MENDELIAN GENETICS IN CORN

CREATED BY:

Adel Ezz

Eman Sulaiman

Iman Abass

Layla Saber

Lidia Samir

Marwa Ala’a

Omar Tarek

Shrouq Adel

Yasmeen Tarek

TABLE OF CONTENTS

INTRODUCTION TO CORN

- The diploid number of chromosomes in corn is 20.
- Corn falls under kingdom Plantae and is a member of the grass family.

Scientific classification	
Kingdom:	Plantae
(unranked):	Angiosperms
(unranked):	Monocots
(unranked):	Commelinids
Order:	Poales
Family:	Poaceae
Subfamily:	Panicoideae
Tribe:	Andropogoneae
Genus:	*Zea*
Species:	*Z. mays*
Subspecies:	***Z. mays* subsp. *mays***

Trinomial name

Zea mays* subsp. *mays
L.

INTRODUCTION TO CORN

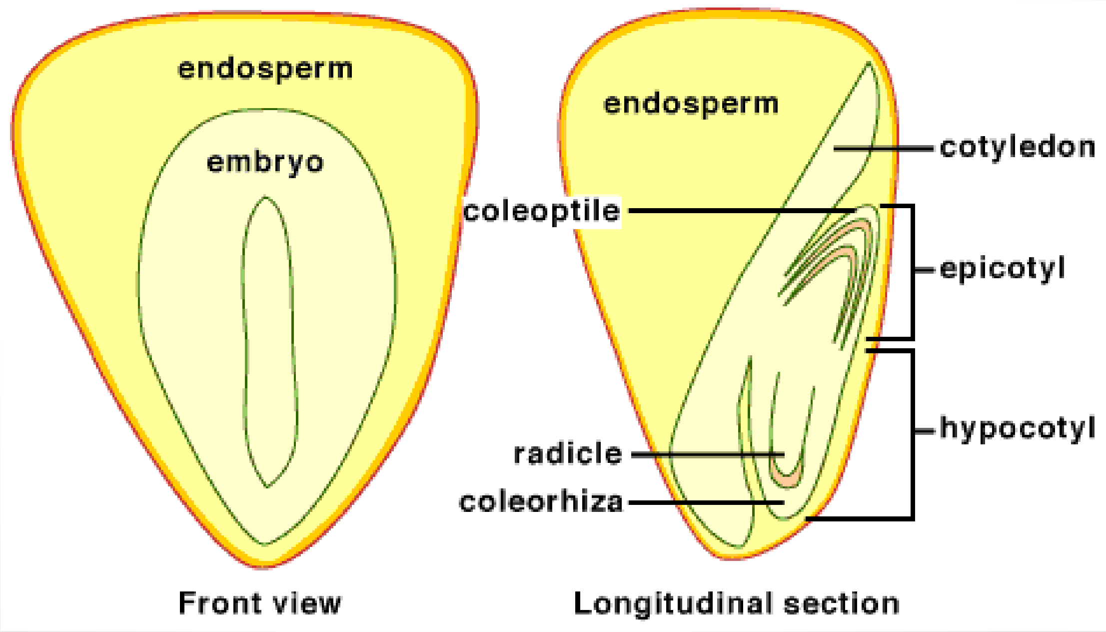
-Each flower produces an egg, which will develop into a seed (kernel).

-The male flowers are on the tassels, which bear anthers and produce pollen.

-An advantage of domestic corn is that the kernels remain attached to the cob, which makes them easy to observe and handle.

Corn kernels consist of several parts:

-The outer layer or shell is called the *pericarp*. The pericarp is not part of the embryo- it is “packaging” from the parent plant. Inside the pericarp is a layer of cells called the *aleurone*, which can be colored, and the *endosperm*, which is the bulk of the seed– the starchy part. Also inside is the embryo.



INTRODUCTION

- Corn cobs were provided for the experiment and each cob had more than one phenotype.
- Corn plants pollinate via wind, therefore, each kernel may be the product of a different cross. All kernels within a cob share the same female parent but could have many different male parents .
- aleurone layer in the corn can be all sorts of different colours due to the anthocyanin pigments that are contained within it

A BRIEF HISTORY OF CORN

The history of modern day maize begins about 10,000 years ago.

Ancient farmers in Mexico took the first steps in domesticating maize when they chose which seeds to plant.

The farmers noticed that not all plants were the same.

Some plants may have grown larger than others, or maybe some tasted better.

The farmers saved kernels from plants with desirable characteristics and planted them. This process is known as selective breeding or artificial selection.

Maize cobs became larger over time, with more rows of kernels, eventually taking on the form of modern maize.

Maize cobs uncovered by archaeologists show the evolution of maize over thousands of years of selective breeding.

EVOLUTION BEGINES WITH HERTITANCE OF GENE VARIANT

Why Corn?

- *Zea mays* is ideal for demonstrating Mendelian principles of inheritance.
- An advantage of domesticated corn is that the kernels (offspring) remain attached to the cob, which makes them easy to observe and handle.
- Each ear has hundreds of kernels , providing the statistical sample that is so important for demonstrating the principles of inheritance.

- There are a great number of inheritable characteristics that can be observed through corn such as: length, shape number of kernel rows, colour, resistance to pests, type and amount of starch produced, ect…

CORN GENETICS LAB

The trait you will investigate in this problem is kernel color. The two forms of kernel color we will look at are Blue and Yellow. Corn is a good organism for this type of analysis since each grain (kernel) represents an independent offspring.

Kernel color is controlled by a single pair of alleles.

The gene for Blue kernels is dominant.

CORN GENETICS LAB

There are two phenotypes in our corn– smooth and wrinkled– and they are controlled by the Su locus.

-The Su gene has two alleles- these are *Su* and *su*.

-Possible diploid genotypes are *SuSu, Susu*, and *susu*.

-Bad enough to write it, but try to say it and make any sense! Lets call *Su* starch and *su* sugar.

-These alleles control the amount of sugar in the endosperm.

-The dominant allele *Su* causes starchy endosperm (little sugar). Homozygous *susu* produces sugary endosperm (sweet corn) and causes the kernel to be wrinkled and somewhat translucent when it dries.

WHY DO CORN KERNELS HAVE DIFFERENT COLOURS?

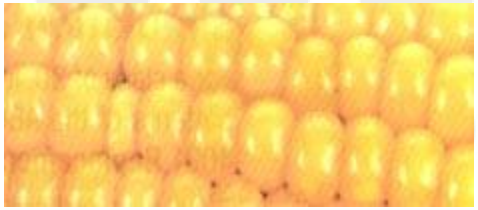
- The colour of a corn kernel is controlled by a large number of genes.
- Each kernel is an individual with its own set of genes.
- These genes determine the phenotype of three tissues: the pericarp, aleurone, and endosperm proper.
- In our corn, the pericarp is colourless, but the aleurone may be colourless, purple, red, and the endosperm yellow or white.

Endosperm characteristics

Normal corn endosperm is high in amylose starch. The gene *Su* in the homozygous recessive condition (*su/su*) produces endosperm that is high in sugar. As corn dries, its sugary endosperm loses water, and its kernels wrinkle.

- Purple starchy

Yellow starchy



Yellow sweet

- Purple yellow cross

Starchy sweet cross

Cross of R and SU alleles

WHY DO CORN KERNELS HAVE DIFFERENT COLOURS?

- **If the aleurone is colourless, the kernel colour will be that of the endosperm (yellow or white).**
- **Normal endosperm colour occurs when the allele *Y* causes the production of the carotenoid pigments in the endosperm.**
- **In the recessive condition *(y/y)* carotenoids are not produced and the endosperm is white.**

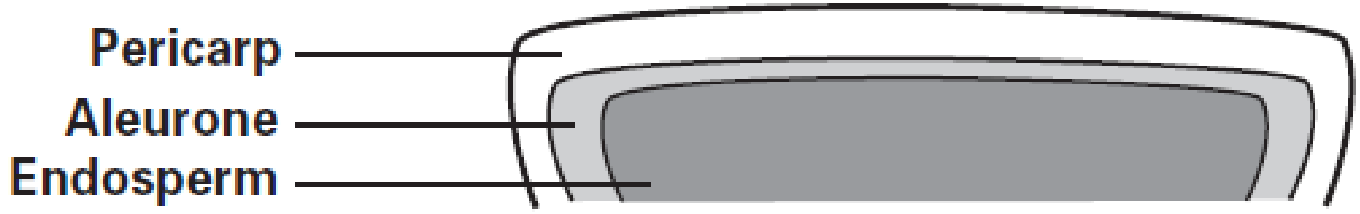


Figure 1: The layers of a corn kernel involved in producing color phenotypes.

For the aleurone to be colored, alleles C and R must be present.

The homozygous recessive of either allele (c/c or r/r) disrupts anthocyanin production and results in a colorless aleurone.

The dominant C allele also inhibits anthocyanin production, giving a colorless aleurone. Genes C and R are located on separate chromosomes and segregate independently.

•**The allele pr interacts with alleles C and R to produce a purple aleurone. The homozygous recessive condition (pr/pr) interacts with C and R to produce a red aleurone.**

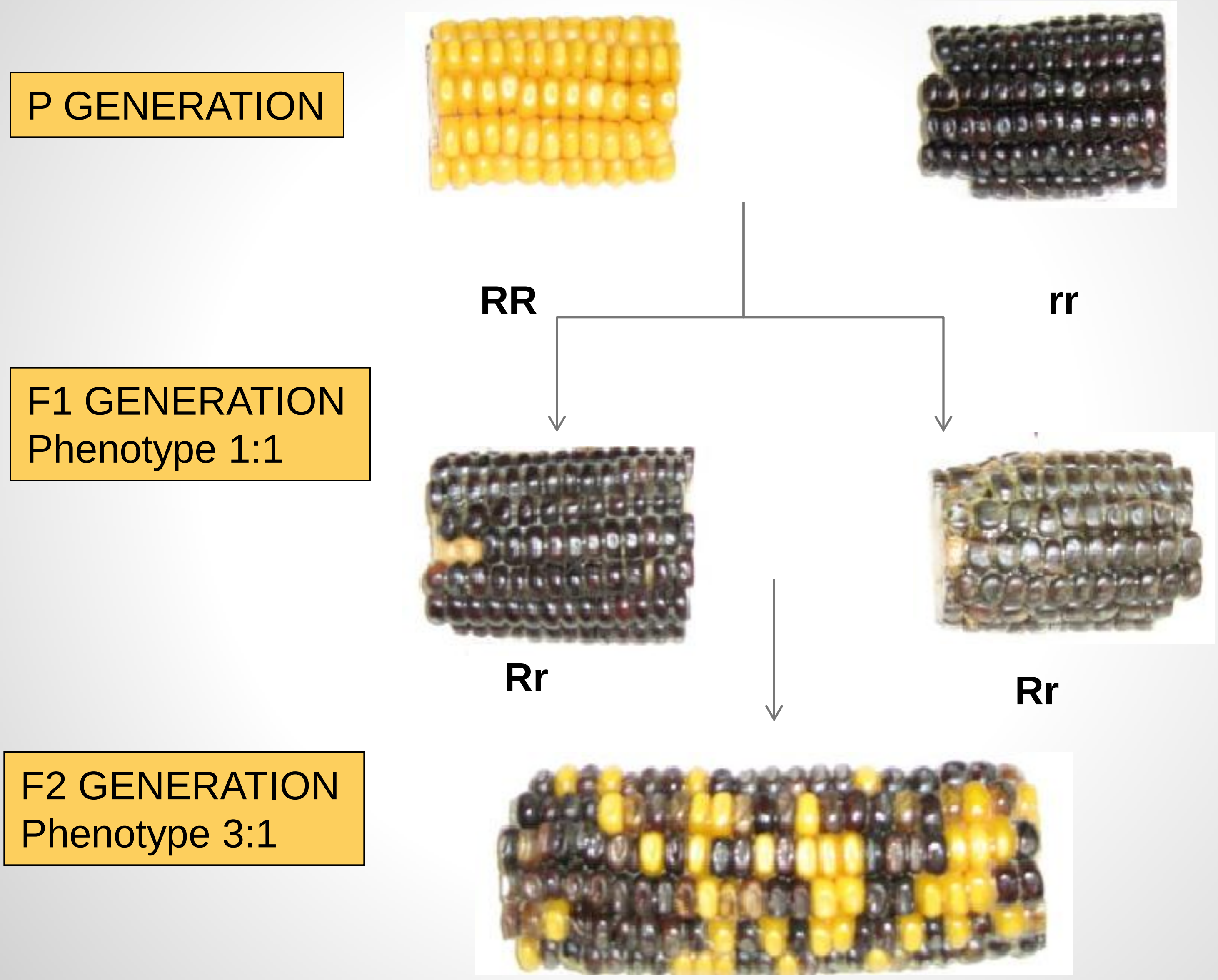
•**Pr, C, and R alleles**

MENDELIAN GENETICS

Mendel's first law (the principle of segregation), is where two alleles of a homologous pair segregate during the formation of gametes, via meiosis, and each gamete only receives one allele and the phenotype ratios are influenced by the dominance of one allele compared to another.

Mendel's second law is the principle of independent assortment where alleles of a pair of genes arrange themselves independently of the other gene pairs on heterozygous chromosomes

MONOHYBRID CROSS



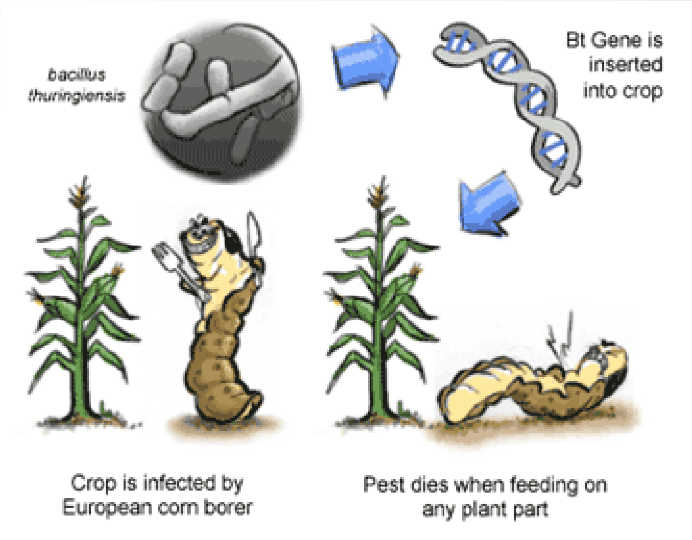
DIHYBRID CROSS

P GENERATION

F1 GENERATION
Phenotype 1:1

F2 GENERATION
Phenotype 9:3:3:1

PEST RESISTANCE CROPS



- Bt corn is GMO that contains one or more genes from the soil bacterium *Bacillus thuringiensis*, or Bt as is commonly used. The gene(s) allow the bacterium to produce one or more toxins that are toxic to certain insects,in particular, , European corn borer.
- Growers use Bt corn as an alternative to spraying insecticides for control of European and southwestern corn borer.

MEDICINAL USE

Corn silk is considered to have detoxifying, relaxing and diuretic properties.

Traditionally, Corn silk has been used in treatments of urinary and genital infections, stomach disorders, skin rashes and sore throat.

Nowadays it is believed to reduce the formation of kidney stones, and that it can be a helpful remedy against cystitis, painful and frequent urinations

THANK YOU FOR WATCHING

Supervised by:

Prof. Rehab M. Hafez