

## CHAPTER-4

### "Principles of Inheritance and Variations"

#### Genetics

\* Branch of biology deals with inheritance, as well as the variation of characters from parents to offspring.

\* **Inheritance**  $\rightarrow$  Process by which characters are passed on from parent to progeny. It is the basis of heredity.

\* **Variation**  $\rightarrow$  It is the degree by which progeny differ from their parents.

-- Human knew from as early as 8000-1000 B.C. that one of the cause of variation was hidden in sexual reproduction.

*for Example \*\** Through Artificial selection and domestication from ancestral wild cows, we have well known Indian breeds eg. Sahiwal cows in Punjab.

Pre Mendelian Genetics  $\leftarrow$  MENDEL  $\rightarrow$  Post-Mendelian Genetics

(Blending Inheritance)

• During the mid-nineteenth century  $\rightarrow$  we made headway towards understanding of inheritance.

Gregor Mendel  $\rightarrow$  conducted hybridisation experiments on Garden Peas for 7 yrs (1856-1863) & proposed the law of inheritance in living organisms.

He proposed that heredity was controlled by paired germinal unit called factors, now called genes. He mentioned that the factors were present in the cells of the body and transmitted to next generation through gametes.

#### Important terms used in Inheritance studies $\rightarrow$

1. **Character** :- It is used for the feature of the individual such as stem, height, flower color etc.

2. **Trait** :- It is an inherited character such as tall or dwarf.

3. **Unit factor** :- This term was used by Mendel. It is a unit of inheritance.

4. **Gene** :- The unit factor of Mendel was called gene by Johannsen in 1909. A gene is the unit of inheritance which is carried from parent by a gamete. Gene occur in a chromosome.

5. **Locus** : A fixed position or place on a chromosome that is occupied by a given gene or one of its allele.

6. **Allele** : They are slightly different forms of the same gene.

7. **Recessive allele** :- Allele which is unable to express  $\downarrow$  its effect in the presence of its contrasting factor in heterozygous condition.  
"Represented by small letter (t)"

8. **Dominant allele** :- Allele which can express itself  $\downarrow$  whether present homozygous or heterozygous state.  
"Represented by Capital letter (T)"

9. **Homologous chromosomes** :- Chromosomes which are similar in shape, size, length, position of gene & centromere.

10. **Homozygous** :- If identical alleles of a same gene present on same locus in homologous chromosome.

TT  $\rightarrow$  Homozygous dominant

tt  $\rightarrow$  Homozygous recessive

11. **Heterozygous** :- If different allele of a same gene present on same locus in homologous chromosome.

Tt  $\rightarrow$  Heterozygous

12. **Genotype** : Genetic constitution of an individual with regard to one or more character.

TT, Tt, tt.

13. **Phenotype** :- It is observable characteristic of an individual with regard to one or more character.

14. **F<sub>1</sub>-generation** :- Generation produced by cross between the genetically different individuals called parents.

15. **F<sub>2</sub>-generation** : Generation of individuals arises as a result of inbreeding amongst individuals of F<sub>1</sub>-generation.

16. **Monohybrid cross** :- A cross in which one character is taken in consideration.

17. **Dihybrid cross** :- A cross in which two character is taken in consideration.

18. **Pure line** :- It is the progeny of an organism that is homozygous because of continued inbreeding. It is also known as true breeding. True breeding line is one that, having undergone continuous self-pollination, shows the stable trait inheritance and expression for several generations.

19. **Punnett Square** :- It was developed by a British geneticist, Reginald C. Punnett. It is graphical representation to calculate the probability of all possible genotypes of offspring in a genetic cross.

20. **TEST cross** :- In a typical test cross an organism showing dominant phenotype (and whose genotype is to be determined) is crossed with the recessive. The progenies of such a cross can easily be analysed to predict the genotype of the test organism.

\* They exploited the variations of plants and animals to selectively breed and select for organisms that possessed desirable characters.