

## **Lab 1: Introduction to Plant Breeding**

### **Plant Breeding**

Plant breeding is the science and art to improve the genetic makeup of plants; particularly improving characters of cultivated varieties and hybrids. In order to develop new varieties with nutritional value and yield improvement, adaptation and meeting market demand.

Or “Plant breeding is the purposeful manipulation of qualities in plants to create new varieties with a set of desired characteristics”.

### **Successful plant Breeders depends on:**

1. Plant breeders scientifically considered as scientists and researchers hence, they should have all the qualities of being a successful researcher including:
  - i. Should be intelligent, curious and initiative
  - ii. Having basic knowledge of how doing research and experiments
  - iii. Should have patience to repeat and recreate work wisely
  - iv. Should be generous to share the advantages and disadvantage of the results of the work through publications, seminar and conferences by using skills in written and oral communications
  - v. Honesty showing the results otherwise dishonesty leads to disasters.
2. Ability to use their skills and scientific efficiency to recognize the more adapted plants and hybridization among the better varieties economically.
3. Must have information about the plant life cycle, flowers and pollinations.

4. Have information about all plant breeding methods as well as to study consumer need.
5. Breeders must have clear objectives.
6. Good breeders must use their experience and information about the plant which used in their experiment.
7. 6. Have information about basic sciences that correlated with plant breeding such as:

***Botany:*** is the science of plant life studies plant structure, properties, and biochemical processes; which involves plant classification, anatomy and all characters as reproduction method, flowering date of maturity correlated with environment.

***Genetics:*** as cytogenetic is the scientific study of genes and heredity. This is essential for plant breeding to study special character and behavior of chromosomes and heritability characters as well as uncovering qualitative and quantitative genetic information.

***Plant physiology:*** it is a subdiscipline of botany concerned with plant function especially plant ecology to study environmental requirements.

***Plant Pathology and Entomology:*** Method of plant breeding for disease and pest resistance for the accurate identification and diagnosis of plant disease and plant problems.

***Experimental design and Statistics:*** To analyze and explain the results, comparing between varieties and inbred lines.

***Principles of crop production:*** Methods of plant reproduction and its correlation with plant breeding.

It's important in plant breeding to know the genotype crops in the field to improve characters.

Therefore; the information about the reproduction method is necessary, to use suitable breeding method. As well as the information on flower

structure, the amount of pollen grain transfer, the degree of incompatibility, inbreeding and the rate of cross pollination.

**Usually, the genotype of plants depends on:**

1. Reproduction method
2. Nature of pollination

## **Reproductive System**

The external plant structures such as roots, stems, leaves and flowers are known as plant organs. Each organ is a group of tissues work together to perform a specific function. These structures can be used for reproduction.

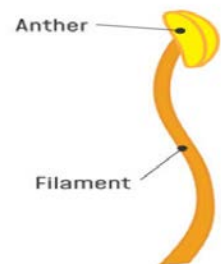
There are two main systems of reproduction in plants which are:

1. Sexual reproduction: done by flower which is the sexual reproductive part that produce seed.
2. Asexual reproduction: vegetative parts of the plant.

## **Sexual Reproduction**

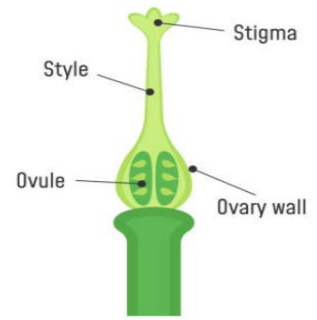
Sexual reproduction in plants completed by flowers which produce seeds. As a plant's reproductive part, a flower contains two main parts in addition to accessory parts each has its function:

1. The **stamen** is the male reproductive organ. It consists of
  - a. a pollen sac **anther** the site of pollen development.
  - b. long supporting **filament** that transmits water and nutrients to the anther and hold it in position to aid pollen dispersal.



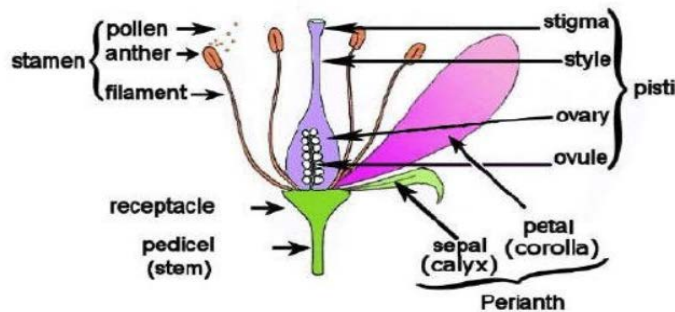
2. **Petals** is the female reproductive organ. It is shaped like a bowling pin and is located in the flower's center. It consists of
  - a. a **stigma** is a sticky knob at the top of the pistil and connected by the style to the ovary.

- b. The **style** is a long, tubelike structure and leads to the ovary.
- c. The ovary is the bottom of the female part contains egg cells called ovules. then after fertilization becomes zygote and develops into seed.



- 3. **Sepals** are small, green, leaflike structures located at the base of a flower. They protect the flower bud. Together, the sepals are called a **calyx**.
- 4. **Petals** generally are the highly colored portions of a flower. Like nectar glands, petals may contain perfume. The petals together are called a **corolla**. The number of petals on a flower often is used to help identify plant families and genera.

### Parts of a Flower

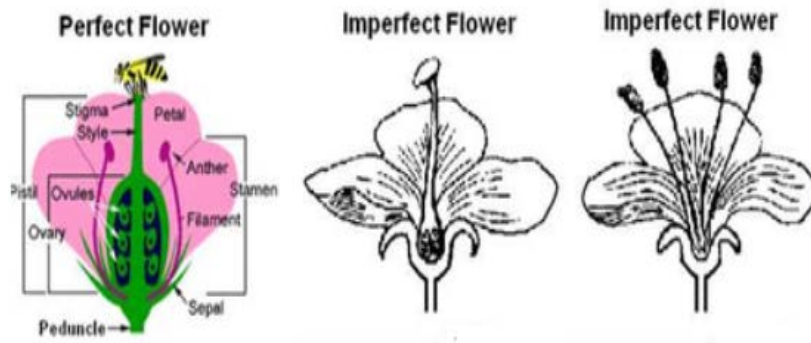


### Flowers

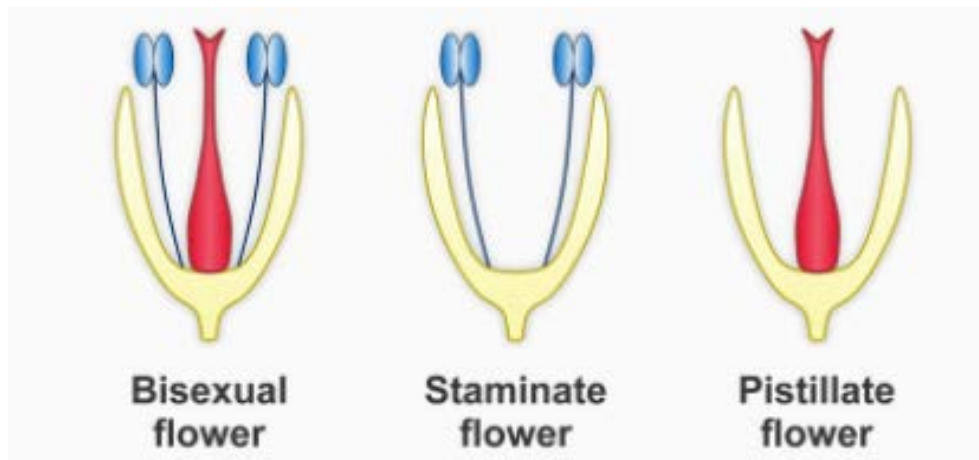
There are different types of flowers according to their sexuality:

- **Complete flower:** A flower having all four floral parts: sepals, petals, stamens, and carpels.

- **Incomplete flower:** A flower lacking one or more of the four parts found in a complete flower.
- **Perfect flower:** contain both male and female reproductive parts regardless to petals and sepals. If a perfect flower has petals and sepals, it is called a complete flower as well.
- **Imperfect flower:** it is also called unisexual flowers do not have male and female parts in the same flower.



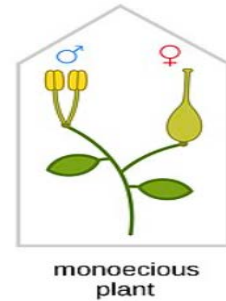
A "unisexual" flower is one in which either the stamens or the carpels are absent. Each flower is either "staminate" (having only functional stamens) and thus "male", or "carpellate" (or "pistillate") (having only functional carpels) and thus "female".



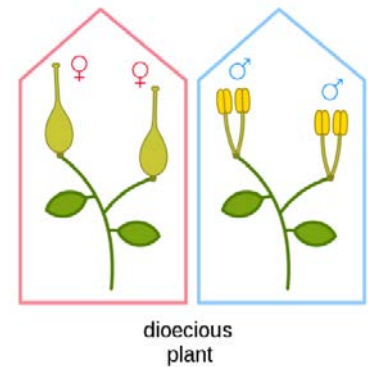
## Individual plants

Specific terms are used to describe the sexual expression of individual plants within a population.

1) **Monoecious plants** an individual that has both male flowers and female flowers in separate structures on the same plant.



2) **Dioecious plants** refer to a plant population having separate male and female plants. None of the individual plant of this population produce both microgametophytes (pollen) and megagametophytes (ovules); individual plants are either male or female.

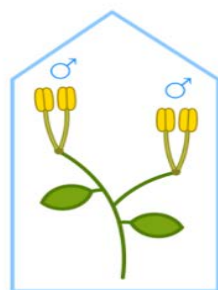


So, they are not called dioecious; they are either gynoecious (female plants) or androecious (male plants).

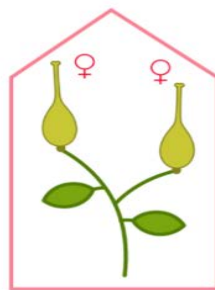
a) **Androecious** plants producing male flowers only, produce pollen but not seeds, the male plants of a dioecious population.

b) **Gynoecious** plants producing female flowers only, produces seeds but not pollen, the female of a dioecious population.

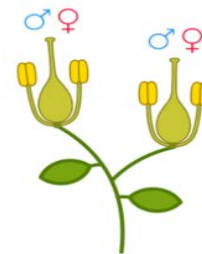
3) **Hermaphrodite** a plant that has only bisexual reproductive units.



**Androecious**

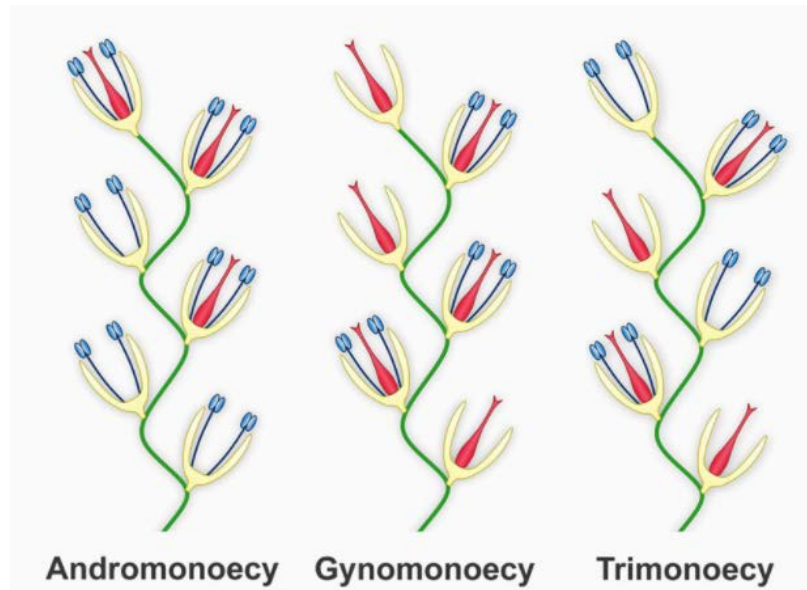


**Gynoecious**



**Hermaphrodite**

4) **Trimonoecious** also called polygamous having male, female, and bisexual (hermaphrodite) flowers on the same plant or sometimes having bisexual and at least one of male or female flowers on the same plant.



**Protandrous** describes individuals that function first as males and then change to females.

**protogynous** describes individuals that function first as females and then change to males.

In other words, **Protandrous** refers to stamens developing, or pollen release occurring, prior to the maturation of carpels or stigmas being receptive. **Protogynous** is the reverse, with carpels or stigmas developing before stamens mature or pollen is released.