

Modifying Larviculture Lighting Based on Spectral Sensitivity of *Puntius titteya* Photoreceptors

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Abstract

- Characterization of visual ontogeny may help determine lighting parameters, such as intensity and spectrum, during larval rearing.
- Microspectrophotometry (MSP) identified the presence of five cone opsins and one rod opsin.
- Applied lighting experiments showed a lower growth coefficient of variation (CV) in complete darkness.

Introduction

- Many ornamental fish experience mortality during the larval period that results in economic losses for producers.
- By changing the lighting, we aim to improve prey visualization by increasing the contrast, thus increasing the feeding response and leading to greater survival.
- **Objective: assess retinal ontogeny to inform lighting protocols that improve survival and growth.**

Methods

Objective 1

- Larvae were reared to 20 days post-hatch (DPH), subsampled periodically, dark adapted, then eyes were dissected and squashed for retinal analysis.
- MSP determines presence/absence of rods and cone opsins.
- Peak absorbance best fit to known photoreceptor templates in MSP-Analysis program (E. Loew).

Objective 2

- Five intensities: 0, 7, 70, 270, 700 lux (n=5)
- Five spectrums: violet, blue, green, orange, white (n=5)
- Larvae evaluated for survival, growth, and growth CV at 20 DPH.

Results

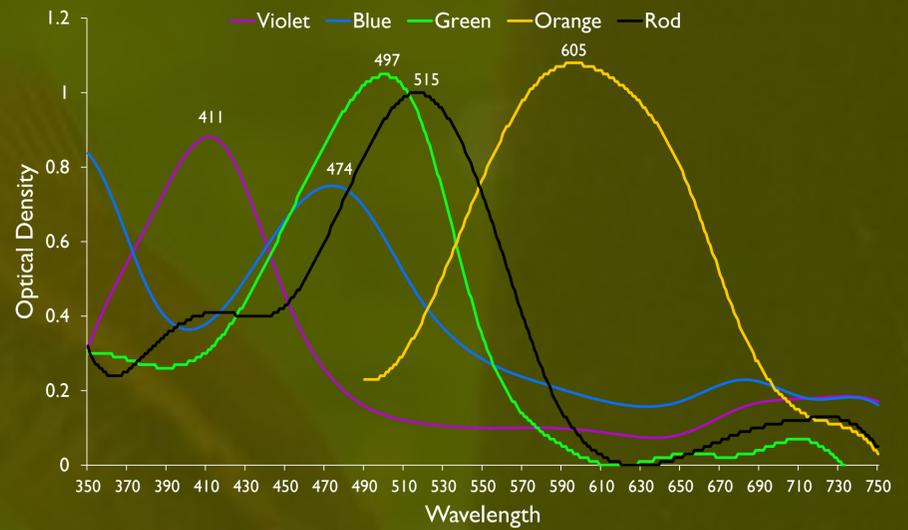


Figure 1. Spectral sensitivities of cherry barb (*Puntius titteya*) larvae measured throughout the larval duration. Visual photoreceptors are measured between 350 and 750 nm. Legend denotes corresponding spectrum of opsin if applicable.

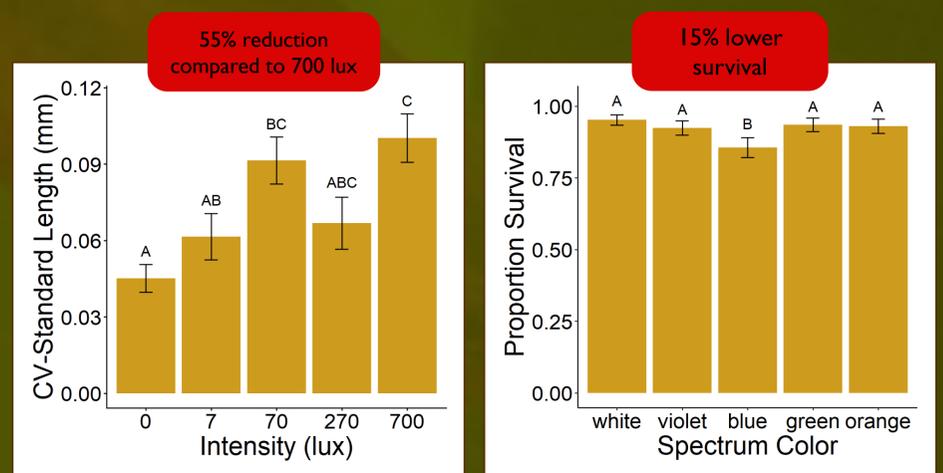


Figure 2. (A) Mean CV (\pm SE) of the standard length (mm) of larval *P. titteya* reared under five light intensity conditions (lux) until 20 DPH. (B) Mean proportion survival (\pm SEp) of larval *P. titteya* reared under five spectrum conditions until 20 DPH. Letters above bars indicate statistical significance ($p < 0.05$).



Discussion

- All cone opsins were detectable by 3 DPH and matched the visual pigment profile of adults. Rods appeared at 8 DPH.
- Growth CV was significantly lower, indicating more uniform growth in the 0, 7, and 270 lux treatments.
- Larvae located and captured prey in complete darkness, suggesting the use of alternative sensory systems (olfaction, lateral line, etc).
- Blue light is not recommended for cherry barb larval rearing.
- Implementing reduced or zero light periods could increase economic viability of the cherry barb.

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Spectrum Brands

