PRINCIPLES OF INHERITANCE AND VARIATION INHERITANCE OF ONE GENE

INHERITANCE OF ONE GENE:

MONOHYBRID CROSS

When we consider the inheritance of one character at a time by a cross is called monohybrid cross.

First of all, Mendel selected tall and dwarf plants



Conclusions (results) of Monohybrid Cross

Ist Conclusion :

According to Mendel each genetic character is controlled by a pair of unit factor. It is known as conclusion of paired factor or unit factor.

IInd Conclusion :

This conclusion is based on F_1 - generation. When two different unit factors are present in single individual, then only one unit factor is able to express itself and known as dominant unit factor. Another unit factor fails to express is the recessive factor. In the presence of dominant unit factor recessive unit factor can not express and it is known as conclusion of dominance.



IIIrd Conclusion :

During gamete formation; the unit factors of a pair segregate randomly and transfer inside different gamete. Each gamete receives only one factor of a pair; so gametes are pure for a particular trait. It is known as conclusion of purity of gametes or segregation.



INHERITANCE OF ONE GENE:

DIHYBRID CROSS

A cross in which study of inheritance of two pairs of contrasting traits or two characters. Mendel wanted to observe the effect of one character on another character.

Mendel selected traits for dihybrid cross for his experiment as follows :

- Colour of cotyledons Yellow (Y) & Green (y)
- Seed form Round (R) and Wrinkled (r)

yellow and round characters are dominant and green and wrinkled are recesive characters. Mendel crossed yellow and round seeded plants with green and wrinkled seeded plants. All the plants in F₁-generation had yellow and round seeds.

All the plants in F_1 -generation had yellow and round seeds.

CLASS XII

When F_1 plants were self pollinated to produce four kinds of plants in F_2 generation such as yellow round, yellow-wrinkled, green round and green wrinkled, there were in the ratio of 9 : 3 : 3 : 1. This ratio is known as Dihybrid ratio.



Expression of yellow round (9) and green wrinkled (1) traits shows as their parental combination. Green round and yellow wrinkled type of plants are produced by the results of new combination (Recombinant).

CONCLUSION :

The F_2 generation plant produce two new phenotypes, so inheritance of seed coat colour is independent from the inheritance of shape of seed. Otherwise It can not possible to obtain yellow wrinkled and green round type of seeds.

This observation leads to the Mendel's conclusion that different type of characters present in plants assorted independently during inheritace.

This is known as **Conclusion of Independent Assortment**. It is based on F_2 - generation of dihybrid cross. The nonhomologous chromosome show random distribution during anaphasei-I of meiosis.

Explaination :

A pure yellow and round seeded plant crossed with green and wrinkled seeded plant which are having genotype YYRR and yyrr to produced F_1 generation having YyRr genotype.

CLASS XII

Both the characters recombine independently from each other during gamete formation in F_1 generation. Factor (R) of pair factor (r) is having equal change to (Y) factor or (y) factor of gametes during recombination to form two type of gametes (YR) and (yr).

Similarly (r) factor also having equal change with (Y) factor or (y) factor of gametes to form a two type gamets (Yr) and (yr).

Thus, total four types of gametes - (YR), (yr), (yR), (yr) are formed.

Therefore during the gametes formation in F_1 generation new combination or recombination appear in F_2 .

Demonstration by checker board method



$F_2 \text{-} \text{Generation} \rightarrow$

	YR	Yr	уR	yr
YR	YYRR	YYRr	YyRR	YyRr
Yr	YYRr	YYrr	YyRr	Yyrr
уR	YyRR	YyRr	yyRR	yyRr
yr	YyRr	Yyrr	yyRr	yyrr

Yellow Round = 9 / 16

Yellow Wrinkled = 3 / 16

CLASS XII

Green Round = 3 / 16

Green Wrinkled = 1 / 16

Phenotypic Ratio = 9 : 3 : 3 : 1

Phenotype		Genoty	ре		
Homozygous yellow & Homozygous Round	_	YY RR	=	1	
Homozygous yellow & Heterozygous Round	—	YY Rr	=	2	
Heterozygous yellow & Homozygous Round	—	Yy RR	=	2	
Heterozygous yellow & Heterozygous Round	—	Yy Rr	=	4	
Homozygous yellow & Homozygous wrinkled	—	YY rr	=	1	
Heterozygous yellow & Homozygous wrinkled		—	Yy rr	=	2
Homozygous green & Homozygous Round	—	yy RR	=	1	
Homozygous green & Heterozygous Round	—	yy Rr	=	2	
Homozygous green & Homozygous wrinkled	—	yy rr	=	1	
F ₂ Genotypic Ratio = 1:2:2:4:1:2:1:2:1		_			