Inheritance of Traits in *Drosophila melanogaster*

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Research Question or Driving Question

Does inheritance of white eyes and sepia eyes in *Drosophila Melanogaster* follow Mendelian Genetics rules?

Introduction

In *Drosophila melanogaster*, sepia eyes are an autosomal recessive. The sepia eyed color is only expressed when an individual has two copies of the sepia allele. Red eyes are the wild-type phenotype, which is represented by the dominant allele (+), while sepia eyes are represented by (se). White eyes are X-linked recessive represented X^w, and since males only have one X chromosome if a male gets passed down a white eyed allele it will display the white eye phenotype. For females to display this phenotype, it must have two copies of the white eye allele. We are researching the differences in inheritance patterns between sepia eyes and white eyes in Drosophila. Our null hypothesis statement is there is no significant difference between the observed and expected data, and any difference is due to random chance and the inheritance follows Mendelian Genetics Rules.

Methodology

F1 Generation Punnett Square
4/4 wild type

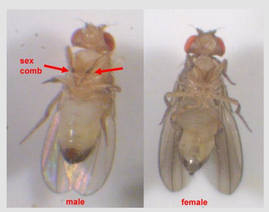
	seX^+	**seX^+**
+ X^w	se + X^w X^+	se + X^w X^+
+ *Y*	se + X^+ Y	se + X^+ Y

F2 Generation Punnett Square
9/16 wildtype (F: 6, M: 3) ¼ white eyed (M: 4), 3/16 sepia eyes (F: 2, M: 1)

	+ X^+	**+ X^w**	**se X^+**	**se X^w**
+ X^+	++ X^+ X^+	++ X^+ X^w	+se X^+ X^+	+se X^+ X^w
+ *Y*	++ X^+ Y	++ X^w Y	+se X^+ Y	+se X^w Y
***se* X^+**	+se X^+ X^+	+se X^+ X^w	sese X^+ X^+	sese X^+ X^w
***se* Y**	+se X^+ Y	+se X^w Y	sese X^+ Y	sese X^w *Y*

F3 Generation Punnett Square
2/8 wild type (F: 1, M: 1) 2/8 sepia eyed (F: 1, F: 1) 4/8 white eyes (F: 2, M: 2)

	se X^w	se X^+
+ X^w	se +X^w X^w	se +X^w X^+
+Y	se + X^w Y	se+ X^+ Y
se X^w	sese X^w X^w	sese X^+ X^w
se Y	sese X^w Y	sese X^+ Y



F1	Wild Type Eyes	Sepia Eyes	White Eyes
Females	34	0	0
Males	32	0	0
F2	**Wild Type Eyes**	**Sepia Eyes**	**White Eyes**
Females	63	23	0
Males	27	6	40
F3	**Wild Type Eyes**	**Sepia Eyes**	**White Eyes**
Females	13	19	33
Males	19	20	31

Procedure

1. Set up fly tubes:
   1. !6 grams of Formula 4-24 and 13 mL of distilled water in 3 tubes.
   2. Label one tube as mating + generation, label one tube as female, and one tube as male.
   3. Put 6 of each sex of flies in the mating tube (white eyed males + sepia eyed females)
2. 2 Mating the flies:
   1. Once larvae are visible in the P generation tube, shake flies into empty tube for euthanizing. Euthanizing: use Anesthefly solution and pout asleep flies into isopropyl alcohol/death chamber
2. Separate pupae into their individual tube.
   1. Repeat all above steps for each generation.

Results

Null Hypothesis: There is no significant difference between the observed and expected data, and the inheritance follows Mendelian genetics. For all the crosses we fail to reject the null hypothesis because there is no significant difference between the observed and expected data. The chi square values 0.06 (F1), 2.509 (F2), 2.628 (F3), are all less than 11.07 which is the critical value for degrees of freedom of 5 with a p value of 0.05. Since these crosses don't show statistical significance and these crosses follow Mendelian Genetics.

F1 gen Chi square

Phenotype	Observed	Expected	O-E	(O-E)^2/E
Red eyes Male	34	33	1	0.03
Red eyes Female	32	33	-1	0.03
White eyes Male	0	0	0	0
White eyes Female	0	0	0	0
Black eyes Female	0	0	0	0
Black eyes Male	0	0	0	0
Total	66	66	0	X^2 = 0.06

degrees of freedom: 6-1 = 5 critical value: 11.07 p value: 0.05

F2 gen Chi square

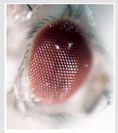
Phenotype	Observed	Expected	O-E	(O-E)^2/E
Red eyes Female	63	59.625	3.375	0.191
Red eyes Male	27	29.8125	-2.8125	0.265
White eyes Female	0	0	0	0
White eyes Male	40	39.75	0.25	0.002
Black eyes Female	23	19.875	3.125	0.491
Black eyes Male	6	9.9375	-3.9375	1.560
Total	159	159	0	X^2 = 2.509

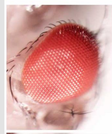
Degrees of freedom 6-1=5 critical value: 11.07 p value: 0.05

F3 generation chi square

Phenotype	Observed	Expected	O-E	(O-E)^2/E
Red eyes Female	13	16.125	-3.125	0.606
Red eyes Male	19	16.125	2.875	0.513
White eyes Female	33	32.25	0.75	0.017
White eyes Male	31	32.25	-1.25	0.048
Black eyes Female	19	16.125	2.875	0.513
Black eyes Male	20	16.125	3.875	0.931
Total	129	129	0	X^2 = 2.628

Degrees of freedom 6-1=5 critical value: 11.07 p value: 0.05





Acknowledgements

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Romberger, T. & Purdue University. (1933). Eye-Colors in Drosophila. In *Proceedings of Indiana Academy of Science* (pp. 261–264).

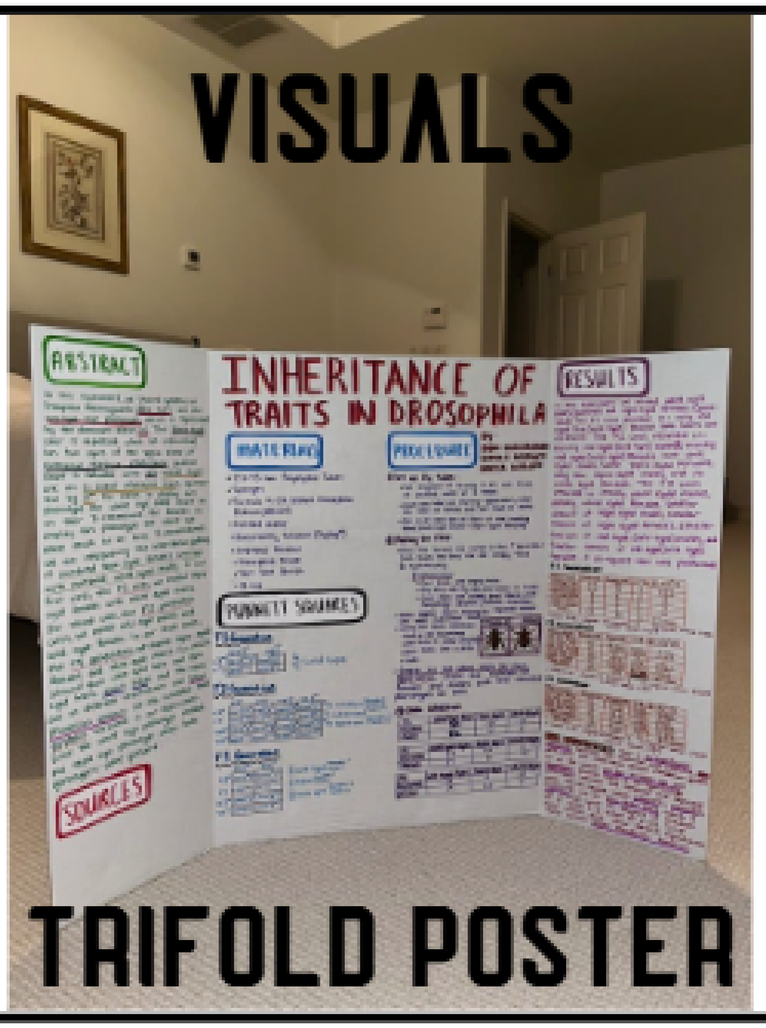
Project #

INVESTIGATING THE INHERITANCE OF SEPIA EYES IN DROSOPHILA MELANOGASTER

AARYA NIGAM, RIDHI MIRCHANDANI, SAMIKA PASPULETI

IS THE INHERITANCE OF THE WHITE EYE AND SEIPA EYE PHENOTYPE A PART OF MENDELIAN GENETICS?

VISUALS



TRIFOLD POSTER

CONCLUSION

SINCE ALL THESE CROSSES DON'T SHOW STATISTICAL SIGNIFICANCE, THIS MEANS THESE CROSSES FOLLOW MENDELIAN GENETICS, AND THE GENES AREN'T LINKED. MENDELIAN GENETICS SHOW SIMPLE GENETICS WITH TWO ALLELES BEING ON ONE GENE, AND ONE OF THE ALLELES SHOWING COMPLETE DOMINANCE, SO WHEN THE CHI-SQUARE SHOWS THAT THE DIFFERENCE IN EXPECTED AND OBSERVED IS DUE TO CHANCE, THAT MEANS THAT THE GENES CROSSED IN A SIMPLE COMPLETE DOMINANCE WAY. IF THERE WAS A STATISTICALLY SIGNIFICANT DIFFERENCE, THEN THAT WOULD SHOW THE GENES CROSSED IN A WAY THAT IS CONSIDERED NON-MENDELIAN GENETICS, WHICH COULD BE GENE LINKAGE, CODOMINANCE, INCOMPLETE DOMINANCE, ETC...

DR. GINNY BERKEMEIER