

## Reproduction in Plants

### Learning Objectives

1. Types of reproduction
2. Asexual reproduction
3. Pollination
4. Pollination
5. Agents of pollination
6. Fertilization
7. Dispersal of seeds
8. Germination of seeds
9. Dormancy of seeds

### INTRODUCTION

Each living organism has a definite span of life. During this period it produces new offsprings which are similar to itself. Thus each organism is survived by its offspring. This is made possible by the process of multiplication. This is also called reproduction which can be defined as "the ability of living organisms to produce new ones of their own kind." Reproduction is mainly of two types - sexual and asexual. In sexual reproduction, the male and the female gametes fuse to form seeds that eventually develop into new plants. The seeds are formed inside the fruit. On the other hand, in asexual reproduction, a new plant is grown from any part of a plant other than the seeds.

### ASEXUAL REPRODUCTION

Asexual reproduction is a mode of reproduction by which offspring arise from a single parent, and inherit the genes of that parent only, it is reproduction which does not involve meiosis or fertilization. It refers to reproduction without the fusion of gametes. Asexual reproduction is the primary form of reproduction for single-celled organisms such as the bacteria, and protists. Many plants and fungi reproduce asexually as well. All prokaryotes reproduce asexually (without the formation and fusion of gametes), A lack of sexual reproduction is relatively rare among multi cellular organisms, for reasons that are not completely understood. Many hypotheses suggest that asexual reproduction may have short term benefits when rapid population growth is important or in stable environments, while sexual reproduction offers a net advantage by allowing more rapid generation of genetic diversity, allowing adaptation to changing environments.

### Characteristics of Asexual Reproduction

- Asexual reproduction involves only one parent.
- All the offspring are identical to the parent.
- Asexual reproduction does not involve the process of meiosis and fertilization, hence the process does not require a mate for reproduction.
- This type of reproduction is seen in lower forms of organisms. Asexual reproduction does not require time and energy to be spent on seeking a receptive mate.
- It is efficient method as large numbers of offspring are produced quickly, this enable animals to take advantage of favorable environmental conditions.
- Asexual reproduction is sometimes known as cloning.
- There are many types of asexual reproduction like vegetative propagation, fission, budding and fragmentation.
- All the forms of sexual reproduction are the variations of process of mitosis.

#### Do you know?

Organisms like Hydra use regenerative cells for reproduction in the process of budding

### Modes of Asexual Reproduction

Following means of asexual reproduction are used by plants:

They are vegetative propagation, budding, fragmentation and spore formation. The vegetative parts of a plant are the roots, stems and leaves. When new plants are produced from these parts, the process is called **vegetative propagation**.

### Vegetative Propagation

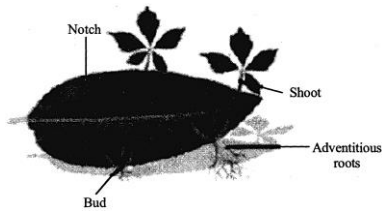
When a new plant is developed by a vegetative part; such as root, stem or leaf; it is known as vegetative propagation. For example:

- A new rose plant can be grown by cutting off a part of the stem of an existing plant, with two or more nodes, and planting it in the ground.
- A node is a part of the stem from where a leaf grows.
- This stem grows into a new rose plant.
- The leaf of bryophyllum produces new plants through its notches.



### Rose cutting

When the buds come in contact with moist soil, each bud is capable of growing into a new plant.



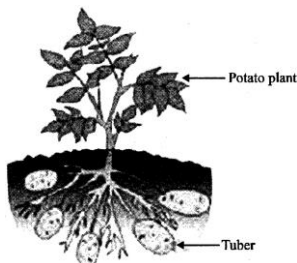
### Do you know?

Bryophyllum can regenerate itself from any of its parts. A leaf, or stem or root or fruit of a Bryophyllum plant can individually grow into a new plant.

Plants that use buds for vegetative propagation are potato, ginger and turmeric, amongst others. Roots that store food are known as tubers. Such roots are the food storage tanks for the plants.

### Do you know?

The word potato comes from the Spanish word Potato



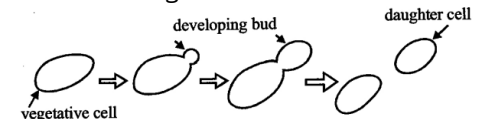
- When these tubers are detached from the parent plant and planted in the soil, they grow into a new plant.
- A plant that grows from a single root tuber, and then branches and retrenches, thereby covering a large area.
- A number of root tubers are produced by a single plant.
- Another plant that is grown from the tuber is the dahlia plant.

**Budding:** This method is used by unicellular plants; like yeast. Yeast is a fungus and fungi are also known as non-green plants. An ingredient used to bake a cake is a single celled plant. Yeast reproduces by a process called budding. The

small bulb-like projection coming out from the yeast is known as a bud. It detaches

### Do you know?

Yeast is commonly used in baking (baker's yeast) and brewing (brewer's yeast). It is very popular in study of unicellular organisms because it can be cultured easily, it grows rapidly and its entire genome is known.



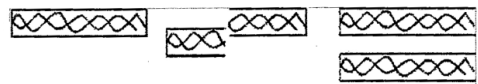
from the parent plant and develops into a new plant. The bud gets its own nucleus. The bud develops to certain size and detaches from the mother cell to produce the new yeast.



Budding in Yeast

### Fragmentation

In some simple plants, the plant body is divided into smaller fragments. Each fragment then develops into a new plant. Example: Spirogyra.

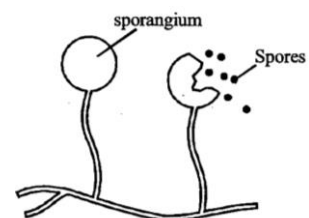


Fragmentation is spirogyra

Algae, the simplest green plants, reproduce by an asexual method known as fragmentation. An alga breaks up into smaller fragments. Each of these smaller fragments grows into a new independent alga.

### Spore Formation:

Special spore-bearing organs are present in some plants; especially in fungi and algae. These are called sporangia. The sporangium bears spores. The spores germinate to develop a new plant. The white mass and cottony like structure on the bread is called mould.



Spore formation in fungi

- It is a type of fungus that grows on moist organic surfaces like leather shoes and moist walls. This fungus reproduces by the means of spores.

- They can survive in extreme conditions like high temperature and low humidity.
- Ferns and moss are the example of the spore type of asexual reproduction.

## SEXUAL REPRODUCTION

The process of producing young ones that look like the parents is called reproduction. Plants reproduce either sexually or asexually. When two parents are involved in the process, it is called sexual reproduction. Two gametes, viz. male and female gametes, are formed. The fusion of male and female gametes is called fertilization. Zygote is formed after fertilization. The zygote develops into an embryo and finally into a new individual. Plants reproduce sexually by the most attractive part, called the flower.

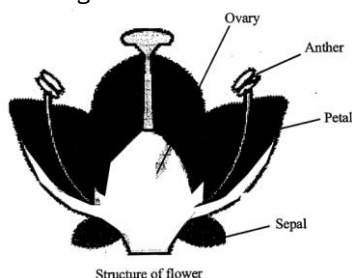
### Do you know?

Stamens of lotus are dried to produce fragrant teas while lotus seeds can be eaten raw or popped like popcorn

- The stalk of a flower is called the pedicel.
- All floral parts are arranged on its flattened tip, called the receptacle.
- The stamens and the pistil are the reproductive parts of a flower.
- The anther contains pollen sacs that produce pollen grains.
- Pollens are the male reproductive unit of the flower.
- Pistil is the female reproductive part of the flower.
- Bisexual flowers contain both - the stamens and the pistil. For example, mustard and rose.
- Unisexual flowers have either the stamens or the pistil. For example, cucumber, maize and watermelon.

### Do you know?

The agave also known as century plant spends many years without growing flowers after which it grows one single bloom and dies.



**Flower:** Flower is a special organ of flowering plants (angiosperms) which works as the

reproductive system. A flower is composed of four distinct whorls.

(1) The outermost whorl is called calyx. It is composed of green leaf-like structures; called sepals.

(2) The second whorl is called corolla. It is composed of colorful structures; called petals. Petals are colourful so that insects and other animals can be attracted towards them. This is necessary for pollination.

(3) Androecium: The third whorl is called androecium. It is composed of stamens. Stamen has two main parts. The tube-like portion is called filament. The capsule-like structure at the top is called anther. The anther produces pollen grains; which are the male gametes.

(4) Gynoecium: The whorl at the center is called gynoecium. It has a swollen base; called ovary and a tube-like structure; called style. The top of the tube is somewhat flattened and is called stigma. Ovary produces the eggs or female gametes.

### Do you know?

- Butterflies are found on every continent but Antarctica.
- Butterflies taste with their feet.

## Pollination

The transfer of pollen grains from anthers to stigma is called pollination. Pollination is of two types, viz. self pollination and cross pollination. Pollen grains transfer from one flower to another by pollinating agents.

### Cross Pollination

The transfer of pollen grains from the anther of one flower, to the stigma of another flower on another plant of the same type, is known as **cross-pollination**. The flowers can be on the same plant or on different plants. Cross pollination is the norm in most of the plants. Plants need help from various agents of pollination to carry out cross pollination. Wind, insects, birds and other animals play the role of agent of pollination.

### Self-Pollination

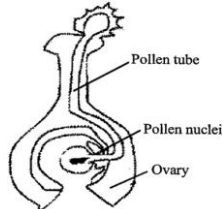
The transfer of pollen grains from the anther to the stigma of the same flower or to the stigma of another flower on the same plant, it is termed **self-pollination**.

Some of the features of flowers pollinated by wind and insects are tabulated as below:

Anemophilous flowers (wind pollinated)	Entomophilous flowers (insect pollinated)
Flowers are dull coloured, without scent and nectar.	Flowers are bright coloured, scented and secrete nectar.
Pollen grains are small, light and smooth.	Pollen grains are large, sticky and spiny
Stigma long, feathery and sticky	stigma small and often deep in corolla
Pollen grains are produced in	Less pollen grains are
Flowers are small	Flowers are large
Stamens are long to be exposed to wind	Stamens are small and may be within corolla tube

**Water:** Some aquatic plants like sea grass are pollinated by water. The flowers release their pollen grains into water which are carried by the water currents to other flowers.

**Mammals:** Bats and rodents are agents of pollination in some flowers. Such flowers have following features: Flowers have strong scent. Those that are attracted by mice have yeasty odour. They are often brown or white in colour. These are quite sturdy in order to allow the mammals to carry out their feeding.



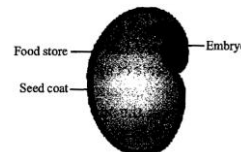
Fertilization in plant

**Birds:** Some flowers are even pollinated by birds. Two most common birds are sunbirds and humming birds. These birds have long sucking beaks that allow them to suck nectar. Such flowers have following features: These are brightly colored so as to attract the birds. The petals are usually red, orange or yellow in color. They are not scented because birds lack sense of smell.

## Fertilization

The fusion of the male gamete and the female gamete is called fertilization. When pollen settles on top of the stigma, it germinates to produce a pollen tube. The pollen tube enters the ovary through the style. Male nuclei are transferred to the ovary, through the pollen tube. The cell formed, just after fertilization, is called zygote. Zygote develops into embryo. Each embryo develops into a seed. The seed is an embryo

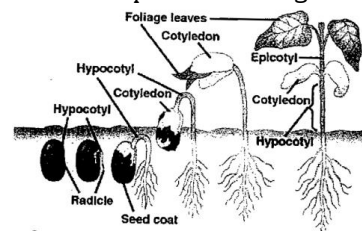
which is enclosed in a protective coat. The ovary gets transformed into fruit. It may be either fleshy or dry.



The seed of a dicotyledonous plant has three main parts: Seed coat-a tough protective outer covering

**Embryo-** consisting of the young roots and shoot which will develop into the adult plant

**Food store** -a store of food (starch) for the young plant to use until it is large enough to make its own food Germination is the start of growth in the seed. The process by which the embryo in the seed becomes active and begins to grow into a new plant is called germination.



Common garden bean

Three factors are required for successful germination:

- Water - allows the seed to swell up and the embryo to start growing
- Oxygen - so that energy can be released for germination common g
- Warmth - germination improves as temperature rises (up to a maximum)

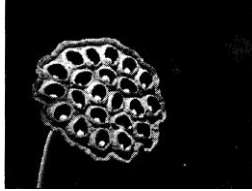
## Dispersal of Seeds

If all the seeds were to germinate near the mother plant, the new plants shall not get adequate resources; like sunlight, air and nutrients. For proper growth of the new plants, it is necessary that they develop away from the mother plant. For this, it is necessary that seeds are spread far and wide. The process of spreading seeds to different places is called dispersal of seeds. Many agents of seed dispersal assist the plants in this process. Seeds and fruits are dispersed by agents like wind, water, animals and humans.



### Dispersal by Wind

Seeds of some plants are light-weight and some hair-like or wing-like structures are present on them. Such seeds float on air and are thus dispersed by wind. Example: Dandelion, maple, drumstick, etc.



### Dispersal by Water

Dispersal by water takes place in some aquatic plants and in some which grow near a water body. Seeds of water lily float and thus dispersed by water. The coconut seed has a tough fibrous covering which has plenty of air inside. This helps the coconut seeds in floating on water.

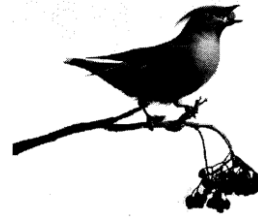


### Dispersal by Animals

Some seeds have spine like structures on them. They get stuck to the fur of animals and thus get spread to different places. Examples; Beggar tick, Xanthium, Urena, etc. Some seeds are swallowed by birds and animals along with fruits. These seeds get dispersed with bird or animal droppings.

### Dispersal by Bursting

The pods present in these seeds dry up in the sun. This causes the pod to split with great force, thereby dispersing the seeds away from the parent plant. This method is called explosion. Such fruits are called dehiscent fruits. Examples are mustard, ladies finger, peas, bean, pod and castor.

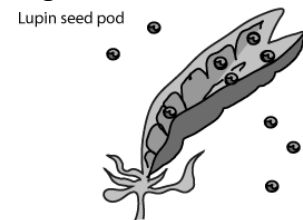


### Dispersal by Humans

Human beings also help in dispersal of seeds, especially during fanning.

### Seed Dormancy

It is a state of rest of the seeds to tide over unfavorable conditions. There are several ways that keep a seed in the dormant stage. Some seeds develop a thick seed coat that does not allow the entry of water or oxygen. In some germination starts only after the seeds are exposed to light.



### KEY WORDS

- Reproduction- ability of living organisms to produce new living beings.
- Asexual reproduction- single parent producing new plants
- Sexual reproduction- two parents contributing to the formation of gametes
- Budding- a bud growing into a new individual.
- Sporangium- a special structure on mould and other spore bearing plants that help in asexual reproduction.
- Vegetative reproduction- Asexual reproduction helped by vegetative parts of the plant.
- Pollination- transfer of pollen grains from the anther of a flower to stigma of same or another flower.
- Fertilization- fusion of male gamete with the egg cell forming oospore or zygote.

## CONCEPT MAP

