Maintenance of Color Pattern Variation in the Trinidadian Guppy, *Poecilia reticulata*

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Abstract

The color patterns of Trinidadian guppies can help us understand the mechanisms that maintain genetic variation in populations. Male guppies with rare color patterns have an advantage in mating success, and the goal of this study is to determine whether competition between males contributes to this. I am blind to the study's hypothesis, and instead have focused on determining whether the color patterns of the guppies impact how competitive they are. We ran behavioral trials to determine which of the three Iso-Y lines was more likely to follow the same female as a rival male. Males from the same line had similar color patterns and males from different lines had different color patterns. We expect to find that male guppies from the IF10 line will be the least likely to follow the same female as a rival male. This would indicate that males with more orange pigmentation are less competitive than males with less orange pigmentation. The results of this study will help us determine if the amount of orange pigmentation on a guppy impacts their behavior.

Introduction

- Maintaining genetic variation within a population is important to prevent inbreeding (1), susceptibility to disease, and susceptibility to environmental change.
- Understanding the mechanisms that maintain genetic variation in populations can aid us in conservation efforts and agriculture.
- Trinidadian guppies are a model system in studying sexual selection because of their heritable color patterns. Color patterns only display in mature males and typically consist of lines, spots, and speckles that are red, orange, yellow, black, and white (2)

Photo: Jedediah Smith

- The female Trinidadian guppy shows a preference for males with rare or unfamiliar color patterns (3, 4, 5). Researchers have predicted that this preference is a reason why rare males have an advantage in mating success, which is a contributing factor in maintaining their genetic variation. However, little research has been done on whether male-male competition plays a role in the maintenance of this variation.
- I am blind to this study's hypothesis. My goal is to quantify the competitive behaviors between male guppies as they court females.

Method

- We ran behavioral trials between laboratory-reared guppies derived from the Paria Tributary in Trinidad. We used males from three Iso-Y lines. Males from the same line had similar color patterns and males from different lines had different color patterns .Each male also had its own distinct colors independent of the pattern bred for.
- Two males of the same line were placed in a tank with two males of a different line. The tank contained two mature females and two immature females. This ratio mimics natural sex ratios in the wild. One male was selected to be the focal male and the rest were determined to be rival males.
- We recorded the competitive behaviors between the focal male and any rival males they interacted with as they tried to court the mature females. We also recorded whether the males interacting were of the same color pattern or different.
- We ran several ANOVAs to compare the competitiveness of each Iso-Y line.
- We recorded the following male-male competitive behaviors

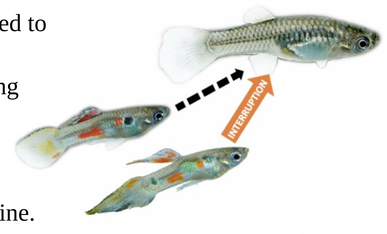
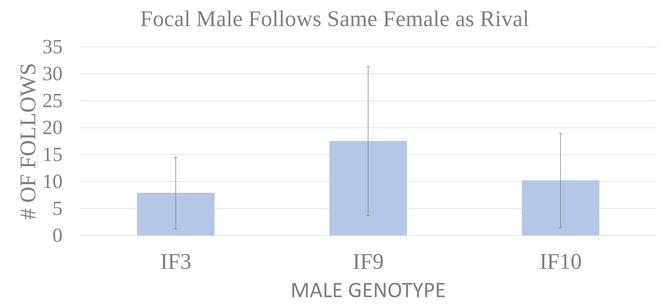


Figure: Alexa Guerrera

interruption	Male darts in front of a rival male that is following a female.
male sigmoids same female	Male sigmoids the same female another male is following. Sigmoids are a mating display defined as an S-shaped shaking movement.
male sigmoids other male	Focal male sigmoids at rival male. This is believed to be display of aggression between males.
male follows same female	Male follows the same female as a rival male.
chase	Male chases another male.
nip	Male nips at another male.

Results

- We expect to find that male guppies from the IF10 line will be the least likely to follow the same female a rival is following because they have the most orange pigmentation. We expect to find that female guppies will prefer males with more orange pigmentation, and therefore those males will not have to display as many competitive behaviors to experience the same reproductive success.
- We expect to find that the IF3 males will be the most likely to follow the same female as a rival male because they have the least amount of orange pigmentation.
- We expect to find that males from the IF9 line will follow the same female more often than the IF10 males but less than the IF3 males.
- We plan to run several ANOVAs to assess the level of competition for each Iso-Y line.



IF lines did not significantly differ in # of times the focal male followed the same female as a rival male ($F_{1,22}$=0.002; p=0.962).

Discussion

- If our predictions are correct, then the amount of orange pigmentation will be an indicator of how likely a male guppy is to interrupt a rival male.
- We predict that the more orange pigmentation a line of guppies has, the less likely a male from that line will be to follow the same female as a rival male.
- This may indicate that males with more orange pigmentation are less competitive than males with less orange pigmentation.
- The results of this study will help us determine if competition between males is a contributing factor in the genetic diversity of Trinidadian guppies.

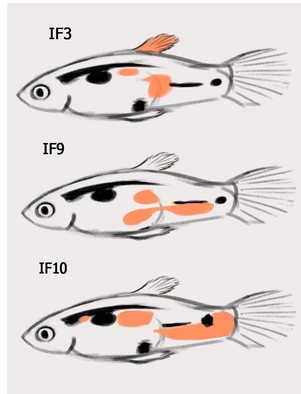


Figure: Resh Meck

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