Exploring the relationship between melanic coloration and aggression in *Drosophila melanogaster*

Taylor Henderson, Paulina Montes Mendez, Katelyn McCaffrey, Sarah Ruckman, Alexandra Duffy, and Kimberly Hughes
Department of Biology, Florida State University

Introduction

- Pleiotropy, when a single gene affects two or more unrelated traits, may impose adaptive constraints on an organism therefore influencing the outcome of their genes. (3,1)
- Pleiotropy can cause different traits to be adaptive or maladaptive. When fitness is negatively impacted or when the new traits do not perform better than the original behaviors, adaptive constraints can develop. (2)
- The link between behavioral and morphological traits is a classic example of pleiotropy. Here, we consider how aggressive behavior is linked to body pigmentation in an invertebrate model system, *Drosophila*.

Hypothesis

We hypothesized that pleiotropic effects cause a link between aggression and melanic coloration, Specifically, we predicted darker pigmentation would be positively associated with a higher degree of aggression.

Methods

- Our collaborators from Rice University conducted behavioral trials to test for aggression. They then selected for aggression for 14 generations.
- ImageJ was used to calibrate the black and white values in the photo to grayscale values (0 and 255)..
- We used the freeform tool to mark the dorsal thorax (trident) of the fly and we then measured and recorded the greyscale value. (Fig. 1)
- We then used an Anova test followed by multiple comparisons (Tukeys) to determine which generations were significantly different than one another.

Methods cont.

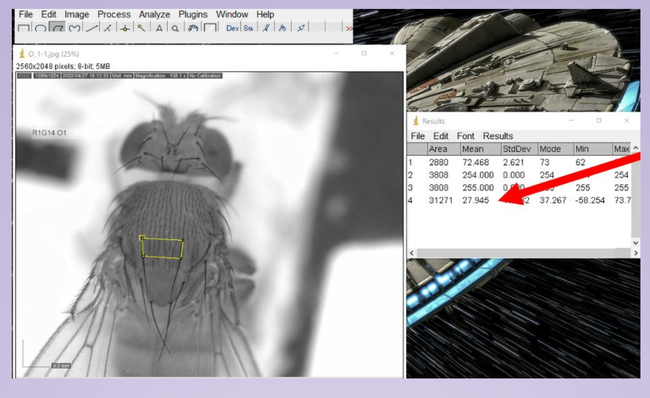

Fig.1. ImageJ is used to calibrate greyscale values in the photo and then the trident greyscale value is measured.

Results

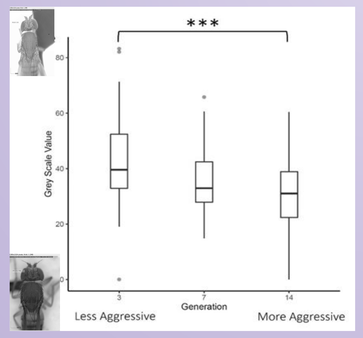

Figure 3: The y axis represents the mean greyscale value and the x axis represents the level of aggression. We selected higher levels of aggression for every generation.

Figure 4: Example of an aggressive behavior (lunging) from *D.melanogaste*r on the right..

- The Anova test found that generation 14 was significantly darker than generation 3 (p-value = 0.0000737). Generation 14 was also known to be more aggressive.

Conclusion

- The results support our hypothesis that pleiotropic effects seem to affect the degree of melanic coloration and level of aggression in *Drosophila melanogaster*. Therefore, we reject the null hypothesis.
- This research contributes to our understanding of pleiotropy and how they affect traits in invertebrates.

Future Directions

- In further experiments, we will be selecting for increased melanin pigmentation in the trident and looking for aggressive behavior.
- We hope to discover the genes that are behind this pleiotropic relationship (paledc, D, yellow-h, etc.).
- In addition, we will be determining whether this pleiotropic effect is adaptive or maladaptive. Future tests will measure fitness outputs.

References

1. Takahashi, A. (2013). Pigmentation and behavior: Potential association through pleiotropic genes in *drosophila*. *Genes & Genetic Systems*, *88*(3), 165–17
2. Roulin, A., & Ducrest, A.-L. (2011). Association between Melanism, physiology and behaviour: A role for the melanocortin system. *European Journal of Pharmacology*, *660*(1), 226–233.
3. Shorter, J., Couch, C., Huang, W., Carbone, M. A., Peiffer, J., Anholt, R. R., & Mackay, T. F. (2015). Genetic architecture of natural variation in *drosophila melanogaster* aggressive behavior. *Proceedings of the National Academy of Sciences*, *112*(27).

Acknowledgements

This research is supported by the Hughes Lab and Saltz Lab. Along with our fellow stem girlies: Nicholas Tan, Addison Crews, and Anthony Romeo. And most importantly our cats: Miyu, Atlas, and Nova <3