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HIGHER SECONDARY SECOND YEAR

Last minute study questions

## BOTANY

### Panchanan Maheswari (1904-1966)

Professor P. Maheswari was an eminent Botanist who specialised in plant embryology, morphology and anatomy. In 1934, he became the Fellow of Indian Academy of Science. He published the book titled "An introduction to the Embryology of Angiosperms" in 1950. He established the International Society for Plant Morphologists, in 1951.



### Functions of Tapetum:

- It supplies nutrition to the developing microspores.
- It contributes sporopollenin through ubisch bodies thus plays an important role in pollen wall formation.
- The pollenkitt material is contributed by tapetal cells and is later transferred to the pollen surface.
- Exine proteins responsible for 'rejection reaction' of the stigma are present in the cavities of the exine. These proteins are derived from tapetal cells.

DO YOU KNOW?

Many botanists speak of a third type of tapetum called amoeboid, where the cell wall is not lost. The cells protrude into the anther cavity through an amoeboid movement. This type is often associated with male sterility and should not be confused with periplasmal type.

DO YOU KNOW?

Bee pollen is a natural substance and contains high protein, carbohydrate, trace amount of minerals and vitamins. Therefore, it is used as dietary supplement and is sold as pollen tablets and syrups. Further, it increases the performance of athletes, race horses and also heals the wounds caused by burns. The study of honey pollen is called Mellitopalynology.



DO YOU KNOW?

Scourge of water bodies /Water hyacinth (*Eichhornia crassipes*) is an invasive weed on water bodies like ponds, lakes and reservoirs. It is popularly called "Terror of Bengal". It spreads rapidly through offsets all over the water body and depletes the dissolved oxygen and causes death of other aquatic organisms.



### 1.4.2 Female reproductive part - Gynoecium

The gynoecium represents the female reproductive part of the flower. The word gynoecium represents one or more pistils of a flower. The word pistil refers to the ovary, style and stigma. A pistil is derived from a carpel. The word ovary represents the part that contains the ovules. The stigma serves as a landing platform for pollen grains. The style is an elongated slender part beneath the stigma. The basal swollen part of the pistil is the ovary. The ovules are present inside the ovary cavity (locule) on the placenta. Gynoecium (carpel) arises as a small papillate outgrowth of meristematic tissue from the growing tip of the floral primordium. It grows

### Disadvantages of conventional methods

- Use of virus infected plants as parents produces viral infected new plants.
- Vegetative structures used for propagation are bulky and so they are difficult to handle

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10<sup>th</sup> to 12<sup>th</sup> important Questions upload soon.

kindly send me your key Answers to our email id - [padasalai.net@gmail.com](mailto:padasalai.net@gmail.com)



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### Types of Ovules

The ovules are classified into six main types based on the orientation, form and position of the micropyle with respect to funicle and chalaza. Most important ovule types are orthotropous, anatropous, hemianatropous and campylotropous. The types of ovule is given in

### 1.4.3 Pollination

Pollination is a wonderful mechanism which provides food, shelter etc., for the pollinating animals.



Many plants are pollinated by a particular animal species and the flowers are modified accordingly and thus there exists a co-evolution between plants and animals. Let us imagine if pollination fails.

### Significance of Pollination

- Pollination is a pre-requisite for the process of fertilisation. Fertilisation helps in the formation of fruits and seeds.
- It brings the male and female gametes closer for the process of fertilisation.
- Cross-pollination introduces variations in plants due to the mixing up of different genes. These variations help the plants to adapt to the environment and results in speciation.



### 1.5 Fertilization

#### Pollen tube in the style

After the germination the pollen tube enters into the style from the stigma. The growth of the pollen tube in the style depends on the type of style.

#### Types of style

There are three types of style a) Hollow or open style b) solid style or closed style c) semi-solid or half closed style.



Aleurone tissue consists of highly specialised cells of one or few layers which are found around the

endosperm of cereals (barley and maize).

Aleurone grain contains sphaerosomes. During seed germination cells secrete certain hydrolytic enzymes like amylases, proteases which digest reserved food material present in the endosperm cells.

#### Functions of endosperm:

- It is the nutritive tissue for the developing embryo.
- In majority of angiosperms, the zygote divides only after the development of endosperm.
- Endosperm regulates the precise mode of embryo development.



Fresh weight of an orchid seed may be 20.33 microgram and that of double coconut

(*Lodoicea maldivica*) is about 6 kg.

Figure 3.1: Comparison of chromosome and gene behaviour

Mendelian factors	Chromosomes behaviour
1. Alleles of a factor occur in pair	Chromosomes occur in pairs
2. Similar or dissimilar alleles of a factor separate during the gamete formation	The homologous chromosomes separate during meiosis
3. Mendelian factors can assort independently	The paired chromosomes can separate independently during meiosis but the linked genes in the same chromosome normally do not assort independently.



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Thomas Hunt Morgan (1933) received Nobel Prize in Physiology or Medicine for his discoveries concerning the role played by chromosomes in heredity.



The differences are given below.

Linkage	Crossing over
1. The genes present on chromosome stay close together	It leads to separation of linked genes
2. It involves same chromosome of homologous chromosome	It involves exchange of segments between non-sister chromatids of homologous chromosome.
3. It reduces new gene combinations	It increases variability by forming new gene combinations. lead to formation of new organism

Table 3.4: Differences between linkage and crossing over

### Uses of genetic mapping

- It is used to determine gene order, identify the locus of a gene and calculate the distances between genes.
- They are useful in predicting results of dihybrid and trihybrid crosses.
- It allows the geneticists to understand the overall genetic complexity of particular organism.

### Significance of Ploidy

- Many polyploids are more vigorous and more adaptable than diploids.
- Many ornamental plants are autotetraploids and have larger flowers and longer flowering duration than diploids.
- Autopolyploids usually have higher fresh weight due to more water content.
- Aneuploids are useful to determine the phenotypic effects of loss or gain of different chromosomes.
- Many angiosperms are allopolyploids and they play a role in the evolution of plants.

**DNA Replication:** In the double helix the two parental strands of DNA separate and each parental strand synthesizes a new complementary strand. DNA replication is semiconservative, i.e each new DNA molecule conserves one original strand.

**Termination sequences** are the DNA sequences which tells when the RNA polymerase should stop producing RNA molecule.

Eukaryotic structural gene has 3 features in promoter

1. Regulatory elements
2. TATA box
3. A transcriptional start site



### Internal methylation

Apart from capping, the internal nucleotides in mRNA are also methylated.

Methylated sites are present in translated, untranslated regions, introns and exons.



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### Purpose of Capping

1. Protects RNA from degradation.
2. Capping plays an important role in removal of first intron in pre mRNA.
3. It regulates the mRNA export from the nucleus into the cytoplasm.
4. It helps in binding of mRNA to the ribosome.

### Translators of the genetic code - tRNA

The tRNA translates the genetic code from the nucleic acid sequence to the amino acid sequence i.e from gene - Polypeptide. When an amino acid is attached to tRNA it is called **aminoacylated or charged**. This is an energy requiring process which uses the ATP for its energy requirement. Protein synthesis takes place as the next aminoacyl tRNA binds to the A-Site.



Plants are sessile. How do they protect themselves from the exposure of sunlight throughout the day?

Plants have effective DNA repair mechanism to prevent UV damage from sunlight. They produce an enzyme called photolyase, which can repair the thymine dimers and restore the structure of DNA.

### Ti Plasmid

Ti plasmid is found in *Agrobacterium tumefaciens*, a bacterium responsible for inducing tumours in several dicot plants. The plasmid carries transfer (tra) gene which help to transfer T- DNA from one bacterium to other bacterial or plant cell. It has Onc gene for oncogenicity, ori gene for origin for replication and inc gene for incompatibility. T-DNA of Ti-Plasmid is stably integrated with plant DNA. *Agrobacterium* plasmids have been used for introduction of genes of desirable traits into plants.

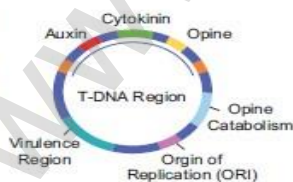


Figure 4.11: Ti Plasmid

### pBR 322 Plasmid

pBR 322 plasmid is a reconstructed plasmid and most widely used as cloning vector; it contains 4361 base pairs. In pBR, *p* denotes plasmid, *B* and *R* respectively the names of scientist Boliver and Rodriguez who developed this plasmid. The number 322 is the number of plasmid developed from their laboratory. It contains  $amp^R$  and  $tet^R$  two different antibiotic

### 1. ELISA (Enzyme Linked Immuno Sorbent Assay)

Elisa is a diagnostic tool for identification of pathogen species by using antibodies and diagnostic agents. Use of ELISA in plant pathology especially for weeding out virus infected plants from large scale planting is well known.

### Types of Blotting Techniques

**Southern Blotting:** The transfer of DNA from agarose gels to nitrocellulose membrane.

**Northern Blotting:** The transfer of RNA to nitrocellulose membrane.

**Western Blotting:** Electrophoretic transfer of Proteins to nitrocellulose membrane.



**Barcode:** You might have seen in all books barcoding and also in items you buy in supermarket. This will

reveal the identity of the book or item as well the details like prize. Similarly, Barcode in genetic term refer to the identify of the taxon based on its genetic makeup. In practice, it is an optical, machine-readable representation of data which describes about the characters of any plants or any objects.





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### GM Food - Benefits

- High yield without pest
- 70% reduction of pesticide usage
- Reduce soil pollution problem
- Conserve microbial population in soil

### Risks - believed to

- Affect liver, kidney function and cancer
- Hormonal imbalance and physical disorder
- Anaphylactic shock (sudden hypersensitive reaction) and allergies.

### 5.2 Plant Tissue Culture (PTC)

Plant tissue culture is used to describe the *in vitro* and aseptic growth of any plant part on a tissue culture medium. This technology is based on three fundamental principles:

- The plant part or explant must be selected and isolated from the rest of plant body.
- The explant must be maintained in controlled physically (environmental) and chemically defined (nutrient medium) conditions.

**Explant:** The tissue taken from a selected plant transferred to a culture medium often to establish a new plant.

### 5.2.3 Types of Plant tissue cultures

Based on the type of explant other plant tissue culture types are

1. Organ culture
2. Meristem culture
3. Protoplast culture
4. Cell suspension culture.

**Alexander von Humbolt - Father of Ecology**

**Eugene P. Odum - Father of modern Ecology**

**R. Misra - Father of Indian Ecology**

The differences between habitat and niche are as follows.

	Habitat	Niche
1.	A specific physical space occupied by an organism (species)	A functional space occupied by an organism in the same eco-system
2.	Same habitat may be shared by many organisms (species)	A single niche is occupied by a single species
3.	Habitat specificity is exhibited by organism.	Organisms may change their niche with time and season.

### Effects of wind

- Wind is an important factor for the formation of rain
- Causes wave formation in lakes and ocean, promotes aeration of water
- Strong wind causes soil erosion and reduces soil fertility
- Increases the rate of transpiration
- Helps in pollination in anemophilous plants



### Green House Effect Albedo Effect

Gases let out to atmosphere causes climatic change. Emission of dust and aerosols (small solids or liquid particles in suspension in the atmosphere) from industries, automobiles, forest fire,  $\text{SO}_2$  and DMS (dimethyl sulphur) play an important role in disturbing the temperature level of any region. Aerosols with small particles is reflecting the solar radiation entering the atmosphere. This is known as Albedo effect. So it reduces the temperature (cooling) limits, photosynthesis and respiration. The sulphur compounds are responsible for acid rain due to acidification of rain water and destroy the ozone.



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### Ecologically important days

March 21 - World forest day  
 April 22 - Earth day  
 May 22 - World bio diversity day  
 June 05 - World environment day  
 July 07 - Van Mahostav day  
 September 16 - International Ozone day



### Types of Carbon

**Green carbon** – carbon stored in the biosphere (by the process of photosynthesis).

**Grey carbon** – carbon stored in fossil fuel (coal, oil and biogas deposits in the lithosphere).

**Blue carbon** – carbon stored in the atmosphere and oceans.

**Brown carbon** – carbon stored in industrialized forests (wood used in making commercial articles)

**Black carbon** – carbon emitted from gas, diesel engine and coal fired power plants.

### 3. Pyramid of energy

A graphical representation of energy flow at each successive trophic level in an ecosystem is called **pyramid of energy**. The bottom of the pyramid of energy is occupied by the producers. There is a gradual decrease in energy transfer at successive trophic levels from producers to the upper levels. Therefore, the pyramid of energy is always upright.

### Ecosystem

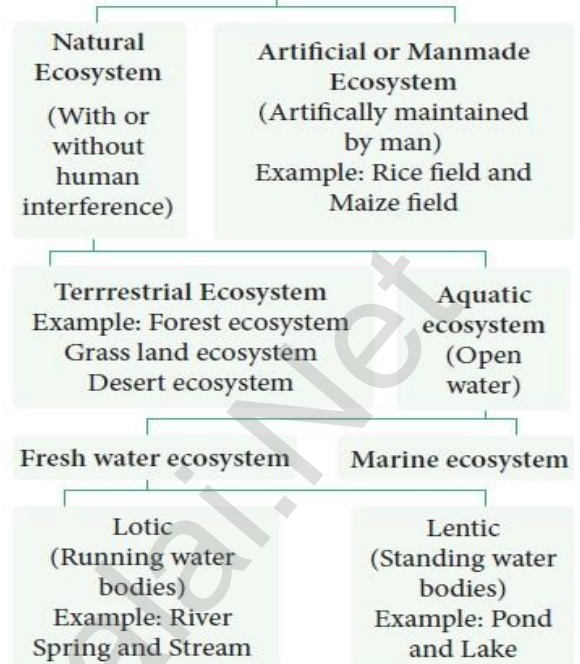


Figure 7.13: Types of Ecosystem



### Limnology

It is the study of biological, chemical, physical and geological components of inland fresh water aquatic ecosystems (ponds, lakes, etc.).

**Oceanography** – It is the study of biological, chemical, physical and geological components of ocean.



Sea grasses and mangroves of Estuarine and coastal ecosystems are the most efficient in carbon sequestration. Hence, these ecosystems are called as “**Blue carbon ecosystems**”. They are not properly utilized and maintained all over the world although they have rich bioresources potential.

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### Mangrove ecosystem services

- Offers habitat and act as nursery for aquatic plants and animals
- Provides medicine, fuel wood and timber.
- Act as bridge between sea and rivers by balancing sedimentation and soil erosion.
- Help to reduce water force during cyclones, tsunamis and high tide periods.
- Help in wind break, O<sub>2</sub> production, carbon sequestration and prevents salt spray from waves.



### 8.9.1 Environmental benefits of Rain Water Harvesting:

- Promotes adequacy of underground water and water conservation.
- Mitigates the effect of drought.
- Reduces soil erosion as surface run-off is reduced.
- Reduces flood hazards.
- Improves groundwater quality and water table / decreases salinity.
- Avoid land wastage for storage purpose and no population displacement is involved.

### Importance of GIS

- Environmental impact assessment
- Disaster management
- Zoning of landslide hazard
- Estimation of flood damage
- Management of natural resources
- Soil mapping
- Wetland mapping
- Irrigation management and identification of volcanic hazard
- Vegetation studies and mapping of threatened and endemic species.

**DO YOU KNOW?**

"By 2025, at least 3.5 billion people, nearly 50% of the world's population are projected to face water scarcity." – IUCN.

"Forests house approximately 50% of global bio-diversity and at least 300 million people are dependent on forest's goods and services to sustain their livelihood." – IUCN

### Types of succession

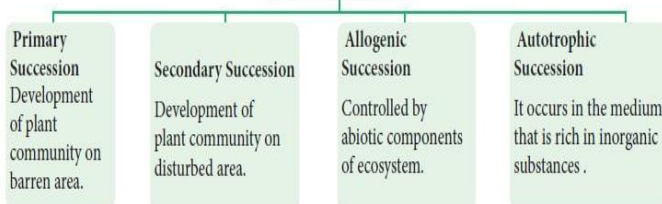


Figure 7.18: Types of succession

### 9.5.1. Objectives of Plant Breeding

- To increase yield, vigour and fertility of the crop
- To increase tolerance to environmental condition, salinity, temperature and drought.
- To prevent the premature falling of buds, fruits etc.
- To improve synchronous maturity.
- To develop resistance to pathogens and pests.
- To develop photosensitive and thermos-sensitive varieties.



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### Benefits of seed treatment

- Prevents spread of plant disease.
- Protects seed from seedling blights.
- Improves germination.
- Provides protection from storage insects.
- Controls soil insects.

### 10.1.7 Nuts

Nuts are simple dry fruits composed of a hard shell and an edible kernel. They are packed with a good source of healthy fats, fibre, protein, vitamins, minerals and antioxidants. Some of the important nuts are discussed below.

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Table 10.3 Classification of fibres

S. No	Types of fibre	Uses	Example
1	Textile fibre	Manufacture of fabrics, netting and cordage.	Cotton, hemp, jute.
2	Brush fibre	Making brushes and brooms.	Palm fibres and brooms.
3	Plaiting fibre	Making hats, baskets, furniture.	Cane, Vitex and Lantana.
4	Filling fibre	Stuffing pillows, cushions and beds.	Silk cotton, Calotropis.

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