Life history traits of *Drosophila melanogaster*

Abhishek Dasgupta
abhidg@gmail.com
Indian Institute of Science Education and Research Kolkata

September 29, 2007

Abstract

In this project, we have studied the life history traits of *Drosophila melanogaster*. We've conducted our study using two variants of drosophila, and compared few life history traits which show that there are trade offs involved with selecting for faster development time.

Introduction

Drosophila melanogaster, the common fruit fly is extensively used as a model organism in biology, including studies in genetics, physiology and life history evolution [4]. It is a good model organism since:

- it is small and easy to grow in a laboratory
- it has a short generation time (about two weeks) and high fecundity.
- males do not show meiotic recombination, facilitating genetic studies.

In our experiment, we have used two variants of drosophila known as JB (Joshi baseline) and FEJ (Faster development time, Early reproduction, derived from Joshi baseline). Selection for smaller mean development time was done over hundreds of generations to create the FEJ population. Overall mean egg-to-eclosion time in FEJ populations is about 26h less than the JB populations [5].

Procedure

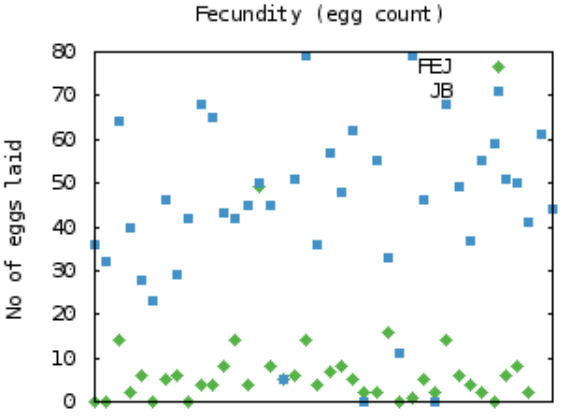
The experiment was conducted over two days. The JB and FEJ populations were prepared beforehand. On the first day we measured the average weight of the flies after they had been killed by freezing. Also, a set of test tubes had been prepared with food, and in each of them one female was put. After a certain period, all the tubes were frozen, and the number of eggs laid were counted. This gives us the fecundity of the female.

On the second day, the pupal development was estimated by using the height reached by the pupae as a metric. This is a feasible metric since we would expect pupae which have reached higher height to have better survival capacity.

Results

The average weights of the flies we got on the first day was measured. The average weights for JB and FEJ's (done independently by three groups) were **24 mg** and **14 mg**, which clearly show the tradeoff in weight for the FEJs.

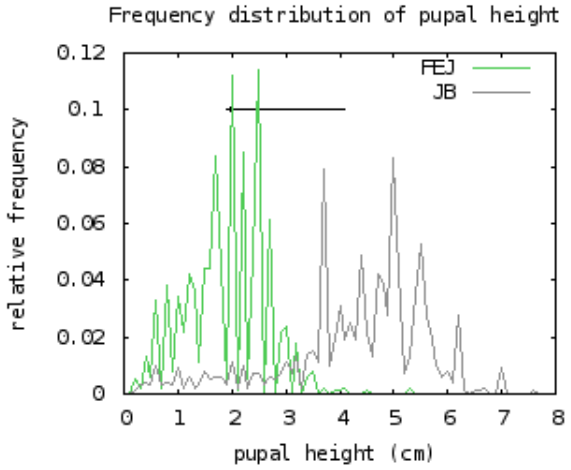
We also measured the fecundity as explained earlier, and the FEJ's had a markedly lower fecundity compared to the JBs:



An interesting thing we note is that the deviation in height is greater in JBs than in FEJs. This could be caused by decrease in variation in FEJs due to selection thus reducing the polymorphicity of the loci which code for pupal height.

On the second day, the average pupal height was measured. We plotted the relative frequency distribution with respect to the pupal height for both FEJs and JBs. The relative frequency was obtained by divid-

ing the frequency by the total number of observations.



Here we see an example of directional selection at work. The arrow shows the direction and magnitude of the change of the mean pupal height (from **4.1** in the JBs to **1.9** in the FEJs). The frequency distribution has shifted to the *left* for the FEJs due to selection of a small subset of the population with faster development time. However, the mean pupal height remains within the bounds of the original population.

The results clearly show that selecting for faster development time in the FEJ population has tradeoffs like far lesser egg count and lesser average pupal height.

Our results show that faster development time carries with it a few constraints such as reduced weight and lower fecundity. Why these phenotypes change in response to selection for faster development time cannot be found out from our experiment but a lot of research has taken place in this area [1][2][3].

Conclusion and Further Work

Our study illuminated the various tradeoffs associated with selecting for faster development time. We can extend our study by doing a genetic analysis of the JB and FEJ flies to find out where they differ. We expect that the genes which are expressed during selection for faster development time are linked to the genes for the tradeoffs. This hypothesis can be tested by grinding up the flies and analysing their genome.

Acknowledgments

I would like to thank Dr. N. G. Prasad, who guided us in the successful completion of this experiment, my classmates with whom I worked on this experiment for their cooperation, and everyone who helped in setting up the apparatus and procuring the flies for our experiment.

References

1. Leroi, A.M., Kim, S.B. & Rose, M.R. 1994b. The evolution of phenotypic life-history trade-offs: an experimental study using *Drosophila melanogaster*. Am. Nat. **144**: 661–676.

2. Luckinbill, L.S. & Clare, M.J. 1985. Selection for lifespan in *Drosophila melanogaster, Heredity* **55**:9–18

3. Zwaan, B., Bijlsma, R. & Hoekstra, R.F. 1995b. Direct selection on lifespan in *Drosophila melanogaster. Evolution* **49**: 649—659

4. Wikipedia: *Drosophila melanogaster*

5. Prasad NG, Shakarad M, Anitha D, Rajamani M, Joshi A (2001) Correlated responses to selection for faster development and early reproduction in Drosophila: The evolution of larval traits. Evolution: Vol. **55**, No. 7 pp. 1363–1372