



REPRODUCTION IN PLANTS



Concepts Covered

- Reproduction.
- Modes of Reproduction, types of asexual reproduction, sexual reproduction.
- Pollination and its types, fertilization, fruit and seed formation and their importance.

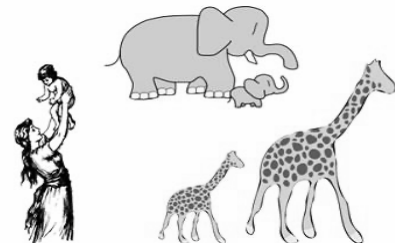
Introduction

Reproduction is one of the most important characteristics of all living beings. It is the production of its young ones. It is necessary for the continuation of the species on earth and also to replace the dead members of the species. The process by which living organisms produce their offspring for the continuity of the species is called reproduction.

The modes of reproduction vary according to individual species and available conditions. Irrespective of the mode of reproduction, all organisms pass on their hereditary material to their offspring during the process of reproduction.

Vegetative Part - Parts of a plant that do not participate in the sexual reproduction process are called vegetative parts. Roots, stems, and leaves are the vegetative parts of a plant.

Reproductive Part - A flower is the reproductive organ of the plant. The stamen/ androecium is the male reproductive part. Anther in the stamen produces the pollen grains. Pistil/ gynoecium is the female reproductive part.



Modes of Reproduction

(1) Asexual Reproduction:-

Asexual reproduction is a mode of reproduction in which a new offspring is produced by a single parent. The new individuals produced are genetically and physically identical to each other, i.e., they are clones of their parents.

Asexual reproduction is observed in both multicellular and unicellular organisms. This process does not involve any kind of gamete.

Extended Learning

Advantages of asexual reproduction are:

1. The process of reproduction is rapid.
2. An enormous number of organisms can be produced in very less time.



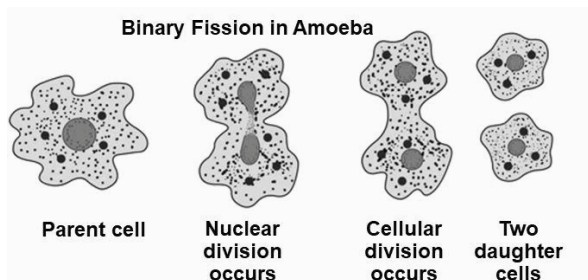
Spores are light weight so they are easily carried away by air and water current to new locations and have a tough covering over them which protect them from harsh conditions of environment like dryness and high temperature.

Types of Asexual Reproduction:

i. Binary Fission

The term "fission" means "to divide". During binary fission, the parent cell divides into two cells. Eg- Amoeba.

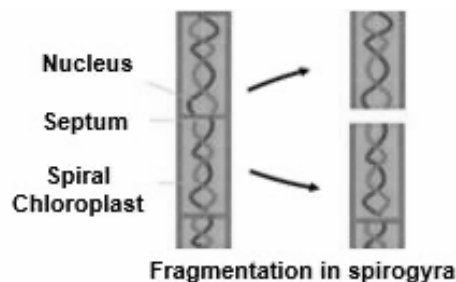
It is one of the simplest and uncomplicated methods of asexual reproduction. The parent cell divides into two, each daughter cell carrying a nucleus of its own that is genetically identical to the parent. The cytoplasm also divides leading to two equal-sized daughter cells.



ii. Fragmentation

The term 'fragmentation' means 'splitting' of various living organisms. E.g. – Spirogyra

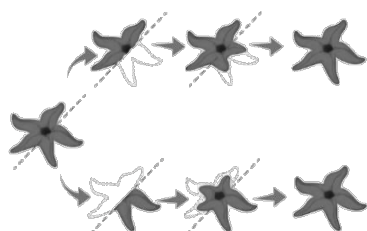
Each of the formed fragments after going through a cyclic process of growth completely matures into a full-grown, identical individual with its parents in terms of shape, size, and other dimensions



iii. Regeneration

Regeneration is the power of growing a new organism from the lost body part.

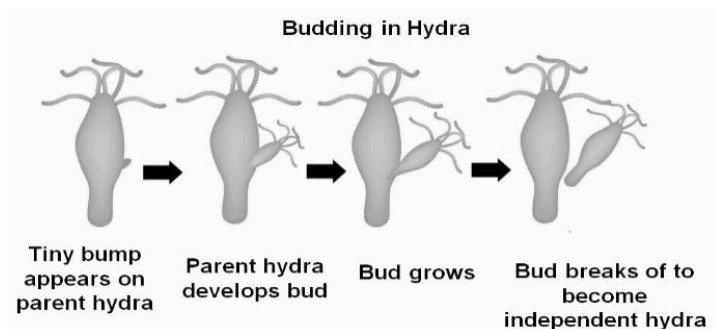
For example - when a lizard loses its tail, a new tail grows. Organisms like hydra and planaria exhibit regeneration.



iv. Budding

Budding is the process of producing an individual through the buds that develop on the parent body.

For example - Hydra is an organism that reproduces by budding. The bud derives its nutrition and shelter from the parent organism and detaches once it is fully grown.



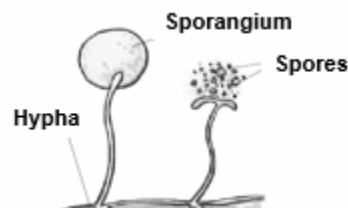
Extended Learning

Regeneration is carried out by specialized cells which re-divide to form a mass of cells from which different cells undergo changes to become different cell types and tissues.

v. Spore Formation

The process of formation of many reproductive units is called spore formation. Example: Rhizopus (a fungus).

- The body of a Rhizopus is made up of thread-like structures called hyphae.
- The erect hyphae bear sporangia inside which reproductive structures called spores are formed.
- Spores are asexually reproducing bodies having a thick protective wall.
- They are produced during unfavorable times and help them to overcome unfavorable environmental conditions.
- When the spores fall on a suitable medium, each one forms a new individual.



Activity: 1

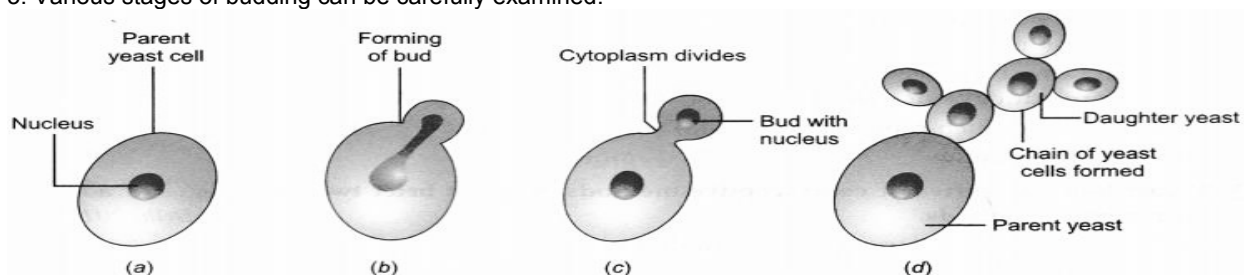
AIM:-To study Budding in yeast with the help of prepared slides.

Material Required:-

1. Compound microscope
2. Permanent slides of budding in yeast.

Procedure:-

1. Place the slide under a compound microscope.
2. Focus the slide, first under low power and later under high power of the compound microscope.
3. Various stages of budding can be carefully examined.



Observation:-

- Protuberance or a tiny outgrowth is observed on the parent cell
- Division of the nucleus is observed which is later seen in the bud
- Repetitive budding leads to the formation of a chain of cells

Conclusions:-

The prepared slides display asexual reproduction. One individual is involved to produce a new individual.



Check Your Concept - 1

- (i) What is Binary fission? Give an example of an organism that reproduces by this method.
- (ii) What is the difference between fragmentation and regeneration?
- (iii) How does a hydra reproduce?
- (iv) How does Rhizopus reproduce?
- (v) Explain the process of reproduction in spirogyra.

(2) Sexual Reproduction:-

It involves the fusion of male and female reproductive cells (gametes) which are haploid and are produced by male and female reproductive organs. This fusion is known as fertilization and results in the production of a zygote (diploid). Further development of the zygote gives rise to a new individual which is diploid. The offsprings are not genetic clones of their parents, but are genetically different and generally exhibit mixed characteristics of their parents.

Extended Learning

Advantages of sexual reproduction are:

1. Produces genetic variation in the offspring.
2. The species can adapt to new environments due to variation, which gives them a survival advantage.
3. A disease is less likely to affect all the individuals in a population.

Flower

Flowers are the reproductive part of a plant. They help plants in sexual reproduction and produce fruits and seeds.

Parts of a flower:-

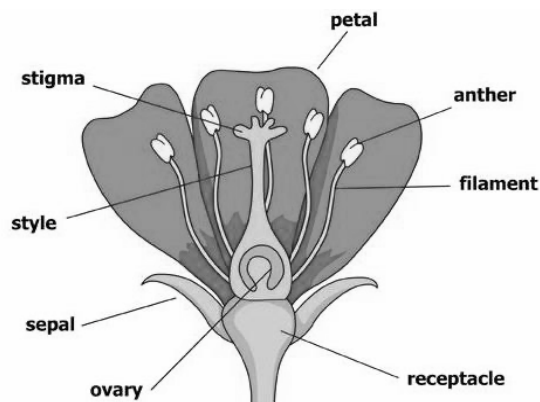
The two outermost whorls are known as non-essential or accessory whorls as they aid in reproduction but do not directly take part in the process.

The other two whorls i.e. Androecium (male reproductive organ) and Gynoecium (female reproductive organ) are known as the essential whorls as their absence from flowers will lead to failure of sexual reproduction.

A typical flower bears four whorls born on the thalamus or stalk. These whorls from outside are:

(1) Calyx: It is the outermost whorl of the flower. It is composed of leaf-like green sepals.

It is usually green in colour but in some flowers, it may be coloured to attract insects. It protects the inner whorls of the flower, especially in bud conditions. Since they are green in colour, they are capable of photosynthesizing.



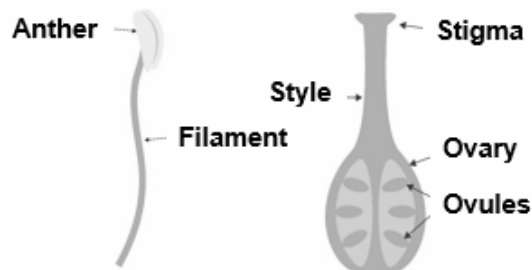
Parts of flower

(2) Corolla:

It is the second whorl of flower and consists of coloured petals. Being coloured in nature, they attract various insects and animals for pollination. If both sepals and petals are coloured and cannot be distinguished from each other, then their whorl is known as perianth and its constituents are known as tepals

(3) Androecium / Stamen / Male reproductive organs:

It consists of two parts, the lower stalk-like part is known as filament and the upper sac-like structure is known as anther. Usually, an anther is made up of two anther lobes, which further contain two pollen sacs. The anther is protected by a layer known as the epidermis. At maturity, anther wall breaks to release pollen grains.



Structure of stamen Structure of carpel

(4) Gynoecium / Carpel / Pistil / Female reproductive organs:

It is differentiated into three distinct regions namely ovary, style, and stigma. Ovary, the swollen part is present at the base, which contains ovules. The arrangement of ovules in the ovary varies from plant to plant. A narrow long stalk is there at the top of the ovary which is called style. The tip of the style has a pollen-receiving surface known as stigma.



If both sepals and petals are coloured and cannot be distinguished from each other, then their whorl is known as perianth. E.g. Tulip and Lily.

Ovule

- The ovule is a structure formed by the ovary of plants.
- An ovary may contain one or more than one ovules.
- In orchids often more than one million ovules are present in each ovary.
- Each ovule has two protective layers called integuments.

Embryo Sac

It is the structure that develops inside the tissues of the ovary. It consists of 7 cells out of which 2 cells lie in the centre. The cells in the centre are called are polar nuclei.

Types of flowers

1. Unisexual flower:

The flower that has only male or female reproductive parts i.e., either stamens or carpels are present are unisexual flowers.

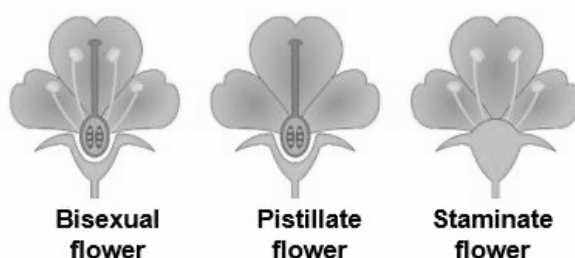
Examples of unisexual flowers are Bitter gourd, Papaya, Pumpkin, and Cucumber.

2. Bisexual flower:

The flower possessing both male and female reproductive parts are a bisexual flower that is both stamens and carpels are present in the same flower.

Examples of bisexual flowers are Rose, Sunflower, Hibiscus, Lily, and Mustard.

Types of flowers



Pollination

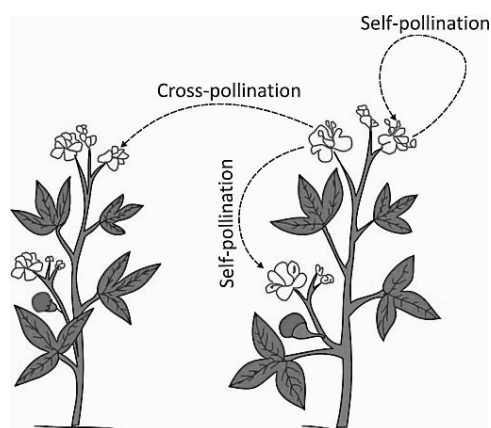
When mature pollen grains, released from anther, are carried to the stigma of a flower of the same or different species, it is called pollination.

Pollination is of two types:

1. Self-pollination: It is between the flowers of the same plant. If it is in the same flower, it is called autogamy and if it is between different flowers of the same plant then it is called geitonogamy.

2. Cross-pollination: It is between the flowers of different plants. This transference of pollen grains can take place in various ways:

- Wind pollination- Anemophily
- Insect pollination - Entomophily



- (c) Water pollination - Hydrophily
- (d) Bird pollination- Ornithophily
- (e) Bat pollination- Chiropterophily

Extended Learning

Importance of Pollination:

1. It results in fertilization and stimulates the ovule to get converted into seed.
2. New varieties of plants are formed through a new combination of genes in case cross-pollination.
3. During pollination pollen tube produces growth hormones which stimulate the ovary to develop into a fruit.

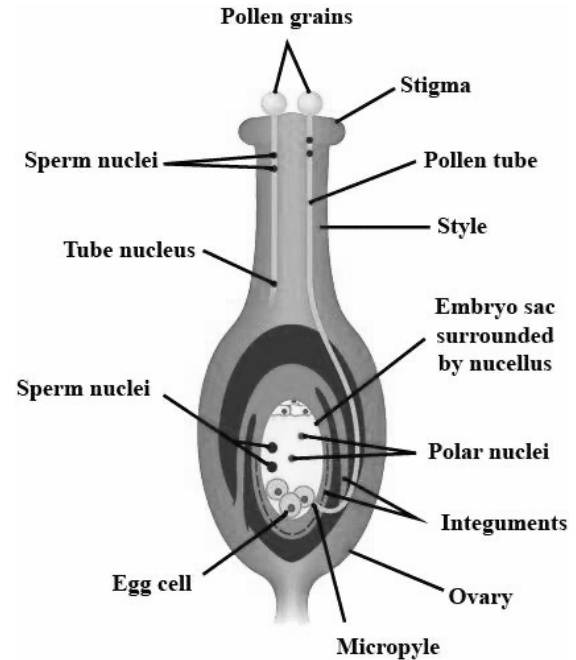
Fertilization

- Fertilization is the process of fusion of male and female gametes to form a zygote during sexual reproduction, pollen grains land on the stigma of the ovary.
- The pollen tubes grow out of the pollen grains, travel through the style, and reach the ovary.
- The Pollen tube has two male germ cells. Each ovule has two polar nuclei and a female germ cell (egg).
- Pollen tube releases two male germ cells inside the ovule near the micropylar region, one of the fuses with a female germ cell and forms a zygote which grows into the baby plant i.e., embryo, the fusion is known as syngamy.
- The other male germ cell fuses with two polar nuclei, the process known as triple fusion results in the formation of the endosperm.
- So in flowering plants, two fusions take place during fertilization. It is called double fertilization.

Post-fertilization Changes

After fertilization, the following changes take place in the flower.

- The zygote divides several times and forms an embryo inside the ovule.
- The ovule develops a tough coat and changes into the seed.
- The ovary grows rapidly and ripens to form a fruit.
- Petals, sepals, stamens, style, and stigma shrivel and fall off.



Solved Examples

(1) **List out the agents of pollination.**

Answer: Animals, birds, insects, wind, and other biotic and abiotic agents are all examples of pollinating agents.

(2) **Define double fertilization.**

Answer: In plants, double fertilization refers to the fusion of one female gametophyte with two male gametophytes. It is a complex process in all flowering plants.

(3) **How do aquatic plants undergo pollination?**

Answer: Their flowers submerged in water release their pollen in the water that drifts in the water and is caught by the feathery stigma of female flowers.

(4) **What is cross-pollination?**

Answer: Cross-Pollination is the type of pollination during which the pollen grains are transferred from the anther of one flower into the stigma of another flower.

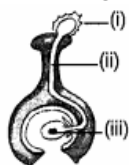
(5) **What are the male and female reproductive parts of a flower?**

Answer: Stamen is the male reproductive part of a flower, while pistil is the female reproductive part of a flower. The stamen is surrounded by anther and filament. The anthers produce pollen grains.

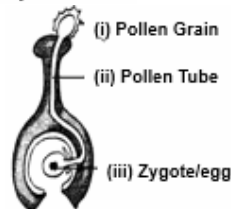
(6) **Why is the process of reproduction necessary?**

Answer: The process of reproduction is necessary for the perpetuation and preservation of species and to increase the number of members of species.

(7) **In the figure given below, label the part marked (i), (ii), and (iii).**



Answer:



(8) **Coconut is a large and heavy fruit. How is it adapted for dispersal by water?**

Answer: The coconut fruits have a fibrous outer coat which enables them to float in water and be carried away by flowing water to far-off places

(9) **What is meant by the term fertilization? List the stepwise manner leading to the formation of an embryo.**

Answer: (a) The process in which the male gamete fuses with the female gamete to form a new cell (called a zygote) is called fertilization.

(b) When the pollens are deposited on the stigma of the pistil, it begins to germinate. After some time, a long pollen tube is developed from the pollen grain which passes through the style towards the female gametes in the ovary. The male gametes move down the pollen tube and the tube enters the ovule present inside the ovary.

(c) The tip of the pollen tube bursts and the male gamete comes out of the pollen tube. Inside the ovary, the male gametes fuse with the female gametes present in the ovule to form a fertilized egg cell which is called a zygote.

(d) The zygote develops into an embryo which is a part of a seed that develops into a new plant.

(10) **Observe the given figure and answer the following questions.**

(a) Name the plant.

(b) Which type of reproduction is seen in this plant?

(c) Is it a root or stem?

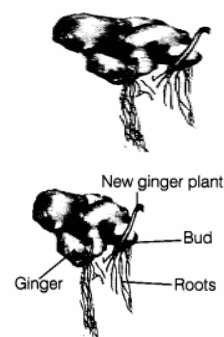
(d) Label the part of this plant.

Answer: (a) The given figure is of a ginger tuber.

(b) Asexual reproduction is seen in this plant.

(c) Ginger is a stem.

(d) Various parts of this plant can be shown as follows:



Exercise

FILL IN THE BLANKS

- (1) The male and female gametes fuse to form a during the process of fertilization
- (2) The is the male reproductive part of a flower
- (3) Light Pollen grains can be carried by or
- (4) The zygote grows into an which is enclosed within a seed
- (5) Planaria divides by

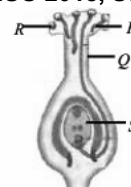
TRUE OR FALSE

- (1) Hibiscus or China rose are bisexual flowers.
- (2) Asexual reproduction in yeast takes place by budding.
- (3) Pollination is the process of fusion of male and female gametes.
- (4) Pollen grains are present in anther.
- (5) Two individuals are needed for sexual reproduction.

OBJECTIVE TYPE QUESTIONS

- (1) Lila observed that a pond with clear water was covered up with green algae within a week. By which method of reproduction did the algae spread so rapidly?
(A) Budding (B) Sexual reproduction
(C) Fragmentation (D) Pollination
- (2) Which of the following parts of sexual reproduction
(i) Flower (ii) Seed
(iii) Fruit (iv) Branch
Choose the correct answer from below
(A) (i) and (ii) (B) (i), (ii) and (iii)
(C) (iii) and (iv) (D) (ii), (iii) and (iv)
- (3) The ovaries of different flowers may contain
(A) Only one ovule (B) Many ovules
(C) One to many ovules (D) Only two ovules
- (4) Which of the following statements is/are true for sexual reproduction in plants?
(i) Plants are obtained from seeds
(ii) Two plants are always essential
(iii) Fertilisation can occur only after pollination
(iv) Only insects are agents of pollination
Choose from the options given
(A) (i) and (iii) (B) only (i)
(C) (ii) and (iii) (D) (i) and (iv)
- (5) The fusion of male and female gametes is called
(A) Ovulation (B) Population
(C) Pollination (D) Fertilization
- (6) Which among the following do not reproduce by vegetative reproduction?
(A) Wheat (B) Sugarcane
(C) Rose (D) Jasmine
- (7) The mode of vegetative reproduction where scion and stock are used is called
(A) Budding (B) Grafting
(C) Cutting (D) Layering
- (8) Observe the given figure and select the correct statement(s) regarding P-S.
(1) The given figure shows the process of pollination.
(2) P secretes sugary solution which stimulates the germination of R.
(3) Male gametes are formed inside the Q.
(4) S contains fertilised ovule which contains zygote.
(A) (1) and (3) only (B) (2), (3) and (4) only
(C) (1), (2) and (4) only (D) (4) only

[NSO 2018, Set 2]



- (9) Study the following features:
- Flowers are small and dull.
 - Pollen grains are lightweight.
 - Stamens and stigmas are exposed.
 - Flowers are colourless and odourless.
 - Pollen grains are produced in large numbers.
- Above cited features are the characteristics of flowers in which pollination is brought about by the agency of

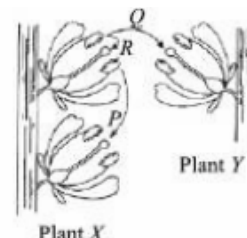
[NSO 2015, Set 2]

- (A) Wind (B) Birds
(C) Insects (D) Explosion.

- (10) Refer to the given diagram and select the correct option regarding processes P, Q and R.

[NSO 2016, Set 2]

- (A) Processes P, Q and R introduce genetic variability in the offspring of sexually reproducing plants X and Y.
(B) Wind serves as an agent for processes P and Q in case plants X and Y belong to the genus *Salvia*.
(C) Flowers of plants X and Y need to produce odour and nectar for completion of processes P and Q if they are rose species.
(D) If plants X and Y are of maize species, then their flowers need to produce sticky and heavy pollens in a very small amount for accomplishment of process Q.



Answer Key

FILL IN THE BLANKS

- (1) zygote
(2) stamen
(3) wind, water
(4) Embryo
(5) Regeneration

TRUE OR FALSE

- (1) True
(2) True
(3) False
(4) True
(5) True

OBJECTIVE TYPE QUESTIONS

- (1) (C) (6) (A)
(2) (B) (7) (B)
(3) (C) (8) (B)
(4) (A) (9) (C)
(5) (D) (10) (D)