Mendel's Law of Inheritance

Introduction -

Gregor Johann Mendel (1822 - 1884) was appropriately called "father of Genetics" with his experiment he explained that characters are inherited. He was a monk at Brunn (Austria). Mendel worked his experiment on pea plant (Pisum sativum) in 1856 & published his result in Natural History of Brunn in 1865 he formulated a law called Mendel's law. Although Mendel published his result in 1865 but it was not recognised in 1900 when the mendel experiment was redisco-ed by in 1900 by three scientist Hugo De Vries, Carl Correns & Tschermak of three different countries.

Why Mendel Selected Pea Plant for his experiment

Mendel selected pea plant for his experiment due to following characters.

i) Well defined characters
ii) Bisexual & annual flowers.
iii) Predominantly self fertilization.
iv) Easy to cross two plants
v) Can grown in short span of time.

Characters Considered by Mendel :-

Mendel selected 7- pairs of constrasting characters for his experiment

1. Length of plant - i) Tall & dwarf of Plant
2. Colour of flower - ii) Plant having white & coloured flower
   Position of flower - iii) Plant having axillary & terminal flower
3. Colour of Pods - iv) Plant having green & yellow Pods.
   Shape of Pods - v) Plant having round & wrinkled Pods
4. Shape of Seed - vi) Plant having round & wrinkled Seed
   Colour of cotyledons - vii) Plant having yellow & green cotyledon.

Confined - limited

these constracting characters are called Allel.
The plants having these constracting characters are known as Allelomorph.

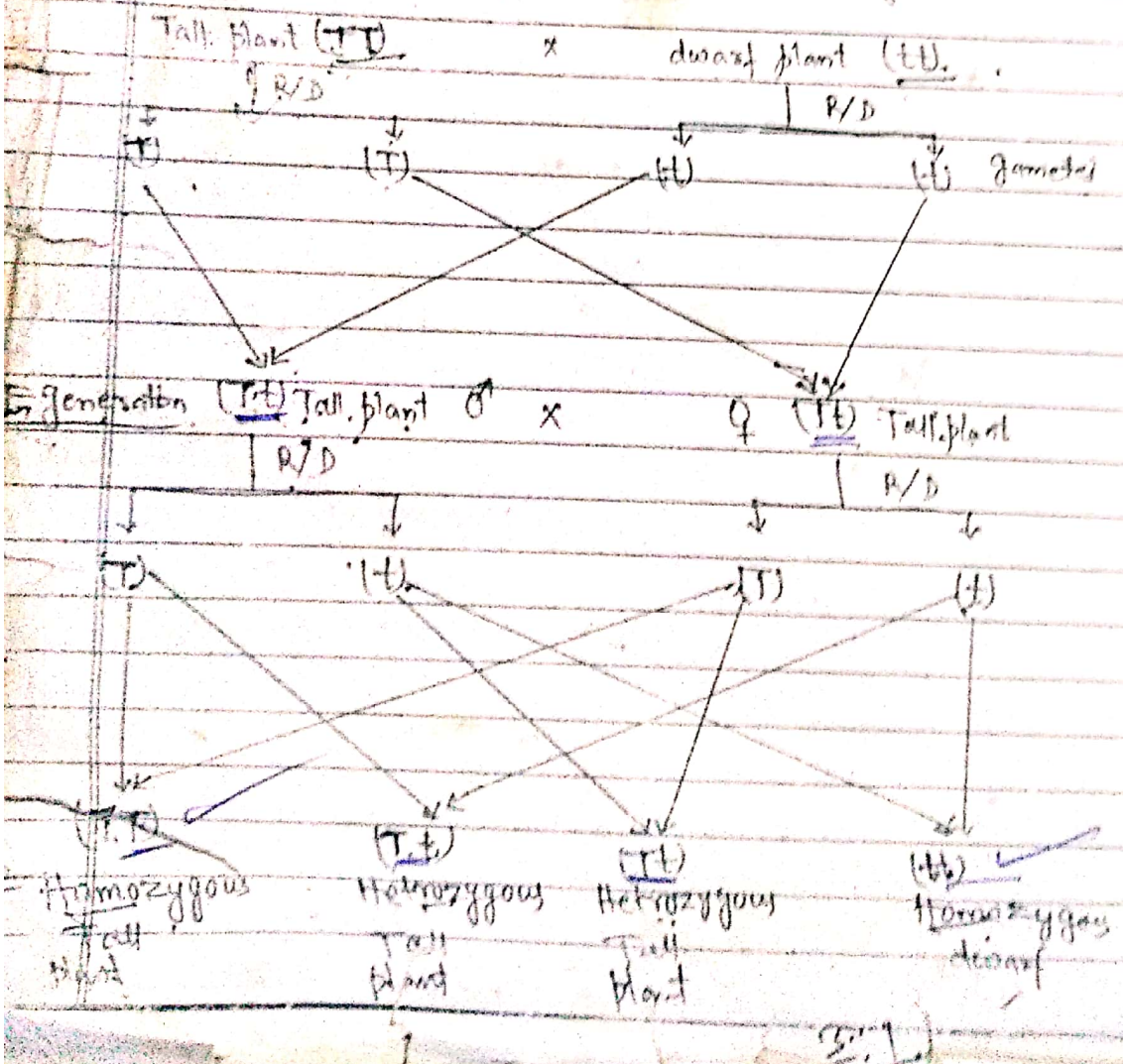
Mendel confined his attention to a single character at a time. When the behaviour of single pair of constracting characters were studied. then he confined his attention on two pairs of constracting characters.

On the basis of single pair & two pairs of constracting characters, Mendel formulated

(A) Monohybrid cross -
(B) Di hybrid cross -

(A) Monohybrid cross -

A cross between single pair of constracting character of two different plant is known as Monohybrid cross.



...ed with either
...cross.

...t cross is not

Mendel forms

one character
...-generation
doesn't not appear
...nown as

F_2-generation

...ected of two

Tall plant red flower (TTRR) × Dwarf plant white flower (ttrr)

Gametes (TR) (TR) (tr) (tr) Gametes

F_1-gen (TtRr) Tall plant red flower

Gametes (TR) (Tr) (tR) (tr) Gametes

Checker's Board :

♀ \ ♂	TR	Tr	tR	tr
TR	TTRR	TTRr	TtRR	TtRr
Tr	TTRr	TTrr	TtRr	Ttrr
tR	TtRR	TtRr	ttRR	ttRr
tr	TtRr	Ttrr	ttRr	ttrr

1. Tall plant with red flower (TTRR, TtRR, TtRr) = 9
2. Tall plant with white flower (TTrr, Ttrr) = 3
3. Dwarf plant with red flower (ttRR, ttRr) = 3
4. Dwarf plant with white flower (ttrr) = 1

Phenotypic ratio = 9 : 3 : 3 : 1

or $\frac{9}{16} : \frac{3}{16} : \frac{3}{16} : \frac{1}{16}$

Genotypic ratio = 1 : 2 : 2 : 4 : 1 : 2 : 1 : 2 : 1

A tall plant with red plant is represented by (TTRR) & a dwarf plant with white flower is represented by (ttrr). The tall plant with red flower produces (TR), (TR) gametes & dwarf plant with white flower produces (tr) (tr) gametes after meiosis. After the cross (TR) & (tr) then in F_1- gen. tall plant with red flower (TtRr) is produced. When the product of F_1- generation (TtRr) male plant is crossed with similar plant (TtRr) female plant throug checker's board. Then in F_2- generation 16 plants of four different combinations are produced. The phenotypic & Genotypic ratio is given above.

On the basis of dihybrid cross Mendel formulated a law known as Law of independent assortment.

Law of independent assortment :-
The law states that characters are not mixed together rather they give arise to new combination.

25/7/11

Test cross of dihybrid ratio :-
The product of F_1 - generation (TtRr) is crossed with recessive parent (ttrr) is known as test cross of dihybrid ratio.

ttrr

F_1 - Gen (TtRr)

♂ / ♀	tr
TR	TtRr Tall plant with red flower
Tr	Ttrr Tall plant white flower
tR	ttRr dwarf plant with red flower
tr	ttrr dwarf plant white flower.

Phenotypic ratio – 1:1 — 1 : 1 : 1 : 1

Genotypic ratio – 1:1 — 1 : 1 : 1 : 1

Phenotypic & genotypic ratio = 1:2:1

i) A plant with red flowers is represented by (RR) symbol (RR) & other plant is represented by white other plant with white flower is represented by (rr)

ii) Both the plant produce garnetes (R) (R) & (r) (r).

iii) Both the garnetes (R) (r) were crossed then in F_1- generation pink flower (Rr) is produced.

iv) F_1 - plant have no red or white flowers.

v) Pink flower are produced due to interaction of two allel of red & white flowers.

vi) The effect is caused by incomplete dominance of allel for red colour. second allel of white colour over the allel of red colour.

vii) When the F_1- generation plant (Rr) & (Rr) produce garnetes (R), (r) & (R), (r).

viii) When these garnetes are crossed then in F_2- generation one red flower (RR), two pink flower (Rr) & one white flower (rr) are produced then the phenotypic & genotypic ratio is same. which is given above.

2. Co- dominance :-

When the two genes of allelomorphic pairs expressed the self equally in F_1- Generation is called co-dominance. & th allel of a pair which are able to express themself indep dently but present together is called co-dominant allel eg:- co-dominance of coat-colour in cattle.

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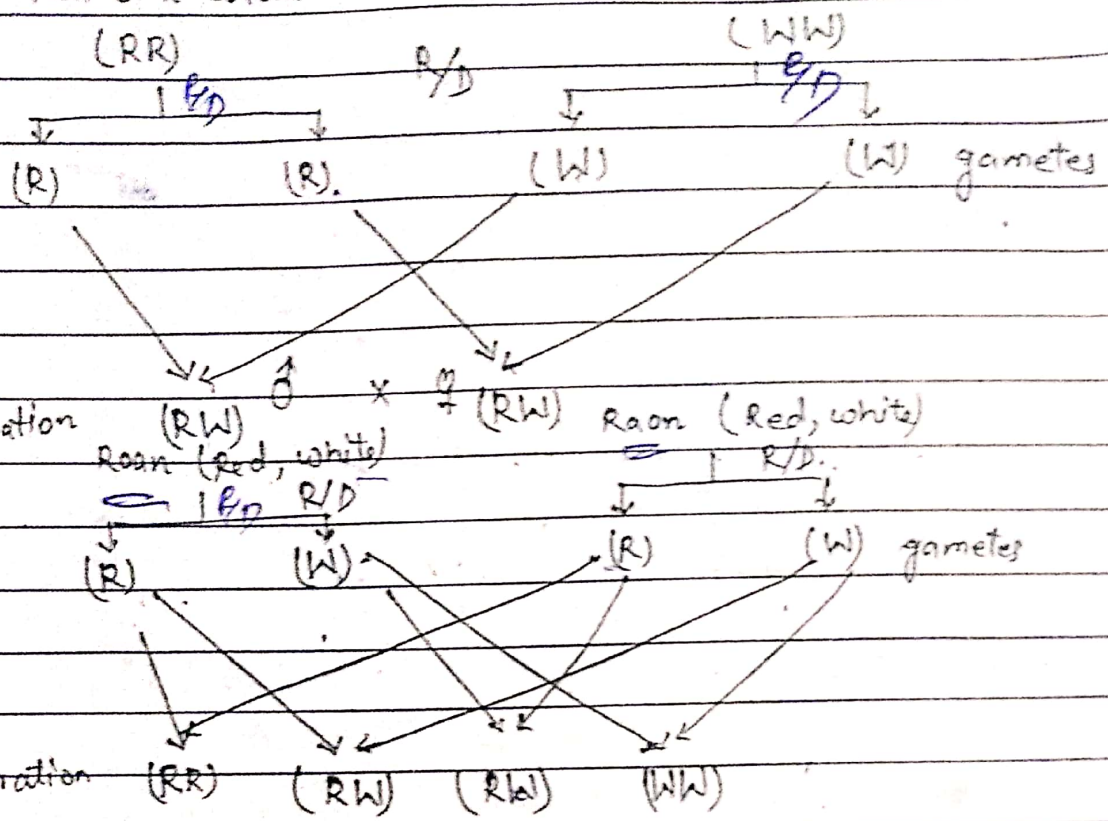
Parents- Red coat colour × white coat colour



Phenotypic & Genotypic ratio = 1:2:1

i) A red coat colour of cattle is represented by (RR) & white coat colour cattle is represented by (WW) symbol.

ii) Both coat colour cattle (RR), (WW) produce (R), (R) & (W), (W) gametes

iii) If these gametes (R), (R) & (W), (W) are crossed with each other then in F_1- generation (RW), (RW) roan cattle is produced.

iv) If the product of F_1- generation Roan ~~colour~~ (RW) is selfing after meiosis then in F_2-generation one red coat colour (RR), two Roan (RW) & one white coat colour (WW) cattle are produce

The alled gene ~~develop~~ ~~si~~ expressed their characte side by side & the phenotypic & genotypic ratio is given above.