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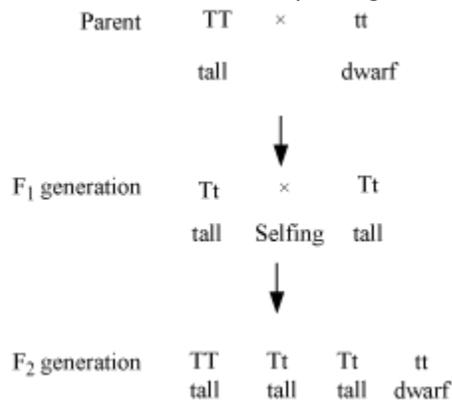
Class 12th

Sub. Biology

Date:- 23.06.2020
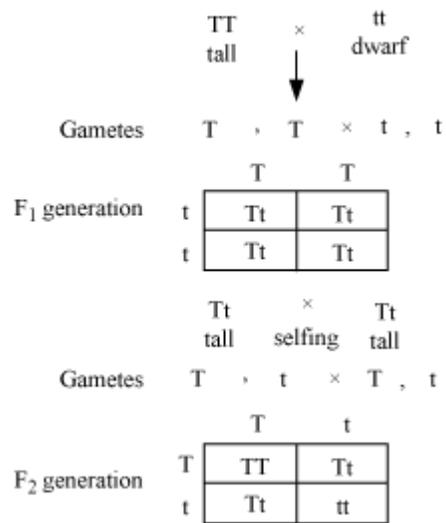
Monohybrid Cross

- Cross that considers only a single character (e.g., height of the plant)

Parent	TT	×	tt
	tall		dwarf

F_1 generation   Tt   ×   Tt

tall   Selfing   tall

F_2 generation	TT	Tt	Tt	tt
	tall	tall	tall	dwarf

- Studying the cross:

  ○ TT, tt , and Tt are genotypes while the traits, tall and dwarf, are phenotypes.

  ○ T stands for tall trait while t stands for dwarf trait.

  ○ Even if a single 'T' is present in the genotype, phenotype is 'tall'. When 'T' and 't' are present together, 'T' dominates and suppresses the expression of 't'. Therefore, T (for tallness) is dominant trait while t (for dwarfness) is recessive trait.

  ○ TT and tt are homozygous while Tt is heterozygous.

  ○ From the cross, it can be found that alleles of parental pair separate or segregate from each other and only one allele is transmitted to the gamete.

  ○ Gametes of TT will have only T alleles; gametes of tt will have only t alleles, but gametes of Tt will have both T and t alleles.

- ● Punnett square

  ○ Graphical representation to calculate the probability of all possible genotypes of offsprings in a genetic cross

○ Possible gametes are written on two sides, usually at top row and left columns, and combinations are represented in boxes.

$$\begin{array}{cc}
TT & tt \\
\text{tall} & \times \quad \text{dwarf} \\
& \downarrow
\end{array}$$

Gametes   T , T   ×   t , t

F_1 generation

	T	T
t	Tt	Tt
t	Tt	Tt

$$\begin{array}{cc}
Tt & Tt \\
\text{tall} & \text{selfing} \quad \text{tall}
\end{array}$$

Gametes   T , t   ×   T , t

F_2 generation

	T	t
T	TT	Tt
t	Tt	tt

○ With the help of Punnet square, genotypic ratio in F_2 generation can be found. From the above given Punnet square, it is evident that **genotypic ratio TT: Tt: tt** is **1:2:1.**

○ The ratio 1:2:1 or $\dfrac{1}{4} : \dfrac{1}{2} : \dfrac{1}{4}$ of TT: Tt: tt can be derived from binomial expression ($ax + by$)².

○ Gamete-bearing genes are in equal frequency of $\dfrac{1}{2}$.

Hence, the expression can be expanded as

$$\left(\frac{1}{2}T + \frac{1}{2}t\right)^2 = \left(\frac{1}{2}T + \frac{1}{2}t\right) \times \left(\frac{1}{2}T + \frac{1}{2}t\right)$$

$$= \frac{1}{4}TT + \frac{1}{2}Tt + \frac{1}{4}tt$$