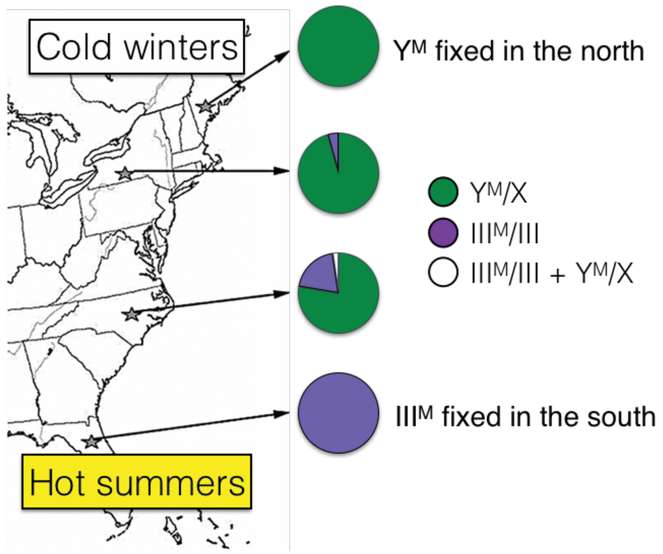
The effect of the chromosomal location of the male-determiner on mating success in house fly

Oluwatomi Hassan, Tammie Trinh, Vyshnika Sriskantharajah, Alexander Oderhowho, Jose Torres Gonzalez, Kiran Adhikari, Richard Meisel
Department of Biology and Biochemistry, University of Houston

Background

- Sex determination is the molecular process that leads to the development of either a male or a female
- Some species are polymorphic for how sex is determined
- We do not have a good understanding of why this variation in the initiation of sex determination exists
- The house fly, *Musca domestica,* is a model organism for studying the genetics and evolution of polymorphic sex determination
- The male-determining *Mdmd* gene can be found on the Y chromosome (Y^M) and third chromosome (III^M)
- Males carrying III^M are found in southern regions where average temperatures are warmer
- Males with Y^M are found in northern regions where average temperatures colder
- We therefore hypothesize that the III^M chromosome carries genetic variants that are "warm-beneficial" and Y^M has "cold-beneficial" variants.

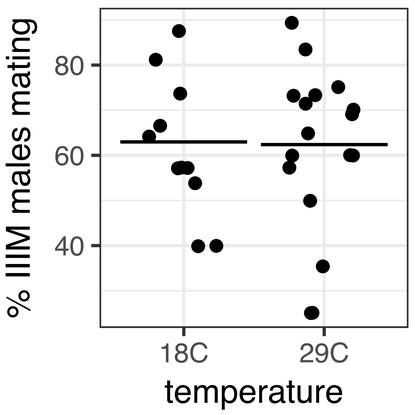


Methodology

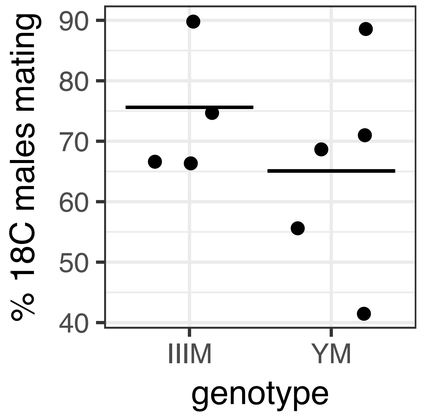
- Our goal is to determine if there is a temperature-dependent difference in mating success between males with Y^M and males carrying III^M
- We reared Y^M and III^M males at 18°C and 29°C (i.e., cold and warm temperatures)
- We performed two types of experiments to measure relative mating success of males:
  1. **Y^M vs III^M:** One Y^M male and one III^M were combined with a single female in a mating container. Both males were raised at either 18°C or 29°C
  2. **18°C vs 29°C:** One male raised at 18°C and one male raised at 29°C were combined with a single female in a mating container. Both males were either Y^M or III^M

- The two males were differentiated with blue and pink powder.
- We hypothesize that Y^M males will have greater success at mating with females when raised at 18°C and III^M males should have greater success when raised at 29°C

Results



Y^M vs III^M: When raised at either 18°C or 29°C, III^M males tend to be more successful at mating with females than Y^M males. Each dot is the % of III^M males that mated with the female when competed against Y^M males in a blocked run of the experiment. The horizontal line is the average across all matings performed.



18°C vs 29°C: Males raised at 18°C tend to be more successful at mating with females than males raised at 29°C, regardless of whether they are Y^M or III^M males. Each dot is the % of males raised at 18°C that mated with the female when competed against males raised at 29°C in a blocked run of the experiment. The horizontal line is the average across all matings performed.

Conclusions

- III^M males outcompeted Y^M males at both cold and warm temperatures
- Males raised at 18°C outcompeted males raised at 29°C regardless of male genotype
- We find no evidence that male mating success is affected by a genotype-by-temperature interaction.
- We conclude that male mating success is unlikely to be a trait that explains the geographic distribution of Y^M and III^M in natural populations

Acknowledgements

This work was supported by a PURS to OH and start up funds to RM. We thank members of the Meisel lab for assistance with the experiments and constructive feedback.

References

Hamm, R. L., Meisel, R. P., & Scott, J. G. (2015). The Evolving Puzzle of Autosomal *Versus* Y-linked Male Determination in *Musca domestica*. *G3: Genes|Genomes|Genetics*, *5*(3), 371–384.