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Principles of Inheritance and Variation –

8. Inferences of Mendel's Experiments

(i) Mendel inferred that something was being passed down, from parents to offspring through the gamete over successive generations. He called them 'factors', now known as genes.

(ii) Genes are the unit of inheritance. They contain the information required to express a trait.

(iii) Genes which codes for a pair of contrasting traits are called alleles or allelomorphs, i.e. they are slightly different forms of the same gene.

(iv) Mendel also proposed that in a true breeding variety, the allelic pair of genes are identical or homozygous, TT and tt for tall or dwarf pea variety respectively.

(v) TT and tt are genotype of the plant.

(vi) Descriptive term tall and dwarf are the phenotype.

(vii) When the tall (TT) and dwarf (tt) pea plant produce gametes, the alleles of the parental pair segregate from each other and only one allele is transmitted to a gamete.

(viii) The gametes of the tall TT plants have the allele T and the dwarf tt plants have the allele t.

(ix) This segregation of alleles is a random process and, so there is a 50% chance of a gamete containing either allele, as verified by the results of crossings. After fertilisation of TT and tt traits, hybrids contain Tt and are called heterozygous.

(x) Mendel found the phenotype of Tt to be similar as TT parent in appearance, he proposed that in a pair of dissimilar factor, one dominates the other (T in this case) and hence, is called the dominant factor, while the other factor (t) is recessive.

(xi) Allele can be similar in case of homozygous TT or tt and dissimilar in case of heterozygous Tt.

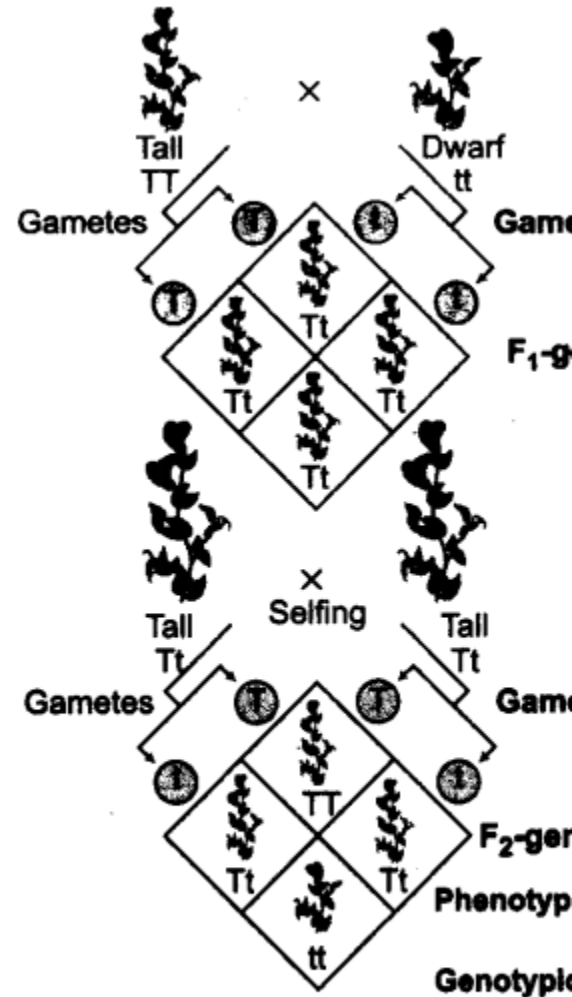
(xii) In Tt plant, one character (height) is controlled by a gene hence, it is monohybrid and cross between TT and tt is called monohybrid cross.

9.

Punnett square

- (i) The production of gametes by the parents, the formation of the zygotes, the F_1 and F_2 -generations can be understood by a diagram called Punnett square developed by a British geneticist RC Punnett.
- (ii) The Punnett square is a graphical representation to calculate the probability of all possible genotypes of offsprings in a genetic cross.
- (iii) The $1/4 : 1/2 : 1/4$ genotypic ratio of $TT : Tt : tt$ is mathematically condensable to the form of binomial expression $(ax + by)^2$, that has the gametes bearing genes T or t in equal frequency of $1/2$.
- (iv) The expression is expanded as

$$\begin{aligned} (1/2 T + 1/2 t)^2 &= (1/2 T + 1/2 t) \\ &\quad \times (1/2 T + 1/2 t) \\ &= \frac{1}{4} TT + \frac{1}{2} Tt + \frac{1}{4} tt \end{aligned}$$



A punnett square used to understand a monohybrid cross conducted by Mendel between true-breeding tall plants and true-breeding dwarf plants.