Identifying the Interbreed and F1 generation Drosophila Melanogaster cross

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Introduction

The fruit fly Drosophila melanogaster thrives in soured and overripe fruit. The Drosophila Melanogaster is an important model organism for studying and understanding its physiology. Drosophila melanogaster has been around for decades and is employed for scientific purposes due to its cell process, reproduction, and lifetime (D; T, 2022). Technology has progressed to the point that it is now possible to modify certain genes. CRISPR is being used to create diverse gene manipulations in Drosophila melanogaster (D; T, 2022). This technology has been around for a long time.

Identifying and recognizing the flies according to their sex. The vaginal plate served as the genital region for female flies. The genital region of male flies consists of the genital arch. The Carolina Drosophila Manual was used to identify and distinguish the flies. The genetics of the Drosophila melanogaster were crucial to the experiment's success. Knowing how to determine the sex and the phenotype were critical skills for the Drosophila melanogaster.

Because of the length of time, it takes for a Drosophila melanogaster to reproduce, it was utilized as a model organism in the Drosophila melanogaster project. Because of the ease with which mutant features could be identified in the Drosophila melanogaster study, this type of model proved vital.

The Law of Segregation, The Law of Independent Assortment, and The Law of Dominance are all part of Mendel's Law. During fertilization, a kid of a parent can only receive one allele from each parent, according to the Law of Segregation (Cornell, 2022). According to the Law of Independent Assortment, genes are separated from one another such that the inheritance of one feature is not dependent on the inheritance of another (Cornell, 2022). Finally, The Law of Dominance asserts that alternate versions of a gene in an organism will express the

dominant one (Cornell, 2022). Mendel's Law of Inheritance was not comprehended and recognized until the 1900s, after his laws were rediscovery (Cornell, 2022).

This experiment was designed to aid students in their understanding of genetic systems. Mendelian Genetics, which includes Mendel's Law, Dominance, Segregation, and Independent Assortment, is one of them. Another technique was Sex Linkage, which is considered a Mendelian Genetics extension.

Hypothesis

Believe the two mutants used to make our P cross were yellow body and vestigial and anticipated to have a ratio of 6:6:3:2. We utilized a chi-square to demonstrate the Drosophila phenotypes to arrive at this ratio. We learned more about the F1 and F2 generations of flies, as well as which ones were mutants. In the F2 generation, there were just two mutations: yellow body and vestigial. Thanks to this knowledge, we were able to match the wild types with yellow body. The core principles of Mendelian Genetics are influenced by the genes listed below. The proposed results for both genes backed up the hypothesis of independent assortment.

Because the yellow body mutation has a high potential of passing down to the male fruit flies, both genes are found on two distinct chromosomes, implying a sex linkage. If the proposed findings of both genes indicate that they are hemizygous, the corresponding genotype results in the same phenotypic ratio in F1 generation fruit flies. When a gene is different, it provides a matching genotype that results in distinct F1 phenotypes, which is related to dissimilar crossings, and the amount is dissimilative to the all-inclusive phenotypic ratio.

Methods

On March 26, 2022, used a disposable plastic vial to mix equal parts instant fly food and distilled water, then gently swirled the vial until the fly food was uniformly blue. After that, sat the food aside to solidify. Wiped away any remaining liquid and transfer the adult flies to an empty vial and learned how to nap fruit flies, differentiate by sex, and look for phenotypes (Kang, Y., Esmaeiliyan, M., Minard, M., 2022).

On April 2, 2022, obtained an empty vial with a foam stopper to create a "napping chamber" in the fume hood. After that, applied 1 or 2 drops of FlyNap to the inside of the foam stopper in the fume hood. Then, returned the foam stopper to the chamber with FlyNap. Held the culture vessel upside down without tapping after that. After that, took the foam stopper from the culture vessel and combined it with the napping chamber. The culture vessel was then rotated 180 degrees, with the napping chamber at the bottom. Once most fruit flies were in the napping chamber, sealed both the napping chamber and the culture media with the proper foam stopper. The flies in the chamber were then observed. Afterwards, transferred the F1 cross fruit flies into a new vial (Kang, Y., Esmaeiliyan, M., Minard, M., 2022).

On April 9, 2022, removed the stopper from the culture, inverted it over the napping chamber, and tapped the adult flies into the chamber. They stopped moving after around 60-90 seconds using FlyNap and retrieved the flies for analysis. Got the F1 flies, which were the offspring of an unknown P hybrid. Following that, were given a fly vial in which P cross was established. The F1 adults were then inspected under a microscope and their phenotypes as males and females were recorded. Subsequently, F2 flies were obtained and napped in the sleeping chamber. On April 9 and 16-23, 2022 a handful of F2 generation fruit flies (20-30) were scored from vials dated March 29 (Kang, Y., Esmaeiliyan, M., Minard, M., 2022).

Results

From April 16 to 23, data for E5; F2 generation Drosophila was obtained. The following are the E5; F2 generation Drosophila scored by Simran have been observed.

Phenotypic class	**Male**	**Female**
Wild-Type	14	21
Mutant 1 (yellow body)	3	6
Mutant 2 (vestigial)	5	6
Doubles	1	1
Total	23	34

Table 1. The table shows the constructed F2 generation flies with two mutations, resulting in a total of 23 male Drosophila and 34 female Drosophila. According to the statistics, mutant 1 had a lower population of Drosophila than mutant 2, and mutant 2 had an equal population of female Drosophila as mutant 1.

Phenotypic Class	**Male**	**Female**
Wild-Type	132	153
Mutant 1 (yellow body)	73	115
Mutant 2 (vestigial)	44	67
Doubles	34	53
Total	283	388
		Total Drosophila Counted = 671

Table 2. The F2 generation is shown in the table by adding all the group members' data on the number of Drosophila acquired. Every male and female Drosophila was divided into four classes: red eyes; wild-type, mutant 1 – yellow body; straight wings, mutant 2 – red eyes; vestigial wings, and doubles – yellow body; vestigial wings.

y+/y; vg+/vg+	**y+/y; vg+/vg**	**y/y; vg+/vg+**	**y/y; vg+/vg**
y+/y; vg+/vg	**y+/y; vg/vg**	**y/y; vg+/vg**	**y/y; vg/vg**
y+/r; vg+/vg	**y+/r; vg+/vg**	**y/r; vg+/vg+**	**y/r; vg+/vg**

y+/r; vg+/vg	y+/r; vg/vg	y/r; vg+/vg	y/r; vg/vg

Table 3. The phenotypes that have been paired are shown in the table above. Different varieties of Drosophila melanogaster were configured to recreate the F2 generation. Wild type, yellow, vestigial, and yellow and vestigial.

Phenotype	**Observed**	**Expected**	**(O-E)**	**$(O-E)^2$**	**$(O-E)^2/E$**
Wild type Male	14	10.69	3.31	10.96	1.03
Wild type Female	21	10.69	10.31	106.3	9.94
Male Yellow	3	10.69	-7.69	59.14	5.53
Female Yellow	6	10.69	-4.69	22.0	2.06
Male Vestigial	5	3.56	1.44	2.07	0.58
Female Vestigial	6	3.56	2.44	5.95	1.67
Double Mutant Male	1	3.56	-2.56	6.55	1.84

Double Mutant Female	1	3.56	-2.56	6.55	1.84

Total = 57
D.F = 7
Chi-Square = 24.5
Critical Value = 14.067

Table 4. The overall chi-square of the group's individual chi-square is shown in the table above. The total was used to calculate the degree of freedom. The chi-square value was calculated using the degree of freedom, and the critical value was calculated using the chi-square value.

Discussion

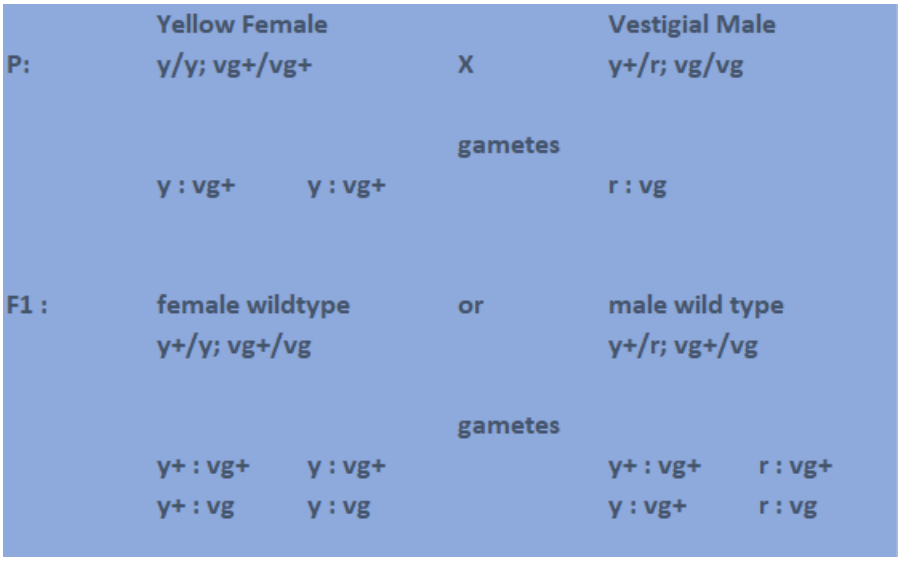

Figure 1. The F1 flies should have a yellow body appearance, whereas the F2 flies should have a vestigial appearance. The outcomes were in line with what was predicted. The Chi-Square

value indicates how much the observed and predicted values differ. The actual values were lower than those predicted. This indicates that there was an error in the chi-square computation.

	y+ vg+	**y+ vg**	**y vg+**	**y vg**
y vg+	**y+/y; vg+/vg+**	**y+/y; vg+/vg**	**y/y; vg+/vg+**	**y/y; vg+/vg**
y vg	**y+/y; vg+/vg**	**y+/y; vg/vg**	**y/y; vg+/vg**	**y/y; vg/vg**
r vg+	**y+/r; vg+/vg+**	**y+/r; vg+/vg**	**y/r; vg+/vg+**	**y/r; vg+/vg**
r vg	**y+/r; vg+/vg**	**y+/r; vg/vg**	**y/r; vg+/vg**	**y/r; vg/vg**

Figure 2. The genotype of the Drosophila can be seen in the Punnett square above. In comparison to the yellow body and vestigial Drosophila, this demonstration shows that the wild-type Drosophila was dominant.

Conclusion

The data did not support the hypothesis, even though the experiment was conducted, performed, and analyzed. The hypothesis could have been rejected because of a counting error that resulted in a statistical analysis error between the observed and predicted numbers, causing the chi-square value to exceed the critical value.

We tested with sex-linked characteristics. The two mutations being observed in the experiment reflect this. The following two mutations were a female yellow body and vestigial, and a male yellow body and vestigial. This happened due to the law of dominance; therefore, the two genes should not follow the law of independent assortment.

Phenotype	**Observed**	**Expected**	**(O-E)**	**$(O-E)^2$**	**$(O-E)^2/E$**
Wild type	285 (3/16)	125.8	159.2	25344.6	201.5

Yellow	188 (3/16)	125.8	62.2	3868.8	30.8
Vestigial	111 (1/16)	41.9	69.1	4774.8	114.0
Double Mutant	87 (1/16)	41.9	45.1	2034.0	48.5

Total = 671
D.F = 7
Chi-Square = 98.7
Critical Value = 14.067

The expected value was larger than the observed value when troubleshooting the Chi-Square, which suggests there was miscounting/miscalculation, and it shouldn't have happened because our final cross was yellow and vestigial. The expected value for the vestigial, on the other hand, was lower than the observed value, which again should not have happened and the same was true for the yellow body and double mutant.

Because the fly feeds were dry, we had to add a few drops of distilled water to make them work. We discovered from this experiment that the egg and larva require eight days to develop, the pupa takes six days to develop, and the adult takes fourteen days to develop. Flies that were not identified as wild types were also tagged as mutants.

References

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