

Evolution of Life-History Traits in *Drosophila melanogaster* – an example of Trade Off.

By

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Abstract: The evolution of life history traits in *Drosophila melanogaster* were studied. Fecundity, pupation height, dry body weight were the traits that were quantified in two varieties of *Drosophila melanogaster*, namely FEJ which were selected for faster development time and the JB which were the ancestral population used as control. A trade-off was noticed between the time for faster development on one hand and fecundity, dry weight and pupation height on the other hand.

Introduction: Life history traits are the key maturational and reproductive characteristics of an organism which determine the life course of it. Example of some life history traits are:

- i. Time for sexual maturity.
- ii. Fecundity.
- iii. Body Weight
- iv. Mortality etc.

Variations in these characteristics reflect differential allocation of individual's resources to competing life functions. For any given individual the availability of resources in a particular environment is finite. Time, energy or effort spent for one purpose, diminishes the allocation of the same for other purposes. Thus allocation of resources involves trade-offs. These trade-off strategies change with change in environment, thus making it an important aspect of evolutionary biology. This work dealt with the study of variations in fecundity, body weight and pupation height in the two different varieties of *Drosophila*, one selected for faster development and other the ancestral population used as control.

Materials & Methods:

Experimental Population: The Experimental population were supplied, so we didn't had to maintain our own experimental population.

Experiment: We used FEJ and JB varieties of *Drosophila melanogaster*, which were made available to us. The FEJ varieties were the one that were selected

for reduced development time whereas the JB varieties were the ancestral population used as control. For the purpose of determination of the dry body weight frozen samples of adult *Drosophila* were used. We were also supplied with vials in which single egg laying females were kept, so that their fecundity could be determined. Similar vials containing pupating larvae were also supplied. For the purpose of determining the height of pupation, we used the following technique. A piece of clear transparency was wrapped around the vials. The position of each pupa on the wall, the line at which the cotton touched the glass and the food level were marked on the transparency. The transparency was then unrolled and the height of the pupa from the food level was measured. The pupa which were inside the cotton were taken to be at an height equal to the average height of the cotton line. The entire work was repeated thrice by three groups of experimenters.

Results:

1) Dry body weight:

The average dry body weight of the FEJ varieties were found to significantly lower than the average dry body weight of the JB's. The Student's T test was performed to establish the statistical significance of the difference in the body weights of the two varieties of *Drosophila* and the T test result came out to be 2.14×10^{-10} . The result has been depicted below graphically.

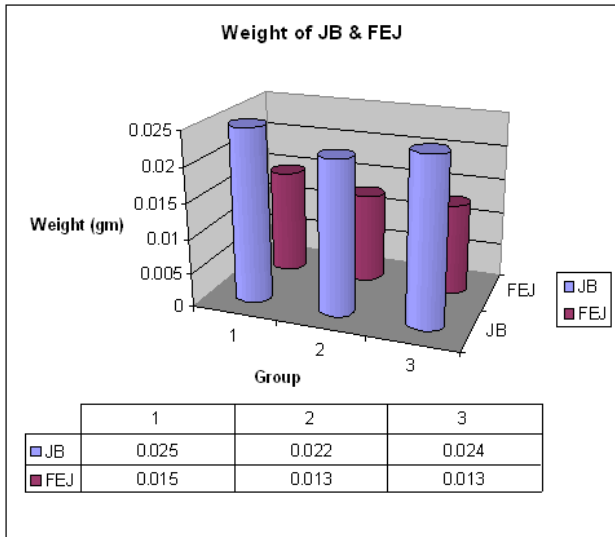


Fig.1

The pupation heights of *Drosophila* in 30 vials of JB and 30 vials of FEJ were measured. It yielded quite interesting results. In the following graphs the heights were plotted along the x axis, whereas the frequency or the number of pupa at that particular height was plotted along the y-axis. The resultant distribution for both the FEJ and the JB were fitted to a Gaussian. It was found that the peaks of the Gaussians were quite apart. The peak height in case of the FEJ was found to be much smaller than the peak height of the JB.

2)Pupation Height:

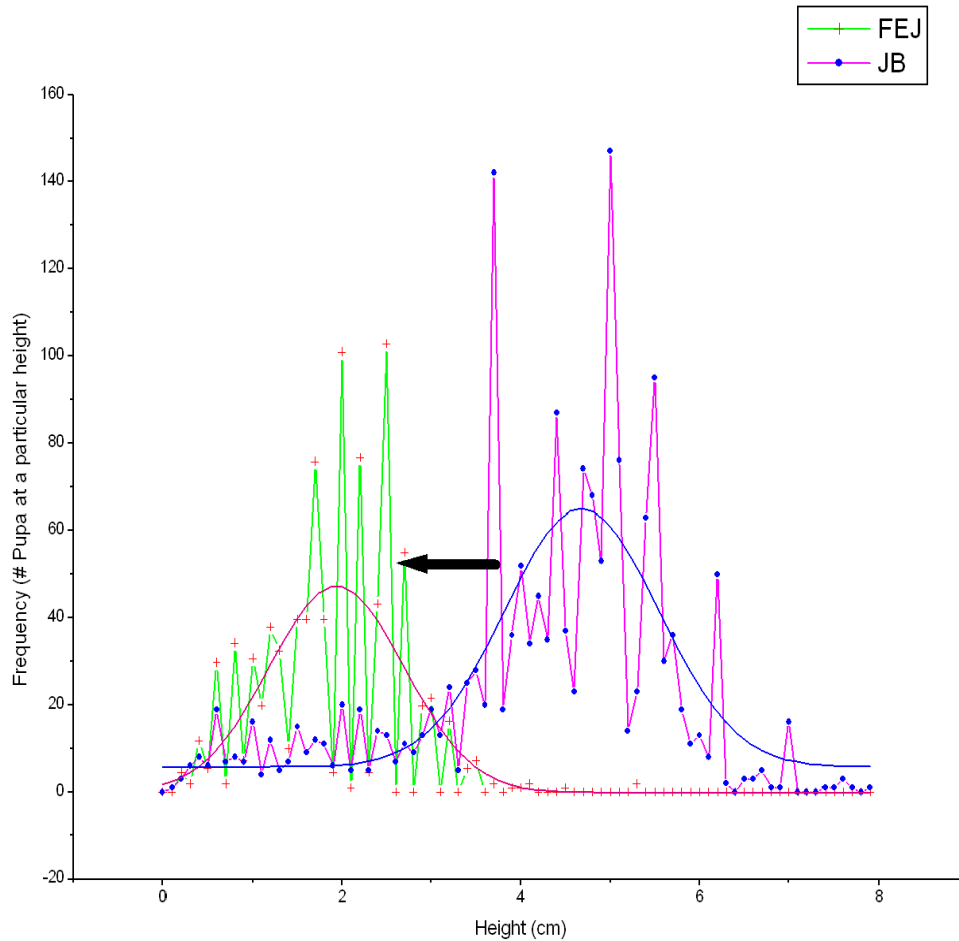


Fig. 2

3)Fecundity:

The fecundity was measured in 20 vials of JB and 20 vials of FEJ. It was found that the FEJs had a significantly less fecundity compared to JBs. The following graph depicts it clearly. In case of fecundity, unlike the other cases only two sets of data (20vials of each instead of 30vials) were taken, because of time limitations.

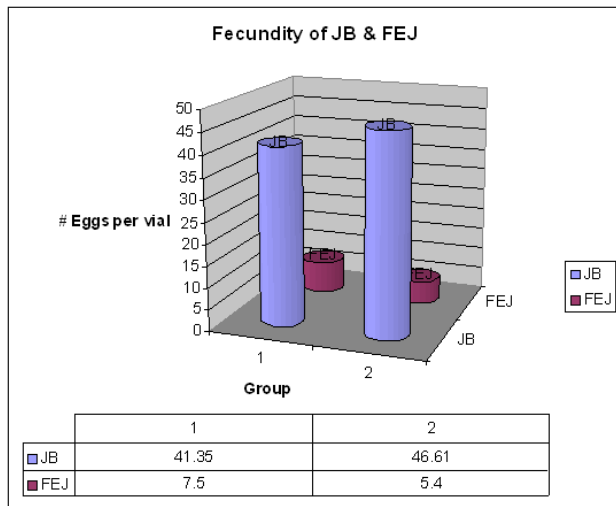


Fig.3

Discussions: It is clearly evident from the experimental results that the FEJs have lower body weight, lower pupation height and lower fecundity compared to the JBs. This can be interpreted as some sort of trade-off between the different life history traits. In case of FEJs which were selected for faster development time, the allocation of resources for reduction in development time led to compromise in other traits like body weight and fecundity. However the reduction of pupation height is some what hard to explain as a trade-off. One of the possible reasons may be that pupation height and developmental time are controlled by the same gene. The reason behind this speculation is that from the frequency distribution curves of FEJs and JBs it seems that there is a strong directional selection acting in favour of lower pupation height. However to confirm this speculation, a genetic analysis has to be performed to establish the genetic correlation between faster development

time and pupation height.

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