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Mutations and X-linked traits in Drosophila Melanogaster

Introduction

Drosophila melanogaster feed on plant sugars and yeast that grows on rotting fruit. This is also where it gets its more common name, the fruit fly. Females lay eggs on the same materials so that when the eggs hatch the larvae can feed on them also.

There are four distinct stages in a Drosophilas life cycle: egg, larva, pupa, and adult. The larva goes through three stages called instars where it molts and grows. Then it becomes a pupa where metamorphosis occurs which produces the adult fly.

Drosophila melanogaster are so popular when studying genetics because they have a short life cycle of 10-14 days, they are inexpensive to care for, and because they have numerous mutations that can be studied. In our experiment we are looking for three different types of mutations. The wild type is dominant which is basically gray with patterns of light and dark areas. The different mutations are vestigial which is withered wings or no wings, ebony meaning the body is mostly black, and white eyes which is an X-linked trait. X-linked meaning the alleles only occur on the X chromosome that means that since males only have one X they can never be heterozygous. That is why recessive X-linked traits are expressed much more often in males than females.

The purpose of this experiment is to cross certain genotypes and observe what is produced in the next generation so that we can determine the ratio for the phenotypes that are expressed.

Methods

Vial # 1: The P generation or Parent generation was vg/vg +/+ X +/+ eb/eb. This was crossed to create the F1 generation that is totally heterozygous. These were the ones that were bought for this experiment.

P generation- vg/vg +/+ X +/+ eb/eb

F1 generation- +/vg +/eb X +/vg +/eb

F2 generation- ?

Week 1: Medium is placed in the bottom of a clean vial. Then 5 flies are placed in the vial, 3 females and 2 males. The sponge plug in placed on the vial and we leave it alone for one week.

Week 2: We dump out the 5 F1 flies before the next generation pupates so that they will not get mixed up as adults and ruin the experiment.

Week 3: First we anesthetize the flies with FlyNap. Then we observe the result of the cross by counting the different offspring for the F2 generation.

Vial # 2: The P generation was wild type +/+ female and white-eyed w/w male. When these are crossed the F1 is heterozygous. These are what are bought for the experiment.

P generation- +/+ X w/w

F1 generation- +/w X +/w

F2 generation- ?

Week 1: Medium is placed in the bottom of a clean vial. Then 5 flies are placed in the vial, 3 females and 2 males. The sponge plug in placed on the vial and we leave it alone for one week.

Week 2: We dump out the 5 F1 flies before the next generation pupates so that they will not get mixed up as adults and ruin the experiment.

Week 3: First we anesthetize the flies with FlyNap. Then we observe the result of the cross by counting the different offspring for the F2 generation.

Results

Vial #1

Phenotype	Observed #	Expected Results (*e*)	Difference (*d*)	d2	Partial Chi-Square (d2/e)
wild / wild	258	238	20	400	400/238 = 1.680
ebony / wild	67	79	12	144	144/79 = 1.822
wild / vestigial	81	79	2	4	4/79 = 0.050
ebony / vestigial	17	27	10	100	100/27 = 3.703
					Chi-Square = 7.255

Vial # 2

Phenotype	Observed #	Expected Results (*e*)	Difference (*d*)	d2	Partial Chi-Square (d2/e)
White-eyed female	129	145	16	256	256/145 = 1.765
White-eyed male	107	145	38	1444	1444/145 = 9.958
Red-eyed female	146	145	1	1	1/145 = .006
Red-eyed male	197	145	52	2704	2704/145 = 18.648
					Chi-Square = 30.377

I used the ratio 9:3:3:1 in Vial # 1 Chi-Square and the ratio 1:1:1:1 in Vial #2. According to Chi-square both of the experiments were rejected. Vial # 2 was way off the Chi-Square chart but Vial # 1 was at about 7%, which is still not enough to support my data. The Drosophila did something very strange in Vial # 2. There were more white-eyed females than males when white eyes are supposed to be an X-linked trait.

Discussion