densities. These results suggests that the cost of relatively low jumping performance may be offset in some other way. For example, large heavy frogs may resist desiccation or starvation better.

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