

13-12-21

EXPERIMENT NO. 6

AIM OF THE EXPERIMENT - To verify the Mendel's Law of Independent assortment.

PRINCIPLE -

In a dihybrid cross, the segregation of one gene pair is independent of the segregation of the other pair. It means the genes of two different traits assort independently to give a probability ratio equal to segregation probability ratio of one allele pair \times segregation probability ratio of other allele pair, which comes to $(3:1) \times (3:1) = 9:3:3:1$.

REQUIREMENTS -

Beakers, 16 coloured peas each of Yellow, Green, Red and Blue to represent, Yellow and Green colour of seed coat and Red and Blue flowers respectively, and towel.

PROCEDURE -

- (i) At first we place 16 peas of each colour in four separate beakers.
- (ii) Put the beakers containing the yellow and red peas on my left side and those containing the green and blue peas on my right side.

The beakers on my left side represents plants bearing yellow seed and red flower (dominant character YY, RR). Beakers on the right side represents plants bearing green seed and blue flowers (recessive character yy, rr). These are the two parental types having contrasting forms of two different characters.

- (iii) Stir the peas in each beaker with a pencil. Each peas now represents alleles in the male and female gametes.
- (iv) Pick up one yellow, one green, one red and one blue and put them together on the towel spread on the table.
- (v) Continue picking up and putting together of the peas of all colours as mentioned in the previous step, till all the peas are utilised.
- (vi) Note that in all, 16 such 4-peas clusters are obtained representing the F_1 individuals. Ascertain the genotype and phenotype.

(vii) Next step is to cross these F_1 individual to raise the F_2 generation. Let us suppose half of the four peas clusters (16 clusters), represented the male parents and the remaining half the female parents. Now put the 8 red and 8 blue peas together in one beaker and similarly put 8 yellow and 8 green peas together in other beaker.

These two beakers represents F_1 female. Similarly put remaining 8 red + 8 blue peas in beaker and 8 yellow and 8 green represent the F_1 male.

The arrangement can be presented as below—

Female F_1	Male F_1
8 red + 8 blue	8 red + 8 blue
8 Yellow + 8 green	8 Yellow + 8 green.

(viii) Stir the peas in each beaker, with a pencil. In order to raise the F_2 generation, pick up one pea from the beaker of female and one pea from the beaker of the male and put into palm of the one of us. Similarly, pick up one pea each from the beakers of female and of male to put in the palm of one

of us. The partner would now keep all the four peas together (to represent F_2 generation individuals) continue this process till all peas are utilised. At the end 16 F_2 individuals are obtained.

(ix) Determine the genotype and phenotype of each of the 16 F_2 individuals and write down the number of individuals of different genotypes and phenotypes in the tabular form, representing that. —

Y = yellow bead = represented ~~round~~ yellow colour

y = green bead = represented ~~wrinkled~~ yellow-green colour

R = Red bead = represented Round green shape

r = Blue bead = represented wrinkled green shape

OBSERVATION -

Tabulating the results as follows —

[Symbol (-) indicates the presence of corresponding dominant or recessive allele eg 'Y' or 'y' and 'R' or 'r'.]

F_1 generation —

(a) Total number of individuals - 16

(b) Phenotypes - Round-Yellow

(c) Genotype - $YyRr$.

Generation	Total no. of offspring	Genotype				Phenotype			
		Y-R-	Y-rr	yyR-	yyrr	Yellow Red	Yellow Blue	Green Red	Green Blue
F ₁	16	16	0	0	0	16	0	0	0
F ₂	16	9	3	2	2	9	3	2	2

F₂ generation -

(a) Total number of individuals - 16

(b) Phenotype -

Round Yellow - 9

Wrinkled Yellow - 3

Round green - 2

Wrinkled green - 2

(c) Phenotypic ratio - Round Yellow (9) :

Wrinkled Yellow (3) : Round green (2) :

Wrinkled green (2)

(d) Genotypic ratio - Y-R- : Y-rr : yyR- : yyrr

9 : 3 : 2 : 2

© Number of individuals of each genotypic classes -

Genotype	Number.
Rr Yy	4
RR Yy	3
rr YY	2
Rr yy	1
Rr YY	1
rr Yy	1
rr yy	2
RR YY	1
RR yy	1

DISCUSSION -

The four phenotypic classes in the F_2 generation are in ratio of 9:3:2:2 which is approximately the same ratio obtained by the law of independent assortment.

The goodness of fit of the ratio to the ratio proposed by G. J. Mendel can be tested using the χ^2 -test.

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