The Correlation Between Coloration and Aggression in *Drosophila melanogaster*

Nicholas Tan, Addison Crews, Anthony Romeo, Sarah Ruckman, Alexandra Duffy, and Kimberly Hughes
Department of Biology, Florida State University

Introduction

- Pleiotropy is the phenomenon of one gene affecting multiple traits. This can be seen in many organisms, including *Drosophila melanogaster*.
- One example of pleiotropy common across animals is the relationship between color morphology and behavior (1). This is thought to be caused by the genes that produce melanin pigmentation influencing behavior through dopamine. Dopamine is the hormone and at low levels produces aggressive behaviors.
- To understand how color relates to aggression, we used the model organism *D. melanogaster*. In fruit flies, dopamine is used to produce melanin pigmentation and can affect aggressive behavior (3). Further, the known genetic pathways for aggressive behavior make this an ideal model system to investigate pleiotropic effects of color and aggression (2,3).

Hypothesis:
- We hypothesized that artificially selecting for increased aggressive behaviors leads to darker pigmentations in *D. Melanogaster*.

Methods

Figure 1: An example of *D, Melanogaster* (right) exhibiting aggressive behavior in this case, lunging.

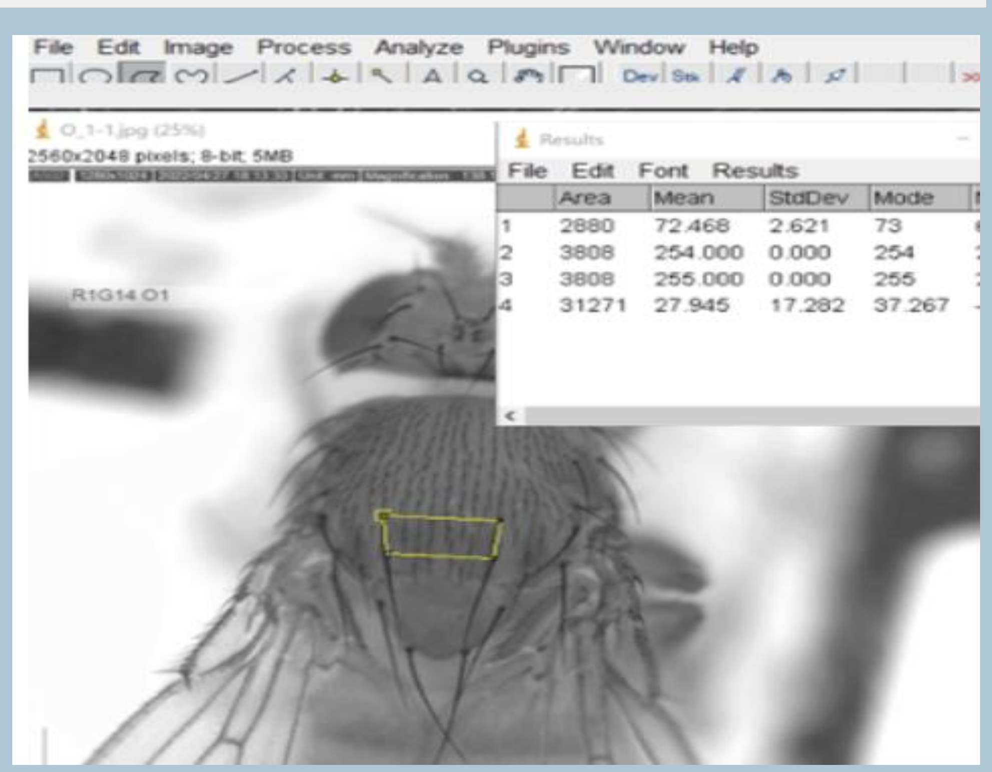

Figure 2: ImageJ software is being used to calculate mean grey scale values. For this *D. melanogaster,* the mean grey scale value is 27.945.

- Our collaborators from Rice University conducted behavioral trials to test for aggressive behaviors for male *D. melanogaster* (Figure 1).
- Based on behavioral data, flies were selected for increased aggression, decreased aggression, or random assortment (control). The behavioral tests and selection regime were repeated for 14 generations for each line.
- 50 flies per generation for each line were photographed and we analyzed pigmentation using Image J software (Figure 2). To do this, we converted the image to 8-bit to compare the mean black and white values to the average grey scale values, with focus on the trident section.

Results

- Flies selected for increased aggressiveness had lower grey scale values (Figure 3).
- Based on ANOVA tests, the more aggressive generation (generation 14) had significantly different grey scale values as compared to the less aggressive (generation 3) flies ($F_{2,147} = 9.73$, $p < 0.001$).

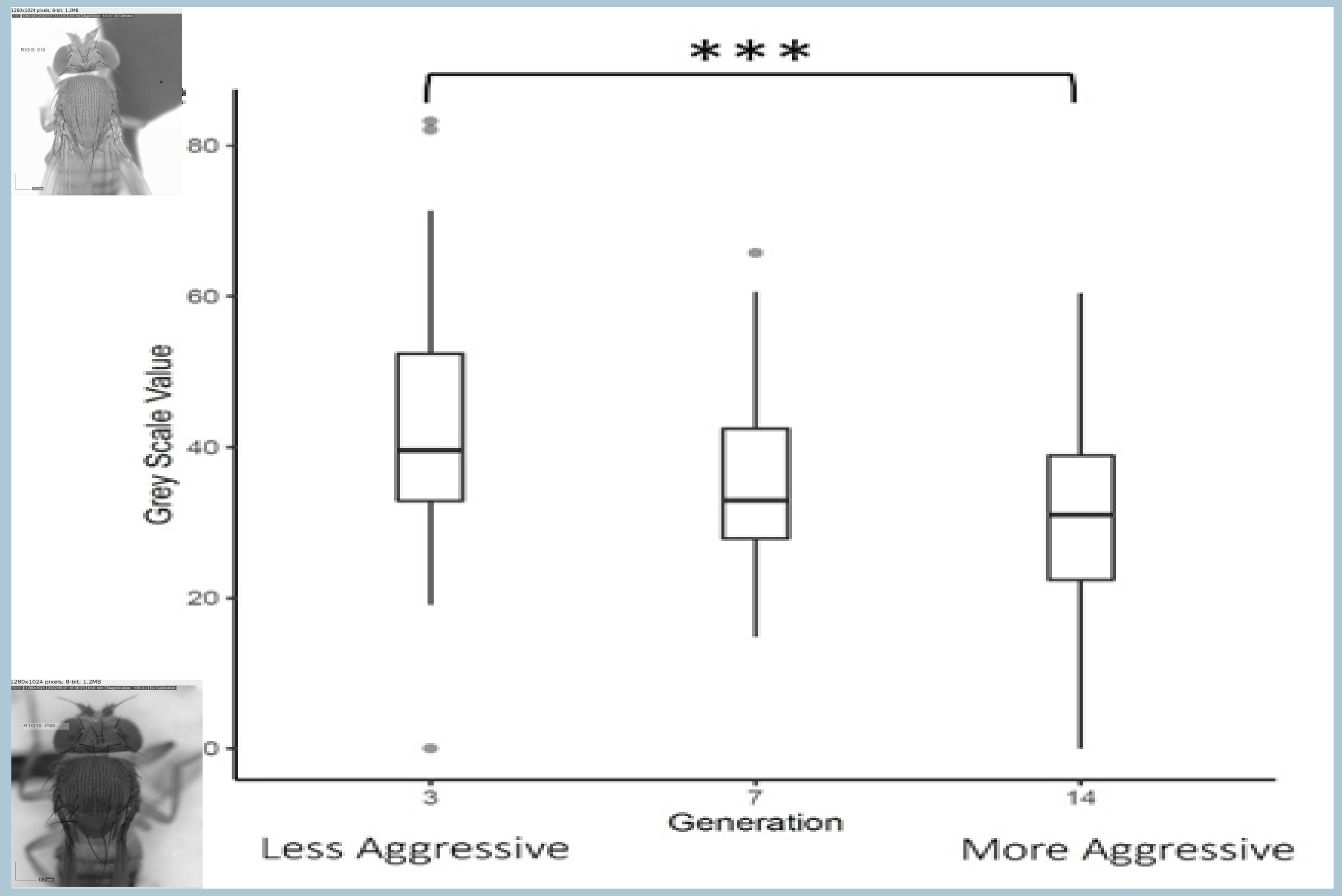

Figure 3: The Relationship Between Grey Scale Values and Aggression Across 14 Generations.

- The figure above consists of three box and whisker plots relating median grey scale values to level of aggression across 14 generations. Outliers, represented by dots, were present in generations 3 and 7. The th.
- ree asterisks grouping generations 3 and 14 symbolize their significant difference in coloration.

Conclusion & Future Directions

- We determined that there is significant difference between generations 3 and 14 such that generation 14 is darker and more aggressive in *D. melanogaster.*
- This confirms our hypothesis that artificially selecting for increased aggression leads to darker pigmented flies.
- This suggests a pleiotropic relationship between aggressiveness and darker colorations.
- To further substantiate this relationship, future studies will also select for color (darker, lighter, and a randomized control) and then test for aggressive behavior.
- Future work will also analyze the genetic patterns to identify pleiotropic genes.

References

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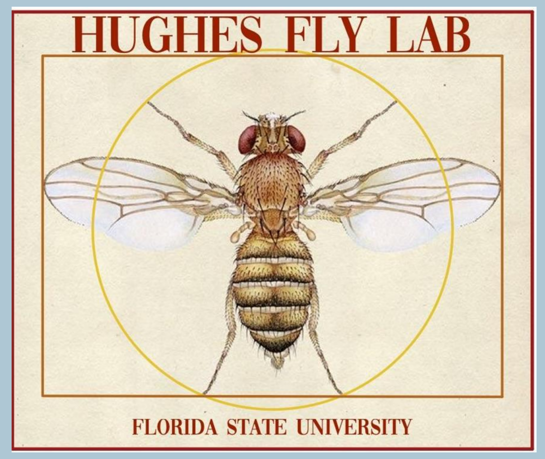
Acknowledgements



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