Cross-breeding Purebred Drosophila Melanogaster with Wild Wing Phenotypes and Curved Wing Phenotypes and Their Children to Study the Effects of Dominant and Recessive Genes.

Kathryn Peterson

Abstract

This study aimed to experiment with the gene expression of Drosophila melanogaster or the common fruit fly. In particular, I singled out two wing phenotypes, Wild and Curved, and bred them to see the number of each phenotype that would express itself. I was also trying to find out which of the two phenotypes was dominant, and which was recessive.

Introduction

Drosophila melanogaster are used in experiments involving genetics and gene expression. They are great model organisms for such experiments. Charles W. Woodsworth originally proposed we use them as model organisms for genetic experiments almost 50 years before we actually began using them. Drosophila melanogaster themselves are commonly used in genetic research but are also used in behavioral studies(Saifuddin et al., 2010). They're well-liked as model organisms for their short life cycle and completely recorded genetics(Saifuddin, et al., 2010). They also have the great benefit of producing nearly 2000 eggs worth of offspring. In this experiment, I want to test two specific phenotypes that the Drosophila melanogaster express, Wild type wings, and Curved type wings. My hypothesis is that there'll be a 3:1 ratio of the phenotypes, with the Wild type being 3, and the Curved type is 1. I've stated this because the Wild type is more common in the wild than the Curved. The purpose is to find out if either phenotype is related to the subject's sex chromosome and which phenotypes are dominant and recessive.

Material and Methods

This study was done by using the online simulator Drosophila. First I clicked on the computer and ordered two Drosophila melanogaster, a male, and a female. The female had no specific traits and was kept as a standard Wild type of Drosophila melanogaster. The male had every trait kept the same except for wing type, which was changed to the Curved wing type. The Drosophila melanogaster were both placed in a jar labeled as "Mating Jar". 14 days later, the jar was removed and the flies were put to sleep with ether. It was now labeled as "Mating Jar Cross #1". The flies were sorted into two groups(male and female) under a microscope, and 1212 were counted in total. All of the Drosophila melanogaster, both male and female had Wild type wings. One Drosophila melanogaster was selected from the male and female groups each. This will be called the F1 generation The two Drosophila melanogaster from the F1 generation were bred in the incubator, and 14 days later, the jar was removed. The Drosophila melanogaster were put to sleep with ether, and the jar was labeled as "Mating Jar Cross #2". The Drosophila melanogaster were sorted into four groups(male/wild, female/wild, male/curved, female/curved) under a microscope, and 1239 were counted in total. This will be called the F2 generation. 475 of the Drosophila melanogaster were females with Wild type wings, and 457 of the Drosophila melanogaster were males with Wild type wings, with a total of 932 Drosophila melanogaster having Wild type wings. 157 Drosophila melanogaster were females with Curved type wings, and 150 Drosophila melanogaster were males with Curved type wings, with a total of 307 Drosophila melanogaster having Curved type wings. Since sex was determined to not be a factor in the expression of either gene, it was ignored for the chi-square data. All data was recorded using the notebook section of the website.

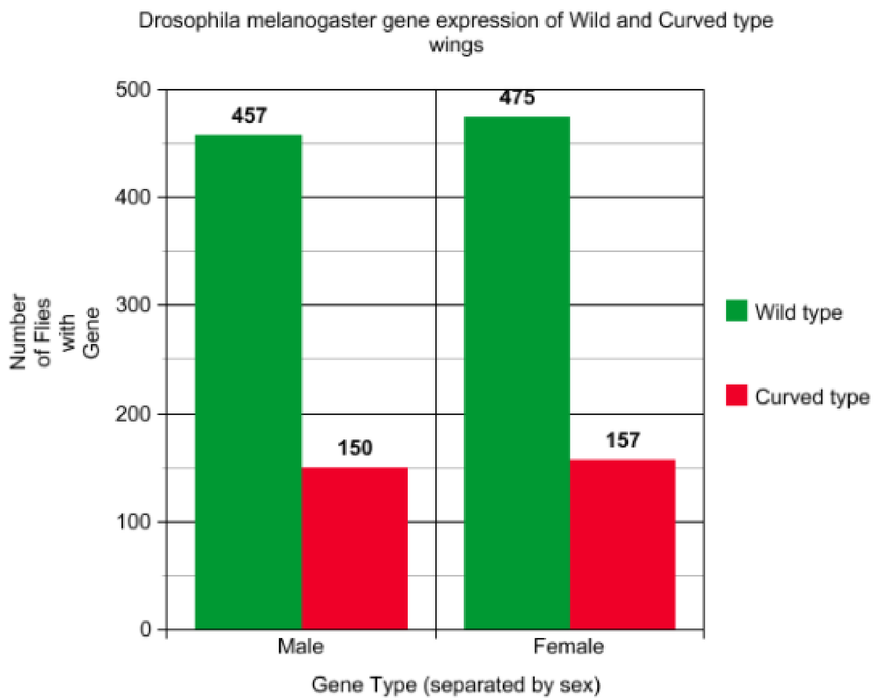

Figure 1. Number of Drosophila melanogaster born with either the Wild type gene or the Curved type gene.

Results

The results show that neither phenotype is linked to a sex chromosome, as both phenotypes show up in both sexes(shown in figure 1). It also shows that, as was hypothesized, the Wild type was the dominant gene as it completely took over in the F1 generation, and showed up in the majority of the flies in the F2 generation(shown in figure 1). Because the Curved type showed up much less than the Wild type, it was the recessive gene. There was also a 3:1 ratio for the phenotypes, which was also hypothesized(shown in figure 2). I did notice while experimenting that there seems to be a slightly higher percentage of females than males in both the Wild and Curved types(shown in figure 1). Whether or not this is a coincidence or not will have to be determined in other experiments.

Table 1
Chi-Square Test Results for F2 Generation Cross-breeding

Phenotype	Df	Level of Signifigance	CV	χ^2	Statistical Difference?	
Wild	1	0.8568	3.84	0.033	3.84>0.033	NO
Curved	1	0.8568	3.84	0.033	3.84>0.033	NO

Figure 2. There is no statistical difference between the expected results and observed results, so this experiment supports my hypothesis. As hypothesized, there is a 3:1 ratio of phenotypes.

Discussion

The results suggest that the dominant trait is the Wild wing phenotype, as it dominates the Curved wing phenotype in a 3:1 ratio, making the Curved wing phenotype the recessive trait. It also shows that the traits were not linked to a sex chromosome, as both traits appeared in both sexes at relatively equal rates. While my hypothesis was not disproven in this study, that doesn't mean it was 100% correct. There could be other outcomes that didn't show in this study. And although we know the reason why some traits are more likely to appear than others is because of Mendel's law of dominance, that doesn't necessarily mean it's the cause of what happened in this experiment. More tests replicating what was done here should be done first before we can definitively say that the results in this experiment are caused by the Wild phenotypes' dominance over the Curved phenotypes' recessive nature. It would be interesting to see if certain traits, regardless of whether or not they're dominant or recessive, can be affected by other traits. Like would the wing shape be affected by the proximity of the hair on the Drosophila melanogaster back to its wings? If a Drosophila melanogaster has long hair, will it have wild wings? And if it has short hair, will it have curved wings? Would the length or texture of the hair affect how the wings were shaped? Would this be caused by genetic factors or by environmental(outside) factors? It would be an interesting experiment that can help us understand genetics further, just as studying Drosophila melanogaster over the years has helped us to better understand human genetics.

List of References

Drosophila.(https://www.sciencecourseware.org/vcise/drosophila/Drosophila.php?guestaccess=1)

Saifuddin, Yahya, & Alias, 2010.Simple Mendelian Genetics in Drosophila Melanogaster.(https://www.slideshare.net/sasasiput/lab-report-drosophila-melanogaster-5357432)