DRAWINGS TO EXPLAIN THE CROSSING

DIHYBRID CROSS

For the dihybrid cross two pairs of contrasting characters are taken into consideration at a time. Mendel selected a tall plt with red flowers – TRTR and a dwarf one with white flowers trtr, their respective gametes being TR and tr. Four unit xters are, therefore, concerned in the dihybrid ratio. Factors for tallness or dwarfness and for red flowers or white flowers are independently inherited. Artificial crossing was brought about between these 2 plts. In F1 generation all individuals were tall with red flowers – TRtr because tallness is dominant over dwarfness, and coloured flowers dominant over white, subsequently their gametes baring factors TR (tall – red), Tr (tall-white), tR (dwardf red) and tr (dwarf white).

When the seeds from the F1 generation were grown, a segregation. A cross, in with the parents are different from end other 2 characters is called a dihybrid cross. Of xters showing all possible combinations took place in the following properties. 9 red talls, 3 white talls, 3 red dwarfs, and 1 white dwarf. This 9:3:3:1 is the DYHYBRID RATIO. i.e MENDEL'S DIHYBRID RATIO.

Drawing

F2 generation

Male gametes of F1

	TR	Tr	tR	tr
TR	TRTR Tall-red (1)	TRTr Tall-red (2)	TRtR Tall-red (3)	TRtr Tall-red (4)
	TRTr Tall-red (5)	TrTr Tall-white (6)	TrtR Tall-red (7)	Trtr tall white (8)
	TRtR tall-red (9)	TrtR Tall-red (10)	tRtR dwarf-red (11)	tRtr dwarf-red (12)
	TRtr tall-red (13)	Trtr tall-white (14)	tRtr dwarf-red (15)	Trtr dwarf-white (16)

9:     3:   3:   1

The dishybrid F2 generation diagram shows that nos 1, 2, 3, 4, 5, 7, 9, 10, 13 are tall-red

= 9

Nos. 6, 8, 14 .... are tall-white = 3

Nos. 11, 12, 15 .... are dwarf-red = 3

No. 16 .... is dwarf-white = 1

It will further be noticed that nos. 1, 6, 11 and 16 are homozygous (i.e. they have two similar gametes), breeding true; while the rest are heterozygous (i.e. they have two dissimilar gametes), segregating in the next generation.

The homozygotes plants are:

No. 1 (TRTR) will breed true for tall-red

No. 6 (TrTr) will breed true tall-white

No 11 (tRtR) will breed true dwarf-red

No 16 (trtr) will breed true dwarf-white

Mendel found out that the dihybrid ratio obeyed the law of probability which states that "the chance of 2 or more independent events occurring together is the product of the chances of their separate occurrences".

E.g Height (tallness or dwarfness) 3:1 (4) = 16

Colour (red or white) 3:1 (4)

Polyhybrid cross – This could be obtained by considering more than two contrasting xters e.g. three contrasting xters could be taken.

For example, tall and dwarf, red flower and white, and smooth seed and wrinkled.

MENDEL'S LAWS OF INHERITANCE

From the results of his genetic studies on the garden pea, Mendel formulated certain laws to explain the inheritance of xters. These laws are two:

I.   Mendel's first law is known as the LAW OF SEGREGATION and states that xters are controlled by pairs of genes of which only one can be represented in a single gamete.

           For example, a plant which had a factor or (gene) for round shaped seed and also an allele for wrinkled shaped seed would transmit only one of these two alleles through a gamete to its offspring.

           Drawing

           Only one gametic type would be obtained from the segregated homozygote. But under heterozygous condition, segregation would yield 2 gametic types.

Mendel's first law of inheritance is also known as the LAW OF PURITY OF GAMETES.

Mendel known nothing of chromosomes or meiosis, as they had not yet been discovered during his time. We now know that the physical basis for this his 1st law is in first meiotic anaphase where homologous (similar) chromosomes segregate or separate from each other. If the gene for round seed is on one chromosome and its allelic form for wrinkled seed is on the homologous chromosome, then it becomes clear that alleles normally will not be found in the same gamete.

II.   Mendel's second law, the LAW OF INDEPENDENT ASSORTMENT is based on Mendel'd results of his dihybrid crossings. The law states that the segregation or separation of one gene pair occurs independently of any other gene pair. Or in other words one of a pair of contrasted xters may be combined with either of another pair.

If two pairs of genes are located on different, non-homologous chromosomes, they can be inherited independently. For example, on one homologous (similar) pair of chromosomes are the seed shape alleles and on another pair of homologous are the alleles for green yellow seed colour. The segregation of the seed shape alleles occurs independently of the segregation of the seed colour alleles because each pair of homologues behaves as an independent mit during meiosis (reduction division of cell).

Drawings

Formula for finding gametic types is:

$$2^n$$

where n represents the no. of pairs of xters

e.g. when n = 2; no. of gametic types will be $2^2 = 4$

when n = 3 ; no. of gametic types will be $2^3 = 8$

If n = 4, no of gametic types will be $2^4 = 16$

Gamete*

An understanding of reduction division (meiosis) r halving of chromosome no in the formation of the gametes and the knowledge that the genes carried on the chromosomes are the factors responsible for the transmission of inherited xtics, make Mendel's conclusions easier to follow. Let us briefly review mitosis (somatic or body-cell division) and meiosis or reduction division. Reduction division takes places in all sexually reproducing organisms at some time in their life-cycle. To properly understand the mechanism of inheritance/laws of inheritance and the fundamental of breeding and tree mpt, a knowledge of the formation of man cells or process of cell division is necessary.

CELL DIVISION

Formation of New Cells

Cell is the smallest unit of life. All living things are composed of these (Ganiete – A sexual reproductive cell; (sex cells). Female gamete is an ovum or egg cell and a male gamete is sperm cell.) basic units, from the simple unit cellular structures of bacteria and protozoa to the complex structures of trees and man. Even within an individual all the cells do not look alike. A muscle cell is obviously different from a nerve cell which in turn is different a blood cell, etc. Thus, there is no such thing as a typical cell type.

All multicellular organisms, plants or animals, no matter their size started their existence as a single cell. This initial cell grows to their (plants or animals) normal size and form. This growth is initiated by the formation of new cells and their enlargement.   Hence increase in size of any multicellular organism is due to division of the existing cells of the organism, and not the growth of the cells.

The three xtics of cells are:

1. Cells continue to exist until they are old.

2. Cells store food in form of protein.

3. All new cells are capable of performing the functions of the old cell.

Cell division goes through three main stages.

I.   Nuclear division (karyokinesis) which is the initial stage of cell division.

II.   Division of the cytoplasm which is known as cytokinesis and follows the division of the nucleus.

III.   The separation of the cell itself.

There are groups of methods of cell division.

1.   The direct division of cell, otherwise known as AMEITOSIS. This is the way unicellular organisms reproduce.

2.   The indirect method of cell division. There are two types

    (i)   Mitosis

    (ii)   Meiosis

An European botanist who worked during the 2nd ½ of the XIXC.

Polish botanist? Strasburge (1878), German Hiostologist V. Flemming (1882), Russian botanist Christiakov all contributed a lot to the study of the complex process of cell division. Their discoveries serve as the basis for further investigations in this area of scientific study.