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## Introduction

The main goal of this biology report is to describe Gregor Mendel's two experiments done on 1865. The experiments resulted in two postulate laws such as the law of independent assortment and the law of segregation (Santaing, 2020). The law of independent assortment is a scientific postulate highlights the difference in genetic composition of organism and how the entire process occurs during cell division. Mendel did an experiment on dihybrid crosses that indicated that there are some mismatches in the genetic components of different organisms, that the genes of offspring were not necessarily resemble those of their parents. He conducted a series of experimental practical to underpin his hypothesis using three main crosses.

The second Mendelian law is the principle of segregation that describes the alleles that every organism has and calls for outstanding characteristic that occurs during cell division. The law states that states that paired genes must segregate equally into gametes such that offspring have an equal likelihood of inheriting either factor through the separation process that occurs through meiosis (Santaing, 2020). Most of the physical characteristics and traits in organisms are controlled by a pair of alleles as described by this Mendelian law. Some of these traits include the skin color, hair, eye colour, and the hairy ears and in some organisms.

The aspect of monohybrid principle is explained by Mendelian law using a pair of flowers with different traits. Through this approach, Mendel used flowers with pure breed with white color and denoted these pair of alleles as WW that came from the segregation process and another purple flower with recessive genetic compositions with a pair of alleles denoted with the letters ww (Santaing, 2020). When these genetic alleles were crossed, it resulted in the first generation of offspring being white and that only 1 of the 4 offspring was purple. It resulted in the Mendelian ration of 3 to 1 where the white flowers were dominant and majority in the

crossing illustration diagram were white. The offspring were Ww and ww where Ww were three and white in colour while ww was one and purple in colour. This Mendelian experiment properly illustrated the role of alleles in determining the external features of the offspring. The second generation of the offspring indicated the possibility of weakened dominant gene and that both white flowers and the purple flowers were similar and same in number, WW or ww as genes are called homozygous while the ones with Ww are called heterozygous.

The observation done using the law of segregation by Mendel indicated that the ratio of the alleles calling for the white and purple colour in the second generation is 1:1. However, this ration changes with the increase in number of generations and the main features of homozygous and heterozygous keep varying through this generational change. The fourth generation shows that the Ww alleles call for a heterozygous while the first generations resulted in an overall homozygous dominant white colour. As indicated by the law of independent assortments, it is clear that different traits in an organism are called by different pairs of alleles that are described by Mendelian experiment using dihybrid crosses that proved this hypothesis. For instance, dragonfly's compound eyes and the thickness of its abdomen are called by different pair of alleles that lead to the differences depicted by these insects.

The practical part of the Mendelian experiment is tested using a Chi-squared test to ascertain the findings of the experiment. The findings of Mendelian experiment that tried to test the effects of breeding two different breeding parents to check the traits and characteristics of the offspring resulted in a ratio of 9:3:3:1 in all the generations. Through this statistical approach of checking the experimental findings, provide a standing on the hypothetical findings of the Mendelian experiment and provide results that reinforces the hypothesis of the experiment. The process is done using distribution tables that show the frequency in which the offspring resemble

their parents or bears traits such as dominant or recessive homozygous or heterozygous characteristics. The Chi-square tests provide an avenue for testing the validity of the findings obtained, comparing them with Mendelian experimental results and the literature values.

### **Materials and Methods**

The Mendelian experiment was conducted according to the procedures highlighted in the laboratory experiment manual "Mendelian Genetics." The materials used in the experiment included the white and purple flowers that were crossed and the offspring's features and traits were analyzed to check the Mendelian hypothesis. All the materials used were from the laboratory and the botanical garden where the flowers and agents of crossing were obtained from.

### **Results**

The experimental findings obtained from counting the flowers with the similar traits were done. The tabulated findings below show the hypothetical and theoretical findings of the Mendelian experiment (Online Calculator, 2019).

#### **a) Monohybrid Crosses**

Traits	White Counted	Purple Counted
Flower petals 1	380	90

Cumulative flower petals counted = 470

#### **b) Test Crosses**

	White Counted	Purple Counted
Flower petals 1	180	270

Cumulative flower petals counted = 450

**c) Dihybrid Crosses**

	White / Smooth	White / Rough	Purple / Smooth	Purple / Rough
Flower petals 1	300	120	140	80

Cumulative flower petals counted = 640

**Chi-Squared Analysis**

**a) Monohybrid crosses that result in the expected 3:1 phenotypic ratios**

Phenotypic Characteristics	Observed # (O)	Expected Results (E)	Difference (d) = (E - O)	Difference Squared (d <sup>2</sup> )	Standardized Squared Deviation (d <sup>2</sup> /E)
<i>White</i>	380	385.5	+5.5	24.25	0.076
<i>Purple</i>	90	95.5	+5.5	16.25	0.864

$$\chi^2 = \text{sum } (d^2/e) = \underline{0.940}$$

**b) Test crosses that result in the expected 1:1 phenotypic ratios**

Phenotypic characteristics	Observed # (O)	Expected Results (E)	Difference (d) = (E - O)	Difference Squared (d <sup>2</sup> )	Standardized Squared Deviation (d <sup>2</sup> /e)
<i>White</i>	180	200	20	200	0.862

<i>Purple</i>	270	250	-20	250	0.569
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$$\chi^2 = \text{sum } (d^2/e) = \underline{\underline{1.431}}$$

c) Dihybrid crosses that resulted in the expected 9:3:3:1 phenotypic ratios

Phenotype	Observed # (O)	Expected Results (E)	Difference (d) = (E - O)	Difference Squared (d <sup>2</sup> )	Standardized Squared Deviation (d <sup>2</sup> /e)
<i>White / Smooth</i>	300	320	1.20	1.44	0.056
<i>White / Rough</i>	120	140	1.45	2.1025	0.048
<i>Purple / Smooth</i>	140	120	-4.89	23.9121	0.098
<i>Purple / Rough</i>	80	60	3.45	11.9025	0.864

$$\chi^2 = \text{sum } (d^2/e) = \underline{\underline{1.066}}$$

### Discussion

Based on the findings obtained from the Chi-square test, there is a very strong correlation between Mendelian experiments and the experimental practical conducted. It is due to the p value obtained and the overall standardized squared deviation  $d^2/e$  which was obtained to be

1.066. The value implies that there is a precision in the data collected which underpin the Mendelian laws of independent assortment and the law of segregation (Charles, 2013). The offspring depicted traits that were called by individual alleles which are stated by both of Mendelian laws. The three tests for the monohybrid, dihybrid and the Chi-squared tests indicated that the features displayed by the flower petals have dominant homozygous and the recessive heterozygous genes. The genetic compositions of these flowers are made up of different alleles that make one flower different from the other and hence resulting in distinctive purple and white flowers. The white flower however is dormant in the crossing hence resulting in the purple color lower in the crosses ratios.

The Chi-squared value of the monohybrid in this experiment is presented in tabular form below. The findings were obtained from online calculator software.

**P-value of the Monohybrid crosses and statistical significance**

Chi squared result of the monohybrid crosses done is 0.94 with 0.5 degrees of freedom.

The two-tailed P value obtained is 0.1872

These results are not statistically significant due to large difference existing between the values obtained.

The P-value however supports Mendel's laws of genetics.

**P-value of Dihybrid Crosses and statistical significance:**

Chi squared result of the monohybrid crosses done is 0.0876 with 1 degree of freedom.

The two-tailed P value obtained is 0.0787

These results are statistically significant due to precision indicated in the values obtained (Charles, 2013).

The P-value however supports Mendel's laws of genetics.

**P value of Test crosses and statistical significance:**

Chi squared result of the monohybrid crosses done is 0.5645 with 1 degree of freedom.

The two-tailed P value obtained is 0.876

These results are not statistically significant due to large difference existing between the values obtained.

The P-value however supports Mendel's laws of genetics.

In conclusion, the Mendelian experiment on the role of genetics and alleles in determining the features, characteristics and the traits of offspring was underpinned. Therefore, the experiment supported both Mendelian laws of genetics.

### References

Charles E. (2013). Definition of Chi-Squared Test. <http://www.chegg.com/homework-help/definitions/chi-square-test-31>

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