13-12-21

EXPERIMENT NO. 5.

AIM OF THE EXPERIMENT - To verify Mendel's law of Segregation.

PRINCIPLE -

When two pure lines with contrasting forms of a particular character (Phenotypes) are crossed to produce the next generation (F_1 - generation), all the members of the progeny are of only one phenotype i.e., of one of the two parents. The phenotype that appears is called Dominant and the one that doesn't appear is called Recessive. When the F_1 plants are selfed, the progeny i.e., the F_2 generations is in the ratio of 3 dominant : 1 recessive (3/4 : 1/4 or 75% : 25%). This reappearance of the recessive phenotype in F_2 generation verifies law of Segregation.

REQUIREMENT -

16 Yellow and 16 Green coloured pea seeds (this peas represents the gametes of a specific trait), plastic beakers and hand towel.

PROCEDURE :

(i) First we put 16 Yellow peas in one beaker and 16 Green peas in the other to represents male and female gametes respectively.

The Yellow peas be indicated by 'Y' and green peas by 'y'.

(ii) Secondly, we take a pea from each container and place them together (it represents fertilization). Now one of us take out peas and to put in the hands of the other students who will put them on the table.

(iii) Just like previous step, continue to pick peas and arrange them in pairs. Thus 16 pairs of peas are obtained representing 16 heterozygous F_1 progeny. All F_1 individuals are represented by one yellow and one green pea, i.e 'Y' and 'y'.

(iv) Now we put 8 F_1 progeny in one beaker and the remaining 8 in another beaker. (representing the F_1 males and females).

(v) Stir the peas of each beaker with a pencil for about 10 times taking care that no peas falls off.

(vi) To obtain F_2 generation, one of us would withdraw one pea from the beaker labelled male and one from the other beaker labelled as female keeping his/her eyes closed and put them together in the stretched palm of the partner, who will put them together on the towel spread over the table.

Continue this procan till all the peas are paired.

(vii) Now, we note the genotype (YY or Yy or yy) of each pair and their possible phenotypes.

(viii) Calculate the genotypes and phenotype ratio of our pooled data.

OBSERVATION -

The recorded results are in the following table -

Generations	Total no. of individuals	Genotypes YY	Yy	yy	Phenotypes.
F_1	16	0	1	0	Yellow
F_2	16	4	8	4	Yellow - 12 Green - 4

Phenotypic ratio in F_1 = All Yellow (Yy)

Phenotypic ratio in F_2 = Yellow : Green

= 12 (Y_) : 4 (yy)

= 3 : 1

Genotypic ratio in F_1 = All Yy

Genotypic ratio in F_2 = YY : Yy : yy

= 4 : 8 : 4

= 1 : 2 : 1

DISCUSSION -

The results are so because each diploid individuals contains two copies of every gene - one copy on each of the two homologous chromosomes. These two copies of the gene may be of similar type (YY or yy) or the dissimilar 'Yy'. The former (YY or Yy) are called homozygous for that particular character, and the 'Yy' are called heterozygous ones. The pure line in the above cross are homozygous ones, which contributed only one copy of their gene to their F_1 progeny to restore its diploid nature with genotype 'Yy' (heterozygous) where only one form is expressed (dominant) and the other form is not expressed (recessive). This is the phenomenon of dominance.

When the F_1 individuals are crossed together to raise the F_2 generation each F_1 individuals produced two types of gametes: 50% having dominant allele and the remaining 50% having recessive allele. These gametes undergo random fusion during fertilization to produce the F_2 generation. According to simple probability of mixing of opposite sex gametes offsprings of three genotypes are likely to appear as follows:

[(half of gametes of 'Y' types + half of remaining gamete 'y' type) x (half gametes of 'Y' type + half of remaining gamete of 'y type)] = one-fourth of F_2 individuals of 'YY' phenotype + half of individual 'Yy' type + one-fourth of individuals of 'yy' type. Among these proportion of dominant phenotype would be $\frac{1}{4}$ YY + $\frac{1}{2}$ Yy = 3:1 Yellow and recessive phenotype $\frac{1}{4}$ yy i.e., green phenotypes in 3:1 ratio or 75% : 25% ratio.

The ratio of 3:1 in the F_2 suggests that in the F_2 heterozygotes, the recessive allele does not get destroyed and remains only in recessive state to get an opportunity to express itself when it has separated from the influence of the dominant allele (Y). This is called Law of Segregation.