

Linkage

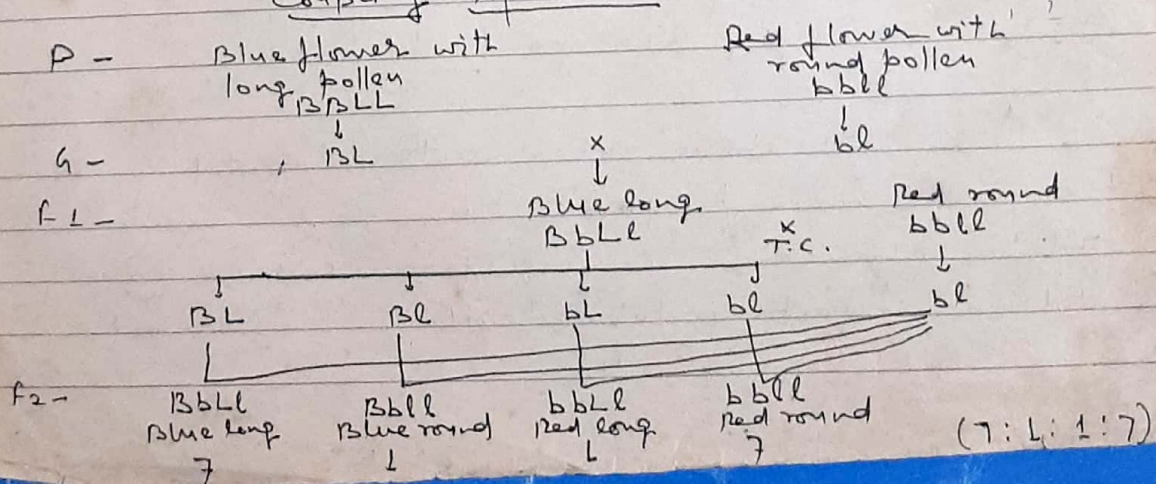
Linkage is the exception of Mendel's Law of Independent Assortment. This exception was for the first time discovered by Bateson and Punnett (1906) in sweet pea where two pairs of alleles did not assort independently. They explained it on the basis of Coupling and Repulsion Hypothesis.

Coupling :- Two genes or characters coming from the same parent as they present in the same chromosome, tend to enter the same gamete and want to live together generation to generation. This is known as coupling.

Repulsion :- Two genes or characters coming from the two parents as they present in two chromosomes, tend to enter the different gametes and want to live separately generation to generation. This is known as repulsion.

Morgan (1910) worked in Drosophila and gave the term Linkage. According to him, characters or genes inherited in a group is known as Linkage. The genes present in the same chromosome would not assort independently. These genes are known as linked genes. According to him, coupling and repulsion are two aspects of a single phenomenon - the linkage.

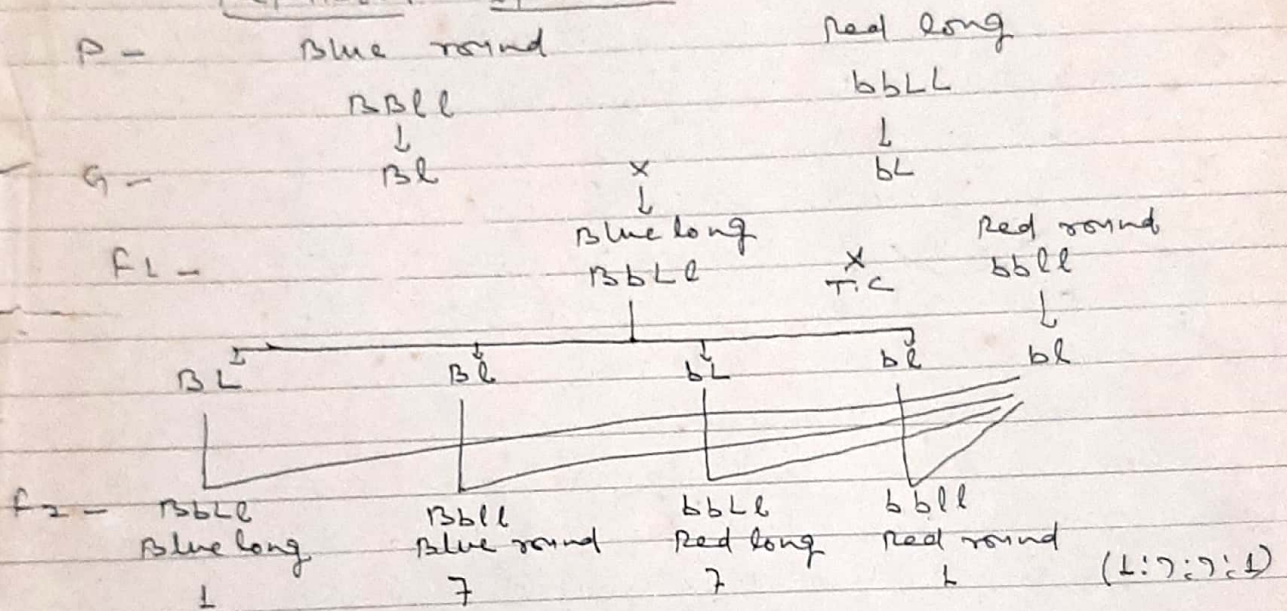
Coupling experiment :-



F₂ - Parental combinations -
 (1) Blue long — 7
 (2) Red round — 7 } 7:7
 14

Recombinations -
 (1) Blue round — 1
 (2) Red long — 1 } 1:1
 2

Repulsion experiment:-



F₂ - Parental combinations -
 (1) Blue round - 7
 (2) Red long - 7 } 7:7
 14

Recombinations -
 (1) Blue long - 1
 (2) Red round - 1 } 1:1
 2

In both above experiments, parental combinations are more frequent than recombinants because the two characters coming from the same parent did not assort independently in F₂ generation.

Linkage in Drosophila :-

Morgan (1910) worked in Drosophila and find similar result. In Drosophila gray body is dominant over black body and normal wing is dominant over vestigial wing.

P - Gray normal \times Black vestigial
F₁ - Gray normal \times Black vestigial

↓
T.C.

f ₂ -T.C.	Gray Normal	Gray vestigial	Black Normal	Black vestigial
% -	41.5%	8.5%	8.5%	41.5%
Number -	506	106	111	465

f₂ - Parental combinations -

(1) Gray Normal — 41.5%

(2) Black vestigial — 41.5%

83%

Recombinations -

(1) Gray vestigial — 8.5%

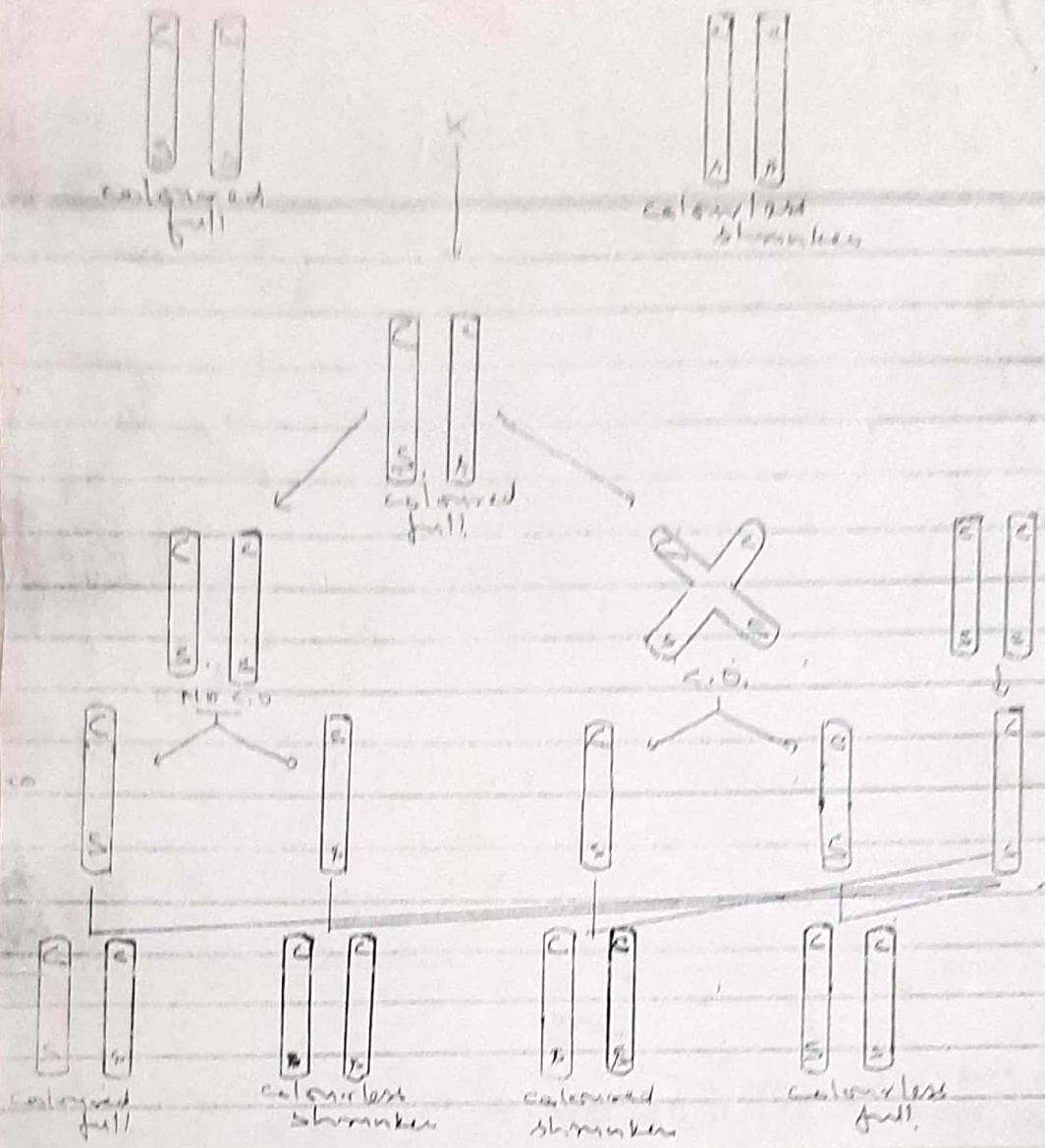
(2) Black Normal — 8.5%

17%

This cross also shows the more frequency of parental combinations than recombinants.

Linkage in Maize :-

Hutchinson studied the linkage in maize while using the two characters or genes located in the same chromosome is to calculate the recombination frequencies. He selected two varieties of maize coloured seed with full endosperm and colourless seed with shrunken endosperm. The cross method is given below:-



Parental Combinations and Recombinations	Genotype	No. of seeds
1. Coloured full	CcSs	4032
2. Coloured shrunken	Cc ss	149
3. Colourless full	ccSs	152
4. Colourless shrunken	cc ss	4035

F2 - Parental combinations -

- (1) Coloured full - 4032
 - (2) Colourless shrunken - 4035
- 8067 = 96.7%

Recombinations -

- (1) Coloured shrunken - 149
 - (2) Colourless full - 152
- 301 = 3.9%