

## **Terminologies to be defined include**

Genetics, Forest Genetics, Tree breeding and Tree Improvement.

**Genetics-** It is a branch of biology. It is the modern experimental study of the laws of inheritance (variation and heredity). The name 'genetics' was proposed by William Bateson (1861-1926) in 1906.

Simply put, genetics is the study of similarities and differences between parents and their offsprings and between offsprings of the same parents. In other words, genetics is the science dealing with **heredity** and **variation**, seeking to discover laws governing similarities and differences in individuals related by descent.

**Heredity-** is the tendency of individuals to resemble their parents or the transmission of characteristics from parents to offsprings.

**Variation-** is the differences in characteristics observed among individuals of the same natural population or species.

### **The Geneticist's BUSINESS is to find out:**

- Why variations occur.
- To determine in what proportions the variant types are to be expected.
- To learn how to make more likely the probability that ideal parents will beget ideal offspring.
- To discover the optimum expression of the inherited potentialities.

## **MENDELIAN GENETICS**

The first known recorded work in the field of genetics , was not discovered until 1900, some sixteen years after the death of Gregor Mendel, who discovered the science of genetics. Gregor Mendel (1822-1884) is regarded as the founder and father of genetics; because the first scientific studies in genetics were carried out by him. Secondly, he discovered the basic laws of inheritance and also his studies laid the foundation of the science of heredity and variation (Genetics). Gregor Mendel, an Austrian monk

who lived between 1822 – 1884 performed his genetic studies on hybridization of plants, particularly garden pea (*Pisumsativum*).

Before Mendel, a lot of experimental work on hybridization of plants had been carried out, but it was he, Mendel, who could for the first time elucidate and formulate the laws involved in the inheritance of parental characters by the offspring. His work covered a period of nine years (1856-1865).

Among the pre-Mendelian period workers are Joseph Kolreuter, a German botanist who in 1760 hybridized two species of tobacco plants (*Nicotianapaniculata* and *N. rustica*).

The pre-Mendelian period workers were unable to discover the mechanism of inheritance of characters/traits from parents by offsprings because of these reasons:

1. The cytological basis of the mechanism was unknown during their period (i.e. the mechanisms of mitosis and meiosis had not yet been discovered).
2. They were trying to study the inheritance of all the characters/traits of the plants at a time.

Mendel in his experiment used garden pea (*Pisumsativum*) and in studying the inheritance of traits paid attention to only one pair of characters/traits at a time, and traced them carefully through many successive generations

. The character that expressed itself in the  $F_1$  generation was called DOMINANT by Mendel, while the other character that remained suppressed( but not absent in the hybrids) was called RECESSIVE by him.

On selfing the  $F_1$  plants he obtained both tall and dwarf plants in the  $F_2$  generation. On counting the plants, he discovered that three-fourths of them were talls while one-fourth were dwarfs. This gave a ratio of 3:1. this is known as MENDEL'S MONOHYBRID RATIO.

Drawings to explain monohybrid ratio.

Mendel's work has proved that traits are transmitted from one generation to another. The hereditary units which are transmitted from one generation to the next (i.e. inherited) are called genes. A gene can be defined functionally as that part of a chromosome responsible for the development of a particular

trait in an organism. Genes reside in a long molecule called deoxyribonucleic acid (DNA). The DNA, in conjunction with a protein matrix, forms nucleoprotein and becomes organised into structures with distinctive staining properties called chromosomes found in the nucleus of the cell.

Geneticists are concerned with (1) genes (2) with the chromosomes that carry them and (3) with the cells in which those chromosomes are found.

Mendel reasoned that there must be two factors separately responsible for each pair of contrasting characters .i.e. tallness and dwarfness. These factors occur in pairs (now known to be arranged in a linear fashion in the chromosome). A member of alleles which manifests in the  $F_1$  is referred to as DOMINANT gene; while the one whose effect is suppressed or 'hidden' is called a RECESSIVE gene. When two alleles ( a pair of allele) are present in the dominant or recessive form, they are said to be in HOMOZYGOUS condition (TT or tt) i.e two members of a pair of alleles existing in the same form. if one member of the allelic form is present in dominant form and the other in recessive form, HETEROZYGOUS (Tt) condition is achieved. Under heterozygous condition/effect, the dominant gene will manifest. for instance, if 2 contrasting colours - yellow and green are crossed, all the  $F_1$ offsprings will be yellow.