

Sample Problem 2: Wing Length in Fruit Flies

A single pair of alleles codes for one of the genes that controls wing length in fruit flies (*Drosophila melanogaster*). The long wing allele (*L*) is dominant to the short wing allele (*l*). If 40 fruit flies out of 1000 that are counted have short wings, how many fruit flies out of 1000 would be expected to be heterozygotes?

What Is Required?

To determine the number of fruit flies that are heterozygous (*Ll*) for the wing length gene, given a population sample (*N*) of exactly 1000.

What Is Given?

The proportion (q^2) of homozygous recessive (*ll*) fruit flies in the sample, $\frac{40}{1000}$.

Plan Your Strategy

Change the frequency of q^2 to a decimal.

Take the square root of the value of q^2 to find the value of q .

Subtract q from 1.00 to find the value of p .

Find the value of $2pq$.

Multiply the population size (*N*) by the frequency of the heterozygous genotype ($2pq$).

Act on Your Strategy

Step 1

$$q^2 = \frac{40.0}{1000}$$

$$= 0.0400$$

Step 3

$$p + q = 1.00$$

$$p = 1.00 - q$$

$$= 1.00 - 0.200$$

$$= 0.800$$

Step 5

$$\text{number of heterozygotes} = (2pq)(N)$$

$$= (0.320)(1000)$$

$$= 3.2 \times 10^2$$

Step 2

$$\sqrt{q^2} = \sqrt{0.0400}$$

$$q = 0.200$$

Step 4

$$2pq = 2(0.800)(0.200)$$

$$= 0.320$$

The population sample would be expected to contain exactly 320 fruit flies that are heterozygous (*Ll*) for the wing length gene.

Check Your Solution

$$p^2 + 2pq + q^2 = 1.00$$

$$(0.800)^2 + 0.320 + 0.0400 = 1.00$$

$$0.640 + 0.320 + 0.0400 = 1.00$$

$$1.00 = 1.00$$



Fruit fly with long wings



Fruit fly with short wings