# Sex linkage in drosophila melanogaster

ASSIGN BUSTER

The principles governing heredity were first formulated by Gregor Mendel, who stated that allele pairs separate independently from parents to off springs in his principle of independent assortment. Later on, Thomas hunt Morgan proposed that genes were responsible for traits of organisms and he used the fruit fly (Drosophila melanogaster) in his experiments to study the role of genes in biological processes. This Experiment was performed to show that traits occur as a result of inheritance due to separation or segregation of alleles/genes. The experiment was aimed at instilling genetic skills in order to ensure that individuals are able to differentiate male from female flies, identify common mutant phenotypes, set up genetic crosses using organism’s genotypes and understand how to utilize data from genetic crosses. Genetic crosses were carried out in the lab to illustrate the difference in the inheritance patterns of sex linked traits. It was observed that the white allele’s frequency is higher in males than in females even when reciprocal crosses are done. This is because this gene is linked to the X-chromosome.

Introduction

Fruit flies are widely used in genetics experiments due to their short life cycle, they multiply in abundance from just a single cross, the cost of maintaining the fly is low, availability of thousands of mutation and their studies are easy to perform. Thomas Hunt Morgan worked extensively with these flies and shade much light on genetics as it is today. During his experiments, he discovered that the gene for white eyes in males was exclusively inherited with the X-chromosome (Christiansen 143). This experiment not only initiated the study of sex linked traits, but also provided

evidence of the chromosomal theory of inheritance. Sex linkage is a form of alternative inheritance pattern where by a specific gene is found on (X or Y chromosomes) sex chromosomes. Sex linked traits occur mainly in males since they only have one X-chromosome but in females they occur only when they are homozygous recessive (Roberts 453). Sex Linkage falls in a broad classification of genetic linkage where by different alleles are inherited together. This mainly happens when the gene loci occurring in the same chromosome are physically closer therefore do not segregate during meiosis, but stay together.

The white-eyed trait was used in this experiment to show the inheritance of X linked traits. The rationale of this experiment is to be able to differentiate male from female flies, be able to identify common mutant phenotypes such as eye color, shape and body color, set up genetic crosses and understand how to utilize data from genetic crosses (Christiansen 143). This experiment will also ensure that one is in a position to generate punned squares for sex linked traits, know the outcome of certain sex linked traits, be able to use these results to calculate the number of individuals from the observed population in this case using fruit fly reciprocal crosses monitor the number of phenotypes with regard to sex and eye color. The two alleles for eye color which are used in this experiment are white (w) and wild type (w+), the wild type allele produces red eye color and is usually dominant to the white allele (Kotpal 70).

Methods:

Experiment 1:

Canton-S females and males flies were anesthetized by CO2 and dumped onto CO2 pads. The CO2 pad was them placed under a dissecting microscope and magnified appropriately. Differences and characteristics of males and females were observed appropriately. A vial of y w sn triple mutant flies was also prepared just like Canton-S. These were observed to identify and differentiate between the mutant phenotypes for eye color, body color, and bristle shape. These characteristics were compared with the wildtype phenotypes for each characteristic.

Experiment 2:

Three white eyed males (hemizygous for the white eye color allele) were anaesthetized and placed in a new vial. In this new vial, three wildtype virgin females (homozygous for the wildtype red eye color allele) were anaesthetized and introduced and the vial labeled appropriately. A reciprocal cross was then made for the same and labeled. After one week, the parents were removed from their respective vials and dumped into a morgue; the larvae were left to grow. After another week, the vials were retrieved for observation. This was done by anaesthetizing the flies and placing them in a Petri dish on top of an ice block. These were then counted to under magnification to identify the males and females as well as white eyed versus red eyed. Three female and three males were obtained and place in a new vial. A punnet square was performed to predict the results.

Results:

Experiment 1: The observed characteristics were drawn carefully.

Experiment 2:

From the experiment of the parental cross, the results of the first filial generation (F1) were as follows.

The parental cross is between Xw+ Xw+ females and Xw Y males (wild type females vs. white males)

XW+ XW+

XW XW+XW XW+ XW

Y XW+Y XW+Y

White Males: 0% Red eyed males: 50%

White Females: 0% Red eyed Females: 50%

The parental cross is between Xw+ Xw females and Xw+ Y males (the F2 generation)

XW+ XW

XW+ XW+XW+ XW XW+

Y XW+Y XWY

White eyed Males: 25% Red eyed Males: 25%

White eyed Females: 0% Red eyed Females: 50%

The reciprocal cross (wildtype males Vs. white virgin female flies)

XW XW

XW+ XW+XW XW+ XW

Y XWY XWY

White Males: 50% Red eyed males: 0%

White Females: 0% Red eyed Females: 50%

The F1 crosses

XW+ XW

Xw XWXW+ XW XW

Y XW+Y XWY

White Males: 25% Red eyed males: 25%

White Females: 25% Red eyed Females: 25%

Discussion

Based on the observed characteristics, the males are larger than females and have shorter and rounder wings. The abdomen of the female is rounded and has striped appearance while that of the male is not rounded and is dark (Roberts 452). The two have different genitalia visible on the posterior ventral abdomen; the female genitalia having a small opening that forms a smooth point at the end of the abdomen while that of the male consists of more complex cuticular structures. Males have sex combs; these are small patches of hair on the elbows while female do not have these.

Interesting frequencies are observed in the second experiment where by the parental cross completely differ from the reciprocal cross. In the original crosses' F2 generation the results are as follows; White eyed Males: 25%, Red eyed Males: 25%, White eyed Females: 0%, Red eyed Females: 50%. This is completely different from the reciprocals' crosses which yield 25% of each trait. Given these results, males are affected by the white eye mutation to a more extent than the females (Jeffreys and Wilson 11). This translates to typical sex linkage genetic crosses. Since males are hemizygous for this trait, it is expressed even if they have one copy of the gene. The females on the other hand must inherit two genes for the trait in question because they only express it when in homozygous state. This means that the trait will be less frequent in the population as compared to the male's frequency.

## Work Cited

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