

Quadrant II – Transcript and Related Materials

Programme: Bachelor of Science (Third Year)

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Paper Code: BOC 108

Paper Title: Cytogenetics and plant breeding

Unit: VII

Module Name: Detection of mutation: CIB method

Module No: 37

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Notes

Definition of Mutation

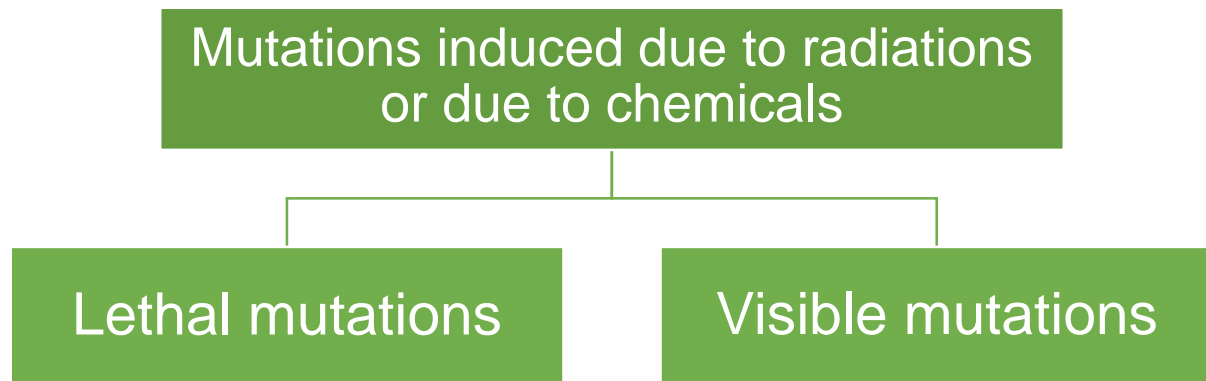
Mutation refers to sudden heritable change in the phenotype of an individual.

In the molecular term, mutation is defined as the permanent and relatively rare change in the number or sequence of nucleotides.

Detection of Mutation

- Morphological mutations - By change in the phenotype of an individual or by change in the segregation ratio in a cross between normal (with marker) and irradiated individuals
- Molecular mutations - By a change in the nucleotide.
- Biochemical mutation - By alteration in a biochemical reaction.

Detection of Mutations in Drosophila



- They could be located either on sex chromosomes or on autosomes.
- Different methods for detection of sex linked lethals, sex linked visible and autosomal mutations are available.
- The methods of detection of morphological mutants have been developed mainly with *Drosophila*.

(1) ClB method.

(2) Muller's 5 method.

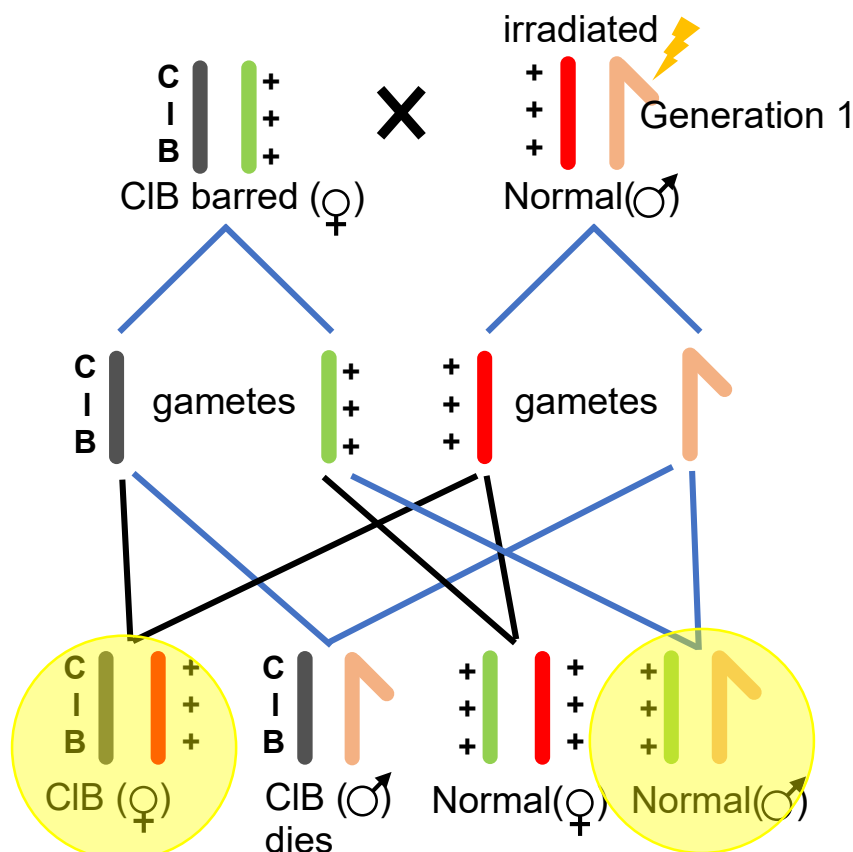
(3) Attached X-chromosome method.

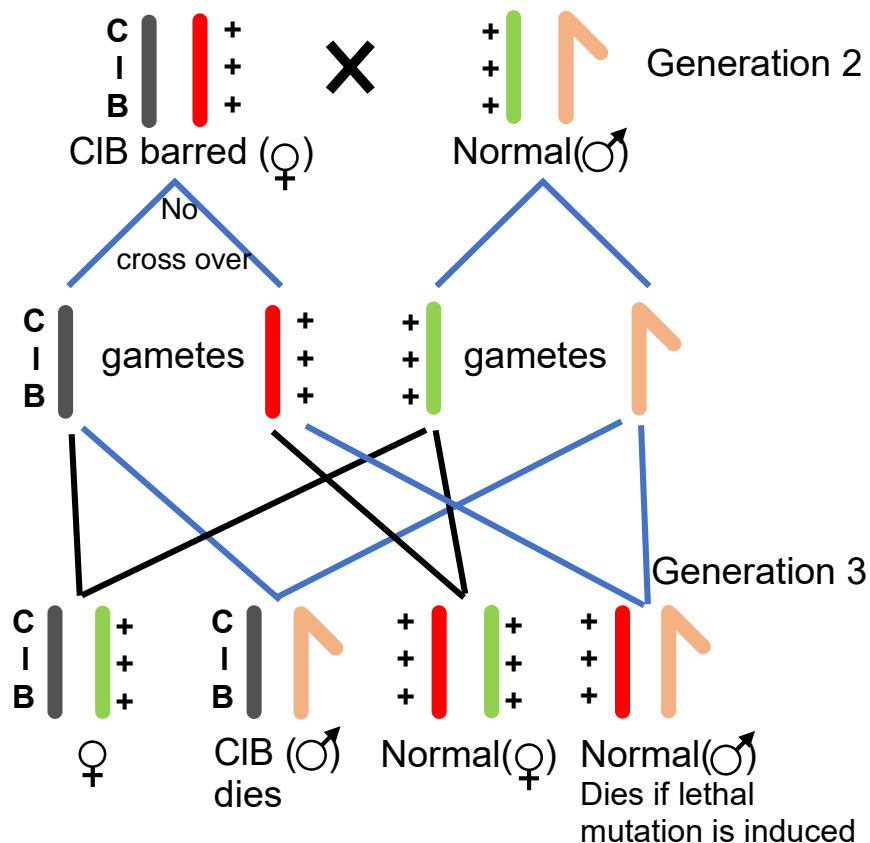
(4) Curly lobe plum method

ClB Method:

- ClB method was developed by H. J. Muller (1928) for detection of induced **sex linked recessive lethal mutations** in *Drosophila* male.
- Aim:- To study mutagenic action of X rays.
- In this method, females containing one normal X-chromosome and another X-chromosome (ClB) containing extra 3 genes are used for the analysis.
- Out of the 3 extra genes.

- One gene suppresses crossover (C).
- The Other is a recessive lethal (I) in heterozygous condition.
- The last gene is dominant marker, Bar (B) gene.
- Females containing CIB chromosome are called as **CIB stock drosophila**.
- **C** : no crossing over during gamete formation and represents a long inversion that prevent crossing over within the inverted segment . Gene **I** and **B** are located in this inverted segment
- **I** : stands for a recessive lethal mutant present on X chromosome. female drosophila is homozygous for this gene i.e. I/I and male hemizygous (I/Y) are nonviable
- **B**: designate a sex linked dominant mutation producing Barred shaped eye (narrow eye) used as a dominant marker





Muller's Experiment

- A cross is made between CIB female & mutagen treated male.
- In F1, half of the males having normal X-chromosome will survive & those carrying CIB chromosome will die due to lethal allele in hemizygous condition.
- Among the females, half have CIB chromosome and half have normal chromosome.
- Therefore in F1 generation all females will survive (100%) but 50% of male will survive and 50% will die.
- From F1, females with CIB chromosome and male with normal chromosome are selected for further crossing.

- Now a cross is made between CIB-barred eye female and normal male.
- This time the CIB female has one CIB chromosome and one mutagen treated chromosome received from the male in earlier cross
- This will produce two types of females. i.e. half with CIB chromosome and half with mutagen treated chromosome (with normal phenotype).
- Both the progeny will survive.
- In case of males, half with CIB will die and other half have mutagen treated chromosome.
- If a lethal mutation was induced in mutagen treated X-chromosome, the remaining half males will also die, resulting in absence of male progeny in the cross.
- Absence of male progeny in F2 confirms the induction of sex linked recessive lethal mutation in the mutagen treated *Drosophila* male.
- So in F2 generation male will die if X-ray Mutation is induced.
- Suppose if no X-ray Mutation was induced then 50% of male would have been survived and 50% of male would die.
- The end result depends on survival of male progeny i.e. No X-ray mutation is induced and vice versa.
- Muller made a cross between heterozygous CIB female stock and irradiated wild type male to detect the lethal that would have been induced by x-ray in x- chromosome of irradiated male

