



F1 Generation: Rr (pink flower)

F2 Generation: 1 red (RR): 2 pink (Rr): 1 white (rr)

F= refers to Filial

### **Incomplete dominance in *Mirabilis Jalapa***

#### **2. Codominance:**

In case of co dominance both alleles express their phenotypes in heterozygote. The example is AB blood group in human. The people who have blood type AB are heterozygous exhibiting phenotypes for both the IA and IB alleles. In other words, heterozygotes for co- dominant alleles are phenotypically similar to both parental types. The main difference between co -dominance and incomplete dominance lies in the way in which genes act. In case of co- dominance, both alleles are active, while in case of incomplete dominance only one allele (dominant) is active.

#### **3. Multiple alleles:**

Mendel always observed two allelic forms of a gene. Now cases are known where a gene has more than two allelic forms, although only two can exist in a diploid cell at a time. Existence of more than two alleles for a gene is called multiple alleles. Examples of multiple alleles are ABO blood group alleles in human, coat colour in rabbit and self incompatibility alleles in tobacco.

#### **4. Linkage:**

Mendel always observed independent assortment of genes. Later on cases of linkage were reported by Bateson and Punnett in 1906 in pea, Hutchinson in maize and Morgan (1910) in *Drosophila*. In a dihybrid test cross, they observed higher frequencies of parental types than recombinants instead of 1:1:1:1 ratio. This led to modification of the concept of independent assortment.

#### **5. Lethal genes:**

Genes which cause death of its carrier when in homozygous condition is called lethal gene. Mendel's findings were based on equal survival of all genotypes. In the presence of lethal genes, the normal segregation ratio of 3:1 is modified into 2:1 ratio. Lethal genes have been reported in both animals as well as plants. In mice, allele for yellow coat colour is dominant over grey. When a cross is made between yellow and grey, a ratio of 1:1 for yellow and grey mice was observed. This indicated that a yellow mouse is always heterozygous, because yellow homozygotes are never born because of homozygous lethality. Such genes were not observed by Mendel. He always got 3:1 ratio in F2 for single gene character.

## **6. Gene interactions:**

When the expression of an allele of one gene pair depends on the presence of a specific allele of another pair, it is known as gene interaction. Mendel always observed 9:3:3:1 ratio in F<sub>2</sub> from a dihybrid cross. Later on many deviations of this phenotypic ratio was observed in dihybrid crosses. The modified ratios include 9:7, 9:3:4, 12:3:1, 13:3, 15:1 and 9:6:1 in different crop plants.

## **7. Pleiotropic gene effects:**

Mendel observed that one gene controls the expression of only one character. Later, cases were observed in which one gene was found to govern the expression of two or more characters. Examples is white eye allele in drosophila. This allele affects eye colour, shape of spermathica, fecundity and testicular membrane.

## **8. Polygenes:**

Mendel always observed that each character is governed by a single gene. Later on Nilsson Ehle observed that some characters are controlled by several genes and each of such gene has additive effect in the expression of character. This concept led to the foundation of polygenic inheritance. East (1916) demonstrated that polygenic characters were perfectly in agreement with mendelian segregation and later on Fisher and Wright provided a mathematical basis for the genetic interpretation of polygenic characters.

## **9. Environmental effects:**














Genes can interact not only with other genes but also with the environment to produce the final phenotype. Thus, phenotype is the result of the interaction between genotype and environment. It leads directly to the concepts of penetrance and expressivity. The importance of environment was first realised by johannsen. He coined the terms genotype and phenotype.

### 10. Maternal effects:

Mendel did not observe any difference between direct and reciprocal crosses. Later investigations revealed the presence of significant difference in the reciprocal crosses, which led to the concept of cytoplasmic inheritance.

All organisms have multiple inheritable traits controlled by genes.

Each trait is inherited independently of the others. A pea plant may, for example, have yellow seeds (dominant) but white flowers (recessive).

Trait	Dominant form	Recessive form
Seed shape	smooth 	wrinkled 
Seed color	yellow 	green 
Pod shape	inflated 	constricted 
Pod color	green 	yellow 
Flower color	purple 	white 
Flower location	at leaf junctions 	at tips of branches 
Plant size	tall (1.8 to 2 meters) 	dwarf (0.2 to 0.4 meters) 