

# **XII – BIO-BOTANY**

**Name :**

**Class : Sec:**

**School :**

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# BIO – BI-OTANY

## UNIT – VI REPRODUCTION IN PLANTS

### Chapter – 1 ASEXUAL AND SEXUAL REPRODUCTION IN PLANTS

### EVALUATION ONE MARKS

1. Choose the correct statement from the following **Yeast reproduce by budding.**
2. An eminent Indian embryologist is **P.Maheswari**
3. Identify the correctly matched pair **Rhizome - *Musa***
4. Pollen tube was discovered **G.B.Amici**
5. Size of pollen grain in *Myosotis* **10 micrometer**
6. First cell of male gametophyte in angiosperm is **Microspore**
7. Match the following

<b>I) External fertilization</b>	<b>i) pollen grain</b>	<b>3</b>
<b>II) Androecium</b>	<b>ii) anther wall</b>	<b>4</b>
<b>III) Male gametophyte</b>	<b>iii) algae</b>	<b>1</b>
<b>IV) Primary parietal layer</b>	<b>iv)stamens</b>	<b>2</b>
8. Arrange the layers of anther wall from locus to periphery **Tapetum, middle layers , endothecium , epidermis**
9. Identify the incorrect pair **Nucellus – nutritive tissue for developing embryo**
10. Assertion: Sporopollenin preserves pollen in fossil deposits  
Reason : Sporopollenin is resistant to physical and biological decomposition  
**Both Assertion and reason are true.**
11. Choose the correct statement(s) about tenuinucellate ovule **Sporogenous cell is hypodermal, ovules have single layer of nucellus tissue.**
12. Which of the following represent megagametophyte **endosperm.**
13. In *Haplopappus gracilis*, number of chromosomes in cells of nucellus is 4. What will be the chromosome number in Primary endosperm cell? **6**
14. Transmitting tissue is found in **Style region of gynoecium**
15. The scar left by funiculus in the seed is **hilum**
16. A Plant called X possesses small flower with reduced perianth and versatile anther. The probable agent for pollination would be **air**
17. Consider the following statement(s) **ii) In Protogynous flowers pistil matures earlieriv) distyle is present in Primula (or) ii and iv are correct.**
18. Coelorrhiza is found in **Paddy**
19. Parthenocarpic fruits lack**seed**

20. In majority of plants pollen is liberated at **2 celled stage**

**Answer the following:**

**1. What is reproduction ?**

- ▶ Reproduction is a vital process for the existence of a species and it also brings suitable changes through variation in the off springs for their survival on earth.

**2. Mention the contribution of Hofmeister towards embryology ?**

- ▶ **1848** – Hofmeister described the structure of pollen tetrad.

**4. What are clones?**

Individuals developed by asexual reproduction are morphologically and genetically identical. Such individuals are called as clones.

**5. A detached leaf of Bryophyllum produces new plant. How ?**

In *Bryophyllum*, the leaf is succulent and notched on its margin. Adventitious buds develop at these notches and are called **epiphyllous buds**.

They develop into new plants forming a root system and become independent plants when the leaf gets decayed.

**6. List out two sub-aerial stem modification with examples ?**

1. Stolon - eg : *Fragaria*
2. Sucker - eg : *Chrysanthemum*

**7. What is layering ?**

In this method, the stem of a parent plant is allowed to develop roots while still intact. When the root develops, the rooted part is cut and planted to grow as a new plant.

Examples: *ixora* and *jasminum*.

**8. Explain the conventional methods adopted in vegetative propagation of higher Plants ?**

The common methods of conventional propagation are cutting, grafting and layering.

▶ **a. Cutting:**

It is the method of producing a new plant by cutting the plant parts such as root, stem and leaf from the parent plant. The cut part is placed in a suitable medium for growth. It produces root and grows into a new plant. Depending upon the part used it is called as root cutting (*Malus*), stem cutting (*Hibiscus*, *Bougainvillea* and *Moringa*) and leaf cutting (*Begonia*, *Bryophyllum*). Stem cutting is widely used for propagation.

▶ **b. Grafting:**

In this, parts of two different plants are joined so that they continue to grow as one plant. Of the two plants, the plant which is in contact with the soil is called **stock** and the plant used for grafting is called **scion** (Figure 1.2 a). Examples are Citrus, Mango and Apple. There are different types of grafting based on the method of uniting the scion and stock. They are bud grafting, approach grafting, tongue grafting, crown grafting and wedge grafting.

**I. Bud grafting:**

A T- shaped incision is made in the stock and the bark is lifted. The scion bud with little wood is placed in the incision beneath the bark and properly bandaged with a tape.

### **ii. Approach grafting:**

In this method both the scion and stock remain rooted. The stock is grown in a pot and it is brought close to the scion. Both of them should have the same thickness. A small slice is cut from both and the cut surfaces are brought near and tied together and held by a tape. After 1-4 weeks the tip of the stock and base of the scion are cut off and detached and grown in a separate pot.

### **iii. Tongue grafting :**

- ▶ A scion and stock having the same thickness is cut obliquely and the scion is fit into the stock and bound with a tape.

### **iv. Crown grafting :**

When the stock is large in size scions are cut into wedge shape and are inserted on the slits or clefts of the stock and fixed in position using graft wax.

### **v. Wedge grafting :**

In this method a slit is made in the stock or the bark is cut. A twig of scion is inserted and tightly bound so that the cambium of the two is joined.

### **▶ c. Layering:**

- ▶ this method, the stem of a parent plant is allowed to develop roots while still intact. When the root develops, the rooted part is cut and planted to grow as a new plant. Examples: *Ixora* and *Jasminum*. Mound layering and Air layering are few types of layering.

#### **i. Mound layering:**

- ▶ This method is applied for the plants having flexible branches. The lower branch with leaves is bent to the ground and part of the stem is buried in the soil and tip of the branch is exposed above the soil. After the roots emerge from the part of the stem buried in the soil, a cut is made in parent plant so that the buried part grow into a new plant.

#### **ii. Air layering:**

- ▶ In this method the stem is girdled at nodal region and hormones are applied to this region which promotes rooting.

This portion is covered with damp or moist soil using a polythene sheet. Roots emerge in these branches after 2-4 months. Such branches are removed from the parent plant and grown in a separate pot or ground.

## **9. Tissue culture is the best method for propagating rare and endangered plants species**

- ▶ Micropropagation of plants invitro through issue culturing is a modern and alternative tool to conserve and safeguard rare plants species. Since the basic principle behind PTC is totipotency. With the help of a single explant it is possible to generate a huge population of plantlets within a short span of time. Conservation through micropropagation offers the possibility to rescue endangered and endemic species.

## **10. Distinguish mound layering and air layering?**

▶ AIR LAYERING	▶ MOUND LAYERING
The stem is girdled at nodal part and hormones are applied and covered with moist soil using polythene sheet. Roots emerge in these branches after 2-4 months. Such branches are removed from parent plant and grown separately	Lower flexible branch with leaves is bent to ground and a part of the stem is buried in the soil and the tip of branch is exposed above the soil. After the roots emerge from the buried stem, a cut is made in parent so that the buried plant grows into a new plant.

**12. What is Cantharophily ?**

pollination carried out by beetle is said to be cantharophily

**13. List any two strategy adopted by bisexual flowers to prevent self-pollination ?**

**i. Dichogamy:**

- ▶ In bisexual flowers anthers and stigmas mature at different times, thus checking self-pollination.

It is of two types.a) Protandryb) Protogyny

**ii. Herkogamy:**

- ▶ In bisexual flowers the essential organs, the stamens and stigmas, are arranged in such a way that self-pollination becomes impossible. For example in *Hibiscus* the stigmas project far above the stamens.

**14. What is endothelium ?**

In some species(unitegmic tenuinucellate) the inner layer of the integument may become specialized to perform the nutritive function for the embryo sac and is called as **endothelium** or **integumentary tapetum** (Example : Asteraceae).

**15. Define the term Diplospory ?**

**Diplospory (Generative apospory):**

- ▶ A diploid embryo sac is formed from megaspore mother cell without a regular meiotic division.
- ▶ Examples. *Eupatorium* and *Aerva*.

**16.What is polyembryony. How it can commercially exploited ?**

**▶ Polyembryony :**

- ▶ Occurrence of more than one embryo in a seed is called polyembryony.
- ▶ The first case of polyembryony was reported in certain oranges by Anton van Leeuwenhoek in the year 1719.

**Practical applications :**

- ▶ The seedlings formed from the nucellar tissue in *Citrus* are found better clones for Orchards.
- ▶ Embryos derived through polyembryony are found virus free.

**17. Why does the zygote divides only after the division of Primary endosperm cell ?**

► **Endosperm :**

- The primary endosperm nucleus (PEN) divides immediately after fertilization but before the zygote starts to divide, into an endosperm. It is a nutritive tissue and regulatory structure that nourishes the developing embryo.

**18. List out the functions of tapetum ?**

**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 pollenkit 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.

**19. What is Mellitophily?**

Pollination carried out by bees is said to be mellitophily.

**20. Write short note on Pollenkitt ?**

Pollenkitt is contributed by the tapetum and coloured yellow or orange and is chiefly made of carotenoids or flavonoids.

It is an oily layer forming a thick viscous coating over pollen surface.

It attracts insects and protects damage from UV radiation.

**21. ‘Pollination in Gymnosperms is different from Angiosperms’ – Give reasons.**

**Pollination** is a characteristic feature of spermatophyte (Gymnosperms and Angiosperms).

Pollination in gymnosperms is said to be direct as the pollens are deposited directly on the exposed ovules, whereas in angiosperms it is said to be indirect, as the pollens are deposited on the stigma of the pistil.

**22. Write short note on Heterostyly ?**

Heterostyly: Some plants produce two or three different forms of flowers that are different in their length of stamens and style. Pollination will take place only between organs of the same length. E.g: Primula.

**23. “The endosperm of angiosperm is different from gymnosperm”. Do you agree. Justify your answer.**

ENDOSPERM OF ANGIOSPERM	ENDOSPERM OF GYMNOSPERM
Develops as a result of double fertilization	Develops before eth fertilization process.
Endosperm is generally triploid (polyploid)	Endosperm is haploid.

**24. Endothecium is associated with dehiscence of anther. Justify the statement.**

- The inner tangential wall develops bands (sometimes radial walls also) of  $\alpha$  cellulose (sometimes also slightly lignified).

- ▶ The cells are **hygroscopic**.
- ▶ The cells along the junction of the two sporangia of an anther lobe lack these thickenings.
- ▶ This region is called **stomium**.
- ▶ This region along with the hygroscopic nature of endothecium helps in the dehiscence of anther at maturity.

**25. Enumerate the characteristic features of Entomophilous flowers ?**

- ▶ **The characteristic features of entomophilous flowers are as follows:**

- Flowers are generally large or if small they are aggregated in dense inflorescence. Example: Asteraceae flowers.

- Flowers are brightly coloured. The adjacent parts of the flowers may also be brightly coloured to attract insect.

For example in *Poinsettia* and *Bougainvillea* the bracts become coloured.

- Flowers are scented and produce nectar.
- Flowers in which there is no secretion of nectar, the pollen is either consumed as food or used in building up of its hive by the honeybees. Pollen and nectar are the floral rewards for the visitors.
- Flowers pollinated by flies and beetles produce foul odour to attract pollinators.
- In some flowers juicy cells are present which are pierced and the contents are sucked by the insects.

**26. Discuss the steps involved in Microsporogenesis ?**

**Microsporogenesis:**

- ▶ The stages involved in the formation of haploid microspores from diploid microspore mother cell through meiosis is called **Microsporogenesis**.
- ▶ The primary sporogenous cells directly, or may undergo a few mitotic divisions to form **sporogenous tissue**.
- ▶ The last generation of sporogenous tissue functions as microspore mother cells.
- ▶ Each microspore mother cell divides meiotically to form a tetrad of four haploid microspores (microspore tetrad).
- ▶ Microspores soon separate from one another and remain free in the anther locule and develop into pollen grains.

**27. With a suitable diagram explain the structure of an ovule ?**

**Structure of ovule(Megasporangium):**

- ▶ Ovule is also called megasporangium and is protected by one or two covering called **integuments**.
- ▶ A mature ovule consists of a stalk and a body.
- ▶ The stalk or the **funiculus** (also called funicle) is present at the base and it attaches the ovule to the placenta.
- ▶ The point of attachment of funicle to the body of the ovule is known as **hilum**.



- ▶ It represents the junction between ovule and funicle. In an inverted ovule, the funicle is adnate to the body of the ovule forming a ridge called **raphe**.
- ▶ The body of the ovule is made up of a central mass of parenchymatous tissue called **nucellus** which has large reserve food materials.
- ▶ The nucellus is enveloped by one or two protective coverings called **integuments**.
- ▶ Integument encloses the nucellus completely except at the top where it is free and forms a pore called micropyle.
- ▶ The ovule with one or two integuments are said to be **unitegmic** or **bitegmic** ovules respectively.
- ▶ The basal region of the body of the ovule where the nucellus, the integument and the funicle meet or merge is called as **chalaza**.
- ▶ There is a large oval, sac-like structure in the nucellus toward the micropylar end called **embryo sac** or female gametophyte.
- ▶ It develops from the functional megaspore formed within the nucellus. In some species (unitegmic tenuinucellate) the inner layer of the integument may become specialized to perform the nutritive function for the embryo sac and is called as **endothelium** or **integumentary tapetum**
- ▶ (Example : Asteraceae).

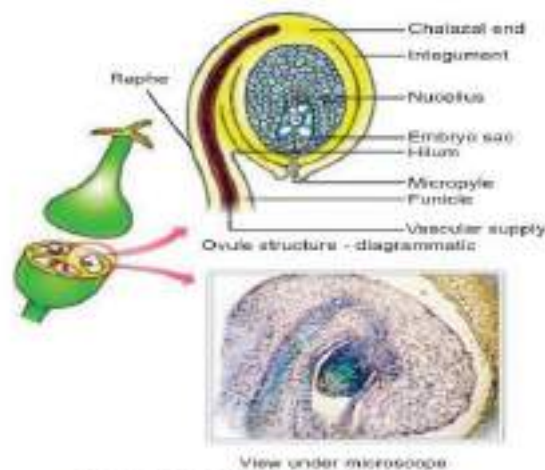


Figure 1.7 Structure of an ovule

**28. Give a concise account on steps involved in fertilization of an angiosperm plant ?**

1. Germination of pollen grain on stigma
2. Formation of pollen tube in stigma
3. Growth of pollen tube inside the style
4. Direction of pollen tube towards the micropyle of ovule
5. Entrance of pollen tube into the synergid of embryo sac
6. Discharge of male gametes from the pollen tube
7. Fusion of male gamete with egg cell (syngamy)
8. Fusion of second male gamete with polar nuclei (triple fusion / double fertilization)

**29. Differentiate the structure of Dicot and Monocot seed ?**

DICOT SEED	MONOCOT SEED
Possess two cotyledons	Possess only cotyledon
Absence of coleoptile and coleorhiza	Presence of coleoptile and coleorhiza surrounding plumule and radicle respectively.
Endosperm is scarce or absent	Endosperm from the major storage tissue

**30. Distinguish tenuinucellate and crassinucellate ovules?**

TENUINUCELLATE OVULE	CRASSINUCELLATE OVULE
Ovules with hypodermal sporogenous cell with unilayered nucellus tissue is called tenuinucellate type	Ovule with subhypodermal sporogenous cell is called crassinucellate type
They have very small nucellus	They have large nucellus

**31. What is endosperm. Explain the types ?**

► **Endosperm :**

The primary endosperm nucleus (PEN) divides immediately after fertilization but before the zygote starts to divide, into an endosperm.

The primary endosperm nucleus is the result of triple fusion (two polar nuclei and one sperm nucleus) and thus has  $3n$  number of chromosomes.

It is a nutritive tissue and regulatory structure that nourishes the developing embryo.

Depending upon the mode of development three types of endosperm are recognized in angiosperms.

Types of endosperm :

**i) Nuclear endosperm:**

Primary Endosperm Nucleus undergoes several mitotic divisions without cell wall formation thus a free nuclear condition exists in the endosperm. Examples: *Coccinia*, *Capsella* and *Arachis*

**ii) Cellular endosperm:**

Primary endosperm nucleus divides into 2 nuclei and it is immediately followed by wall formation.

Subsequent divisions also follow cell wall formation.

Examples: *Adoxa*, *Helianthus* and *Scoparia*

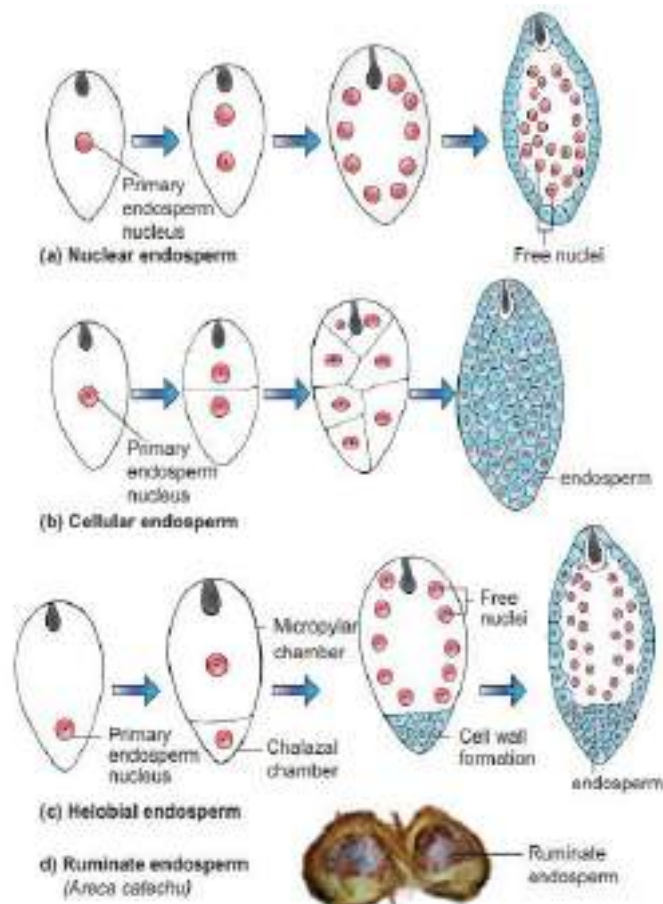


Figure 1.21 Types of Endosperm

iii) **Helobial endosperm:**

Primary Endosperm Nucleus moves towards base of embryo sac and divides into two nuclei. Cell wall formation takes place leading to the formation of a large micropylar and small chalazal chamber. The nucleus of the micropylar chamber undergoes several free nuclear division whereas that of chalazal chamber may or may not divide.

Examples : *Hydrilla* and *Vallisneria*.

iv) **Ruminant endosperm:**

The endosperm with irregularity and unevenness in its surface forms ruminant endosperm.

Examples : *Areca catechu*, *Passiflora* and *Myristica*

32. Give a detailed account on parthenocarpy. Add a note on its significance ?

- ▶ In some plants, fruit like structures may develop from the ovary without the act of fertilization.
- ▶ Such fruits are called **Parthenocarpic fruits**.
- ▶ Invariably they will not have true seeds.
- ▶ Many commercial fruits are made seedless.
- ▶ Examples: Banana, Grapes and Papaya.
- ▶ Nitsch in 1963 classified the parthenocarpy into following types:

i) **Genetic Parthenocarpy:**

Parthenocarpy arises due to hybridization or mutation Examples: *Citrus, Cucurbita*.

**ii) Environmental Parthenocarpy:**

Environmental conditions like frost, fog, low temperature, high temperature etc., induce Parthenocarpy.

- ▶ For example, low temperature for 3-19 hours induces parthenocarpy in Pear.

**iii) Chemically induced Parthenocarpy:**

Application of growth promoting substances like Auxins and Gibberellins induces parthenocarpy.

**Significance :**

- The seedless fruits have great significance in horticulture.
- The seedless fruits have great commercial importance.
- Seedless fruits are useful for the preparation of jams, jellies, sauces, fruit drinks etc.
- High proportion of edible part is available in parthenocarpic fruits due to the absence of seeds.

## Unit – VII GENETICS

### Chapter – 2

### CLASSICAL GENETICS

### EVALUATION ONE MARKS

1. Extra nuclear inheritance is a consequence of presence of genes in **Mitochondria and chloroplasts**
2. In order to find out the different types of gametes produced by a pea plant having the genotype AaBb, it should be crossed to a plant with the genotype **aabb**
3. How many different kinds of gametes will be produced by a plant having the genotype AABbCC? **Two**
4. Which one of the following is an example of polygenic inheritance **Skin Colour in humans**
5. In Mendel's experiments with garden pea, round seed shape (RR) was dominant over wrinkled seeds (rr), yellow cotyledon (YY) was dominant over green cotyledon (yy). What are the expected phenotypes in the F<sub>2</sub> generation of the cross RRY<sub>2</sub> x rryy? **Round seeds with yellow cotyledons and wrinkled seeds with yellow cotyledons**
6. Test cross involves **Crossing the F<sub>1</sub> hybrid with a double recessive genotype**
7. In pea plants, yellow seeds are dominant to green. If a heterozygous yellow seed plant is crossed with a green seeded plant, what ratio of yellow and green seeded plants would you expect in F<sub>1</sub> generation? **50:50**
8. The genotype of a plant showing the dominant phenotype can be determined by **Test cross**
9. Select the correct statement from the ones given below with respect to dihybrid cross **Tightly linked genes on the same chromosomes show very few combinations**
10. Which Mendelian idea is depicted by a cross in which the F<sub>1</sub> generation resembles both the parents **co-dominance**
11. Fruit colour in squash is an example of **Dominant epistasis**
12. In his classic experiments on Pea plants, Mendel did not use **Pod length**
13. The epistatic effect, in which the dihybrid cross 9:3:3:1 between AaBb Aabb is modified as **Dominance of one allele to another alleles of same loci**
14. In a test cross involving F<sub>1</sub> dihybrid flies, more parental type offspring were produced than the recombination type offspring. This indicates **The two genes are linked and present on the same chromosomes.**
15. The genes controlling the seven pea characters studied by Mendel are known to be located on how many different chromosomes? **four**
16. Which of the following explains how progeny can possess the combinations of traits that none of the parent possessed? **Chromosome theory**
17. "Gametes are never hybrid". This is a statement of **Law of segregation**
18. Gene which suppresses other genes activity but does not lie on the same locus is called as **epistatic**
19. Pure tall plants are crossed with pure dwarf plants. In the F<sub>1</sub> generation, all plants were tall. These tall plants of F<sub>1</sub> generation were selfed and the ratio of tall to dwarf plants obtained was 3:1. This is called **Dominance**
20. The dominant epistatic ratio is **12:3:1**

21. Select the period for Mendel's hybridization experiments **1856 - 1863**

22. Among the following characters which one was not considered by Mendel in his experimentation pea?  
**Trichomal glandular or non-glandular**

**Answer the following.**

**1. Name the seven contrasting traits of Mendel ?**

Plant height, seed shape, cotyledon, flower colour, pod colour, pod form, flower position

**2. What is meant by true breeding or pure breeding lines / strain?**

- ❖ A true breeding lines (Pure-breeding strains) means it has undergone continuous self pollination having stable trait inheritance from parent to offspring.
- ❖ Matings within pure breeding lines produce offsprings having specific parental traits that are constant in inheritance and expression for many generations.
- ❖ Pure line breed refers to homozygosity only.

**3. Give the names of the scientists who rediscovered Mendelism ?**

Mendel's experiments were rediscovered by three biologists, **Hugo de Vries** of Holland, **Carl Corren** of Germany and **Erich von Tschermak** of Austria.

**4. What is back cross?**

- Back cross is a cross of F<sub>1</sub> hybrid with any one of the parental genotype.
- The back cross is of two types they are dominant back cross and recessive back cross.
- It involves the cross between F<sub>1</sub> offspring with either of the two parents.

**5. Define Genetics.**

- ▶ "Genetics" is the branch of biological science which deals with the mechanism of transmission of characters from parents to off springs.
- ▶ The term **Genetics** was introduced by **W. Bateson** in 1906.

**6. What are multiple alleles ?**

Three or more alternative forms of a gene that occupy the same locus and control the expression of a single trait.

Eg : ABO blood group

**7. What are the reasons for Mendel's successes in his breeding experiment?**

▶ **Mendel was successful because:**

- ❖ • He applied mathematics and statistical methods to biology and laws of probability to his breeding experiments.
- ❖ • He followed scientific methods and kept accurate and detailed records that include quantitative data of the outcome of his crosses.
- ❖ • His experiments were carefully planned and he used large samples.
- ❖ • The pairs of contrasting characters which were controlled by factor (genes) were present on separate chromosomes.

- ❖ • The parents selected by Mendel were pure breed lines and the purity was tested by self crossing the progeny for many generations

### 8. Explain the law of dominance in monohybrid cross.

- ✓ Law of dominance states that the offsprings of an individual with contrasting (dissimilar) traits will only express the dominant trait in F1 generation and both the characters are expressed in F2 generation.

This law also explains the proportion of 3:1 ratio in F2 generation.

### 9. Differentiate incomplete dominance and co-dominance.

Incomplete dominance	Co - dominance
In incomplete dominance, neither of the allele is not completely dominant to another allele rather combine and produce new trait.	In co-dominance, both the alleles in heterozygote are dominant and the traits are equally expressed (joint expression)
New phenotype is formed due to character blending not (alleles)	No formation of new phenotype rather both dominant traits are expressed conjointly
Example : pink flower of <i>Mirabilis jalapa</i>	Example : red and white flowers of <i>camellia</i>

### 10. What is meant by cytoplasmic inheritance ?

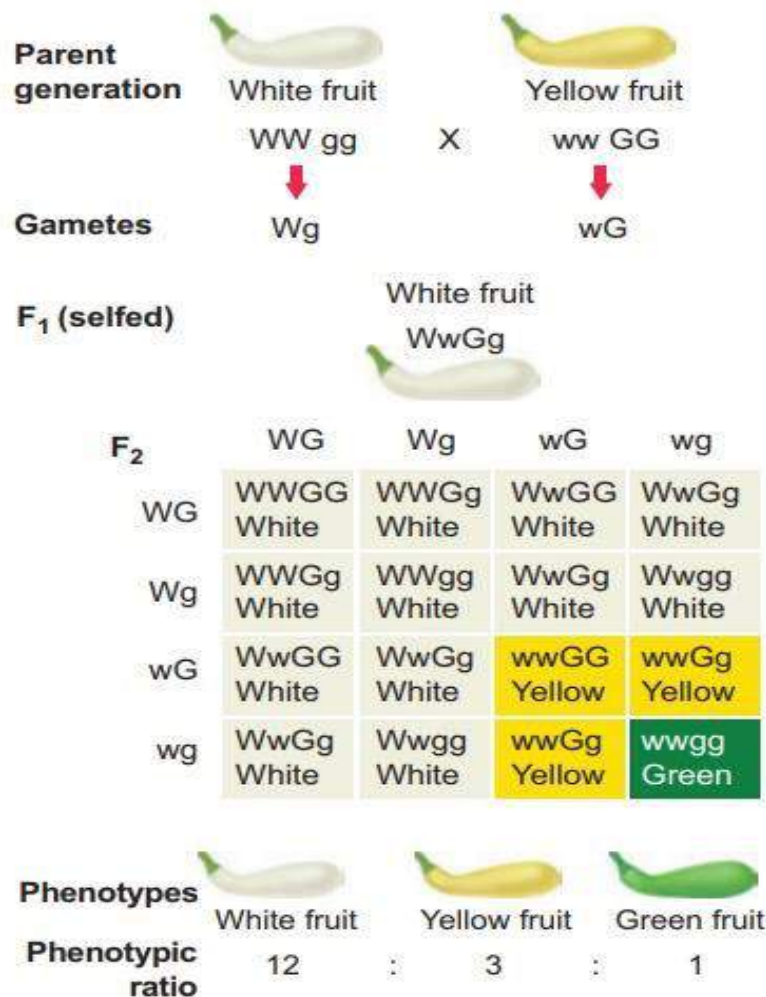
- DNA is the universal genetic material. Genes located in nuclear chromosomes follow Mendelian inheritance.
- But certain traits are governed either by the chloroplast or mitochondrial genes.
- This phenomenon is known as extra nuclear inheritance. It is a kind of Non-Mendelian inheritance.
- Since it involves cytoplasmic organelles such as chloroplast and mitochondrion that act as inheritance vectors, it is also called Cytoplasmic inheritance.

### 11. Describe dominant epistasis with an example.

#### ► Dominant Epistasis :

It is a gene interaction in which two alleles of a gene at one locus interfere and suppress or mask the phenotypic expression of a different pair of alleles of another gene at another locus.

The gene that suppresses or masks the phenotypic expression of a gene at another locus is known as **epistatic**



**Figure 2.16: Dominant epistasis in summer squash**

- ▶ The gene whose expression is interfered by non-allelic genes and prevents from exhibiting its character is known as **hypostatic**. When both the genes are present together, the phenotype is determined by the epistatic gene and not by the hypostatic gene.
- ▶ In the summer squash the fruit colour locus has a dominant allele 'W' for white colour and a recessive allele 'w' for coloured fruit.
- ▶ 'W' allele is dominant that masks the expression of any colour.
- ▶ In another locus hypostatic allele 'G' is for yellow fruit and its recessive allele 'g' for green fruit.
- ▶ In the first locus the white is dominant to colour where as in the second locus yellow is dominant to green. When the white fruit with genotype  $WWgg$  is crossed with yellow fruit with genotype  $wwGG$ , the F<sub>1</sub> plants have white fruit and are heterozygous ( $WwGg$ ).
- ▶ When F<sub>1</sub> heterozygous plants are crossed they give rise to F<sub>2</sub> with the phenotypic ratio of 12 white : 3 yellow : 1 green.
- ▶ Since W is epistatic to the alleles 'G' and 'g', the white which is dominant, masks the effect of yellow or green. Homozygous recessive  $ww$  genotypes only can give the coloured fruits (4/16).
- ▶ Double recessive ' $wwgg$ ' will give green fruit (1/16).
- ▶ The Plants having only 'G' in its genotype ( $wwGg$  or  $wwGG$ ) will give the yellow fruit (3/16).

**12. Explain polygenic inheritance with an example.**



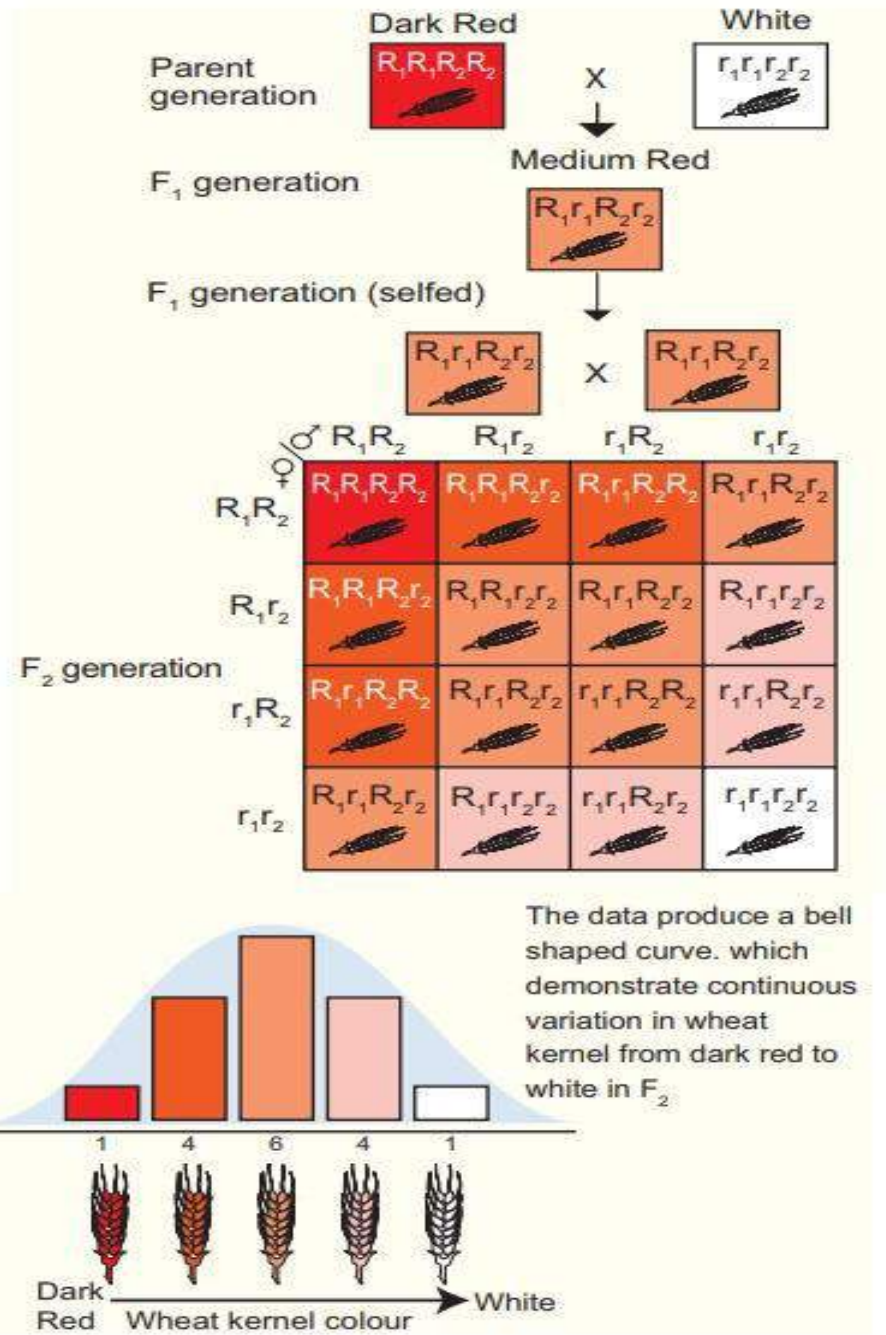
- ▶ A group of genes that together determine (contribute) a characteristic of an organism is called polygenic inheritance. It gives explanations to the inheritance of continuous traits which are compatible with Mendel's Law.
- ▶ The first experiment on polygenic inheritance was demonstrated by Swedish Geneticist H. Nilsson - Ehle (1909) in wheat kernels.
- ▶ Kernel colour is controlled by two genes each with two alleles, one with red kernel colour was dominant to white.
- ▶ He crossed the two pure breeding wheat varieties dark red and a white.
- ▶ Dark red genotypes  $R_1R_1R_2R_2$  and white genotypes are  $r_1r_1r_2r_2$ . In the F1 generation medium red were obtained with the genotype  $R_1r_1R_2r_2$ . F1 wheat plant produces four types of gametes  $R_1R_2$ ,  $R_1r_2$ ,  $r_1R_2$ ,  $r_1r_2$ .
- ▶ The intensity of the red colour is determined by the number of R genes in the F2 generation.
- ▶ **Four R genes:**
- ▶ A dark red kernel colour is obtained. **Three R genes:** Medium - dark red kernel colour is obtained. **Two R genes:** Medium-red kernel colour is obtained.

#### One R gene:

- ▶ Light red kernel colour is obtained. **Absence of R gene:** Results in White kernel colour.
- ▶ The R gene in an additive manner produces the red kernel colour.
- ▶ The number of each phenotype is plotted against the intensity of red kernel colour which produces a bell shaped curve. This represents the distribution of phenotype.
- ▶ Other example: Height and skin colour in humans are controlled by three pairs of genes.

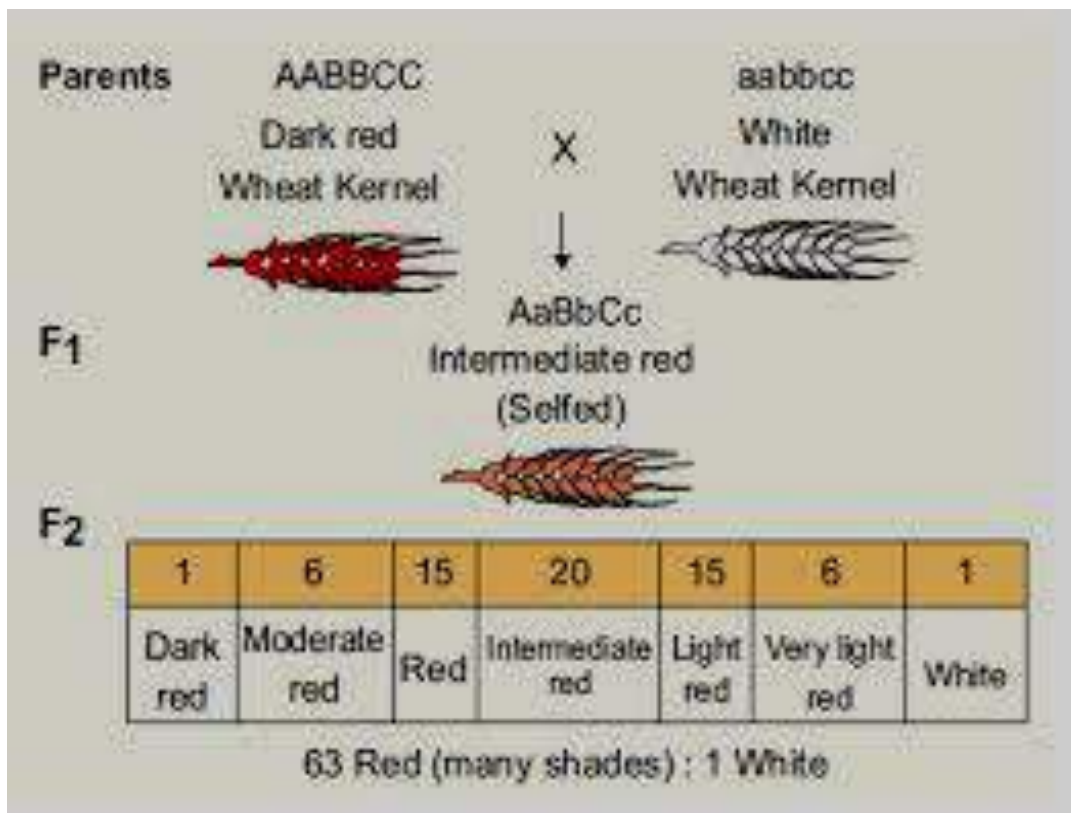
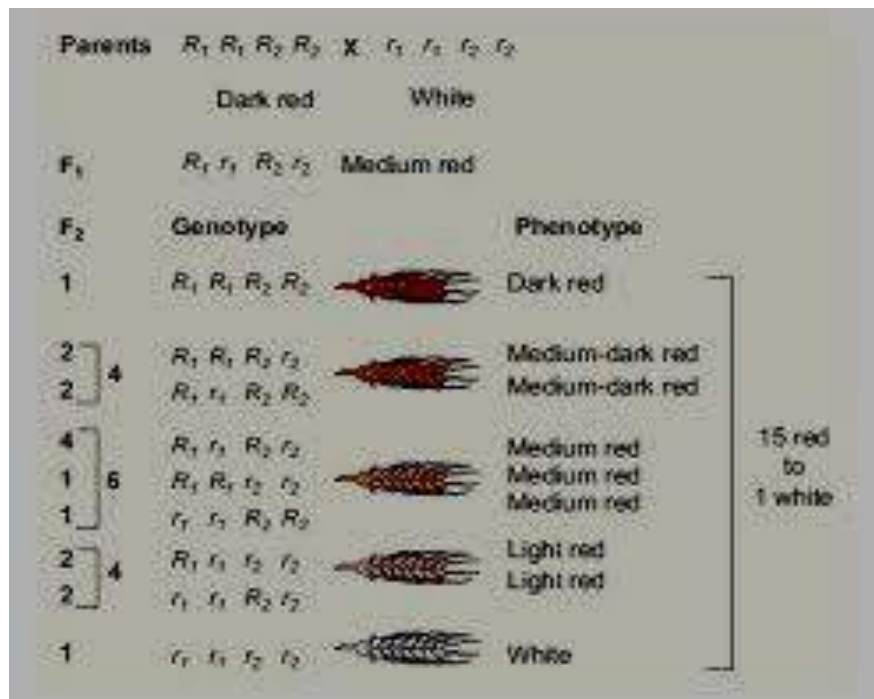
#### Conclusion:

- ▶ Finally the loci that was studied by Nilsson – Ehle were not linked and the genes assorted independently.
- ▶ Later, researchers discovered the third gene that also affect the kernel colour of wheat.
- ▶ The three independent pairs of alleles were involved in wheat kernel colour.
- ▶ Nilsson – Ehle found the ratio of 63 red : 1 white in F2 generation – 1 : 6 : 15 : 6 : 1 in F2 generation.



**Figure 2.17 (a):** Polygenic inheritance in wheat kernel colour





**13. Differentiate continuous variation with discontinuous variation.**

► **1. Discontinuous Variation:**

- Within a population there are some characteristics which show a limited form of variation. Example: Style length in *Primula*, plant height of garden pea.
- In discontinuous variation, the characteristics are controlled by one or two major genes which may have two or more allelic forms. These variations are genetically determined by inheritance factors.
- Individuals produced by this variation show differences without any intermediate form between them and there is no overlapping between the two phenotypes.

- ▶ The phenotypic expression is unaffected by environmental conditions. This is also called as qualitative inheritance.
- ▶ **2. Continuous Variation:**
- ▶ This variation may be due to the combining effects of environmental and genetic factors. In a population most of the characteristics exhibit a complete gradation, from one extreme to the other without any break.
- ▶ Inheritance of phenotype is determined by the combined effects of many genes, (polygenes) and environmental factors. This is also known as quantitative inheritance.
- ▶ Example: Human height and skin color.

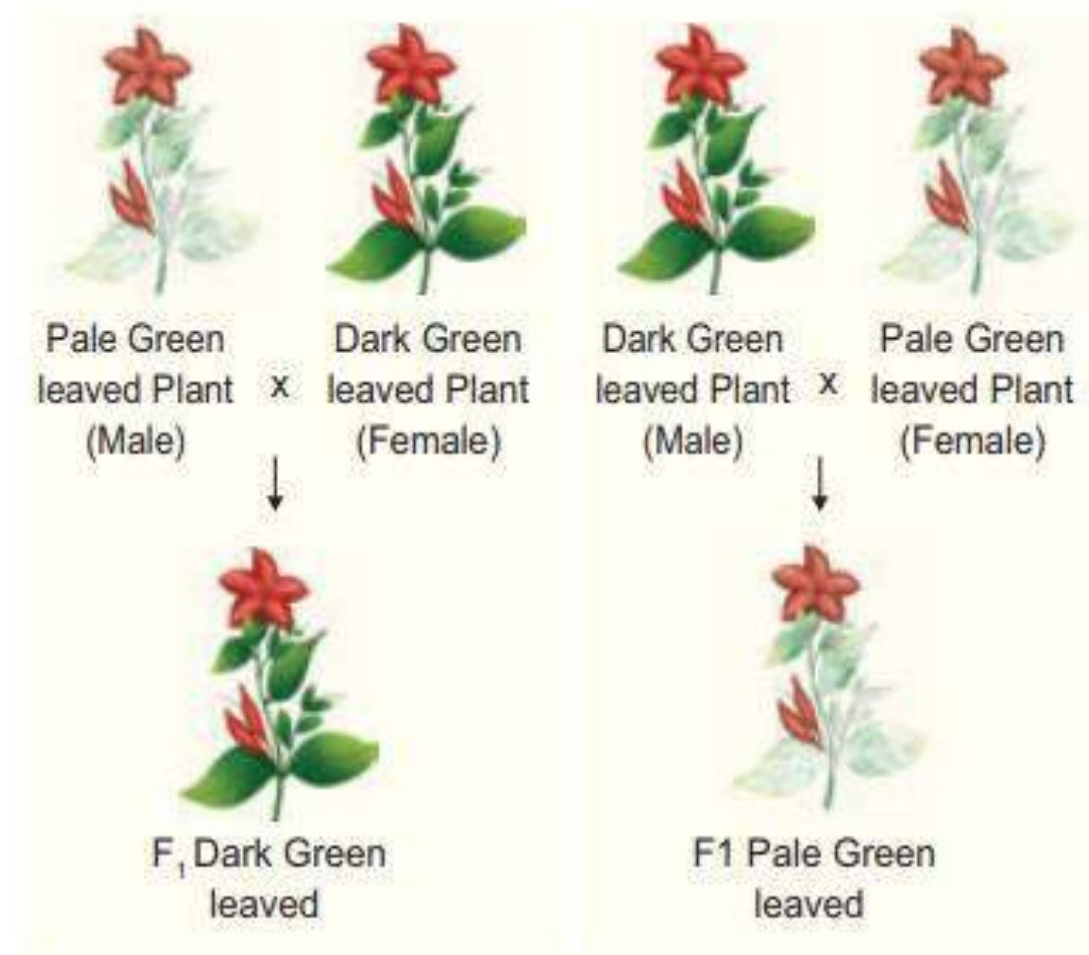
**14. Explain with an example how single genes affect multiple traits and alleles the phenotype of an organism.**

- ▶ In Pleiotropy, the single gene affects multiple traits and alter the phenotype of the organism.
- ▶ The Pleiotropic gene influences a number of characters simultaneously and such genes are called pleiotropic gene.
- ▶ Mendel noticed pleiotropy while performing breeding experiment with peas (*Pisumsativum*).
- ▶ Peas with purple flowers, brown seeds and dark spot on the axils of the leaves were crossed with a variety of peas having white flowers, light coloured seeds and no spot on the axils of the leaves, the three traits for flower colour, seed colour and a leaf axil spot all were inherited together as a single unit.
- ▶ This is due to the pattern of inheritance where the three traits were controlled by a single gene with dominant and recessive alleles.
- ▶ Example: sickle cell anemia.

**15. Bring out the inheritance of chloroplast gene with an example.**

- ▶ **Chloroplast Inheritance :**
- ▶ It is found in 4 O' Clock plant (*Mirabilis jalapa*). In this, there are two types of variegated leaves namely dark green leaved plants and pale green leaved plants.
- ▶ When the pollen of dark green leaved plant (male) is transferred to the stigma of pale green leaved plant (female) and pollen of pale green leaved plant is transferred to the stigma of dark green leaved plant, the F1 generation of both the crosses must be identical as per Mendelian inheritance.
- ▶ But in the reciprocal cross the F1 plant differs from each other.
- ▶ In each cross, the F1 plant reveals the character of the plant which is used as female plant.

This inheritance is not through nuclear gene. It is due to the chloroplast gene found in the ovum of the female plant which contributes the cytoplasm during fertilization since the male gamete contribute only the nucleus but not cytoplasm.



**Figure 2.19: Chloroplast inheritance**

## UNIT – VIII GENETICS

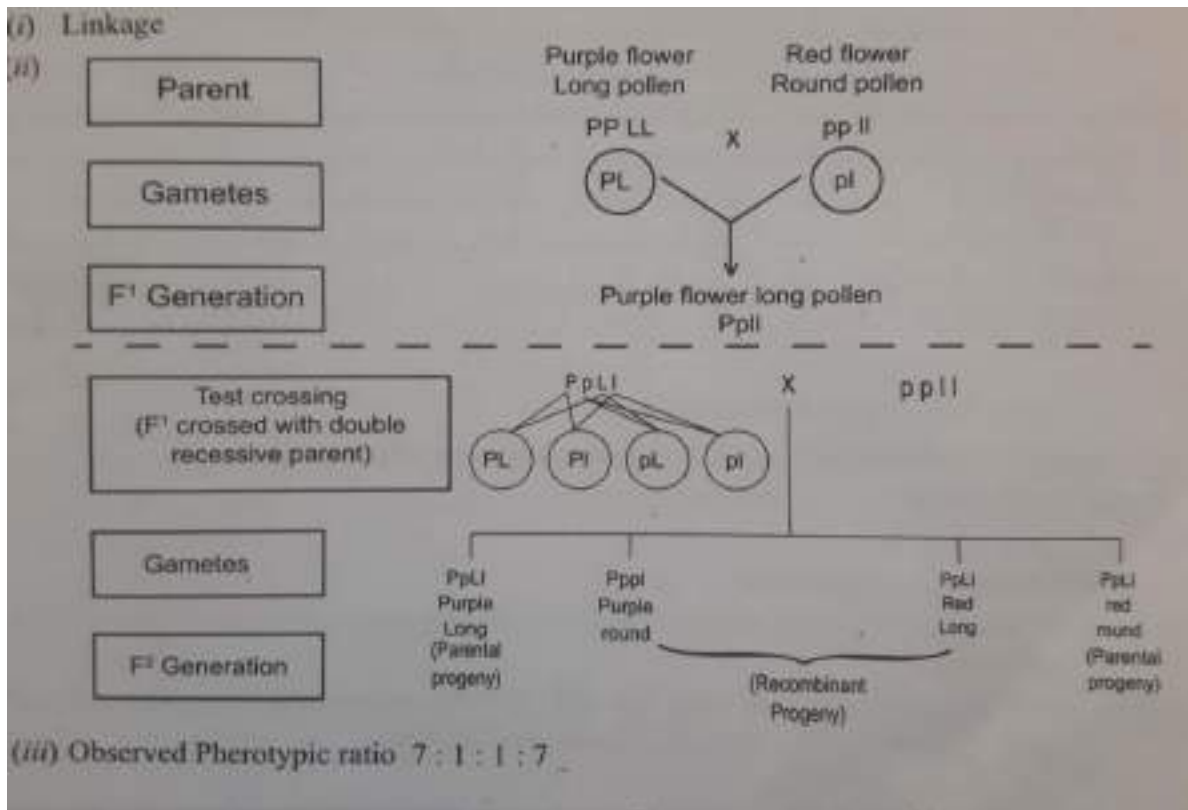
### Chapter – 3 CHROMOSOMAL BASIS OF INHERITANCE

#### EVALUATION ONE MARKS

1. An allohexaploidy contains **two copies of three different genomes**
2. The A and B genes are 10 cM apart on a chromosome. If an AB/ab heterozygote is testcrossed to ab/ab, how many number of each progeny class would you expect out of 100 total progeny? **45 AB, 45 ab, 5 Ab, 5 aB**
3. Match list I with list II
  - A. A pair of chromosomes extra with diploid i) monosomy **3**
  - B. One chromosome extra to the diploid ii) tetrasomy **1**
  - C. One chromosome loses from diploid iii) trisomy **2**
  - D. Two individual chromosomes lose from diploid iv) double monosomy **4**
4. Which of the following sentences are correct? **The separation of two linked genes are possible in incomplete linkage , Crossing over is absent in complete linkage (or) 3 and 4**
5. Accurate mapping of genes can be done by three point test cross because increases **Possibility of double cross over**
6. Due to incomplete linkage in maize, the ratio of parental and recombinants are **96 : 4 : 3 : 6**
7. Genes **G S L H** are located on same chromosome. The recombination percentage is between L and G is 15%, S and L is 50%, H and S are 20%. The correct order of genes is **SHGL**
8. The point mutation sequence for transition, transition, transversion and transversion in DNA are **A to G, C to T, C to G and T to A**
9. If haploid number in a cell is 18. The double monosomic and trisomic number will be **34 and 37**
10. Changing the codon AGC to AGA represents **mis-sense mutation**
11. **Assertion (A):** Gamma rays are generally use to induce mutation in wheat varieties.  
**Reason (R):** Because they carry lower energy to non- ionize electrons from atom  
**A is correct. R is wrong explanation of A**
12. How many map units separate two alleles A and B if the recombination frequency is 0.09? **9 cM**

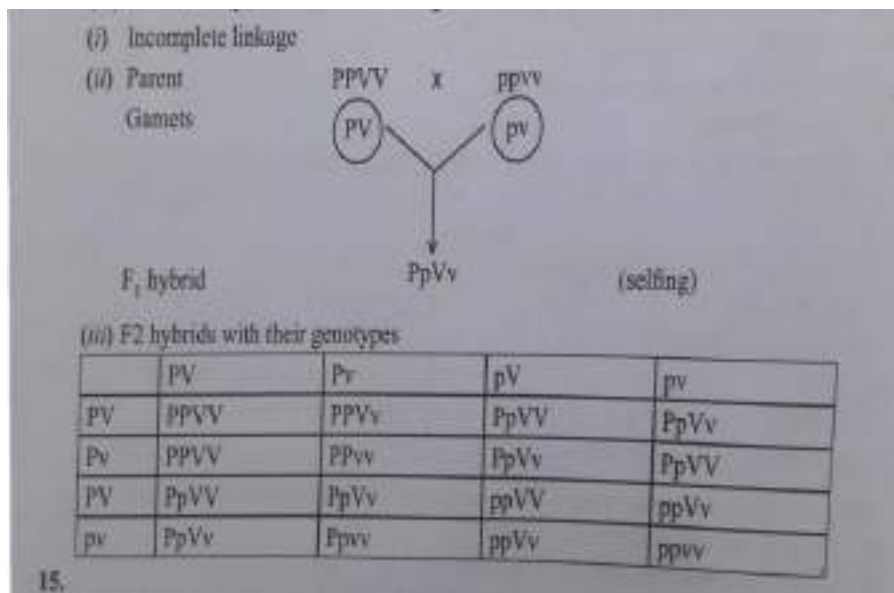
**Answer the following:**

1. **When two different genes came from same parent they tend to remain together.**
  - ▶ **i) What is the name of this phenomenon?**
  - ▶ **ii) Draw the cross with suitable example.**
  - ▶ **iii) Write the observed phenotypic ratio**



2. If you cross dominant genotype PV/PV male *Drosophila* with double recessive female and obtain F<sub>1</sub> hybrid. Now you cross F<sub>1</sub> male with double recessive female.

- ▶ i) What type of linkage is seen? ii) Draw the cross with correct genotype.
- ▶ iii) What is the possible genotype in F<sub>2</sub> generation?



3.



S. No	Gamete types	No. of progenies
1	ABC	349
2	Abc	114
3	abC	124
4	AbC	5
5	aBc	4
6	aBC	116
7	Abc	128
8	abc	360

**i) What is the name of this test cross?**

**ii) How will you construct gene mapping from the above given data?**

**iii) Find out the correct order of genes.**

▶ I) three point test cross.

▶ ii) construction of gene map :

▶ To construct the gene map, the recombinant frequency (rf) of the alleles has to be calculated.

From the given data it is clear that abc and abc parental (p) types and the others (abc, abc, abc, abc, abc) are recombinant (r) type

iii) Ans



Gametes	No. of Progenies	Recombinant for the alleles		
		A and B	A and C	B and C
ABC	349	-	-	-
Abc	114	R	R	-
abC	124	-	R	R
AbC	5	R	-	R
aBc	4	R	-	R
aBC	116	R	R	-
ABc	128	-	R	R
abc	360	-	-	-

Lets analyse the loci of two alleles at a time starting with A and B. Since the genes AB and ab are parental type, the recombinants will be Ab and aB.

Therefore

$$\text{Recombinant frequency of alleles Ab and aB} = \frac{\text{No. of recombinants}}{\text{Total progenies}} \times 100$$

$$= \frac{114+5+4+116}{1200} \times 100 = 19.91\%$$

Recombinant frequency for the loci A and C

The parental form are AC and ac and the recombinants are Aa and aC

$$\text{Recombinant frequency of alleles Aa and aC} = \frac{114+128+124+116}{1200} \times 100 = 40.16\%$$

Recombinant frequency for the loci B and C

The parental form are Bc and bC and the recombinant are Bc and bC.

$$\text{Recombinant frequency of alleles Bc and bC} = \frac{4+128+124+5}{1200} \times 100 = 21.75\%$$

Since the recombinant frequency of the alleles A and C shown highest frequency, they must be the farthest apart and alleles B must lie in between A and C. So the gene map can be constructed as follows



(iii) The correct gene order is ABC/abc.

#### 4. ABBCDEFGHI From the above figure identify the type of mutation and explain it.

- In reverse tandem duplication, the duplicated segment is located immediately after the normal segment but the gene sequence other will be reversed.

#### 5. What is the difference between missense and nonsense mutation?

Mis -sense mutation

Non-sense mutation

The mutation where the codon for one amino acid is changed into a codon for another amino acid is called mis-sense or non-synonymous mutation.

The mutation where codon for one amino acid is changed into a termination or stop codon is called non-sense mutation.

## 6. Write the salient features of Sutton and Boveri concept.

- ▶ **Salient features of the Chromosomal theory of inheritance :**
- ▶ Somatic cells of organisms are derived from the zygote by repeated cell division (mitosis). These consist of two identical sets of chromosomes. One set is received from female parent (maternal) and the other from male parent (paternal). These two chromosomes constitute the homologous pair.
- ▶ Chromosomes retain their structural uniqueness and individuality throughout the life cycle of an organism.
- ▶ Each chromosome carries specific determiners or Mendelian factors which are now termed as genes.
- ▶ The behaviour of chromosomes during the gamete formation (meiosis) provides evidence to the fact that genes or factors are located on chromosomes.

## 7. Explain the mechanism of crossing over.

- ▶ **Mechanism of Crossing Over :**
- ▶ Crossing over is a precise process that includes stages like synapsis, tetrad formation, cross over and terminalization.

### (i) Synapsis :

- ▶ Intimate pairing between two homologous chromosomes is initiated during zygotene stage of prophase I of meiosis I. Homologous chromosomes are aligned side by side resulting in a pair of homologous chromosomes called **bivalents**. This pairing phenomenon is called **synapsis or syndesis**. It is of three types,
- ▶ 1. **Procentric synapsis** : Pairing starts from middle of the chromosome.
- ▶ 2. **Proterminal synapsis**: Pairing starts from the telomeres.
- ▶ 3. **Random synapsis** : Pairing may start from anywhere.

### (ii) Tetrad Formation :

- ▶ Each homologous chromosome of a bivalent begin to form two identical sister chromatids, which remain held together by a centromere. At this stage each bivalent has four chromatids. This stage is called **tetrad stage**.

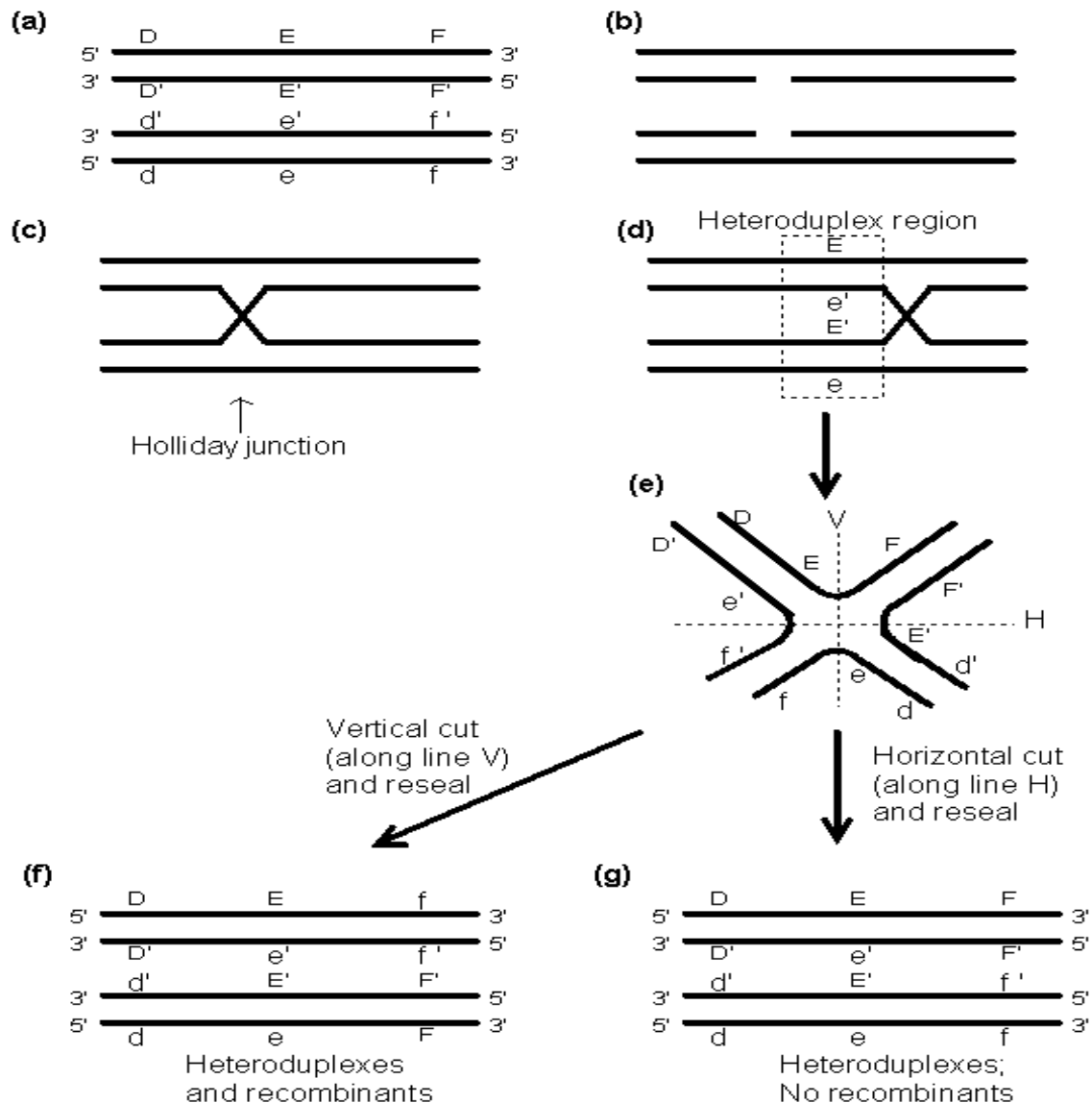
### (iii) Cross Over :

- ▶ After tetrad formation, crossing over occurs in pachytene stage. The non-sister chromatids of homologous pair make a contact at one or more points. These points of contact between non-sister chromatids of homologous chromosomes are called **Chiasmata**(singular-Chiasma). At chiasma, cross-shaped or X-shaped structures are formed, where breaking and rejoining of two chromatids occur. This results in reciprocal exchange of equal and corresponding segments between them. A recent study reveals that synapsis and chiasma formation are facilitated by a highly organised structure of filaments called **Synaptonemal Complex (SC)**. This synaptonemal complex formation is absent in some species of male *Drosophila* hence crossing over does not takes place.
- ▶ **(iv) Terminalisation** :After crossing over, chiasma starts to move towards the terminal end of chromatids. This is known as **terminalisation**. As a result, complete separation of homologous chromosomes occurs.

#### 8. Write the steps involved in molecular mechanism of DNA recombination with diagram ?

The widely accepted model of DNA recombination during crossing over is **Holliday's hybrid DNA model**. It was first proposed by **Robin Holliday** in 1964. It involves several steps.

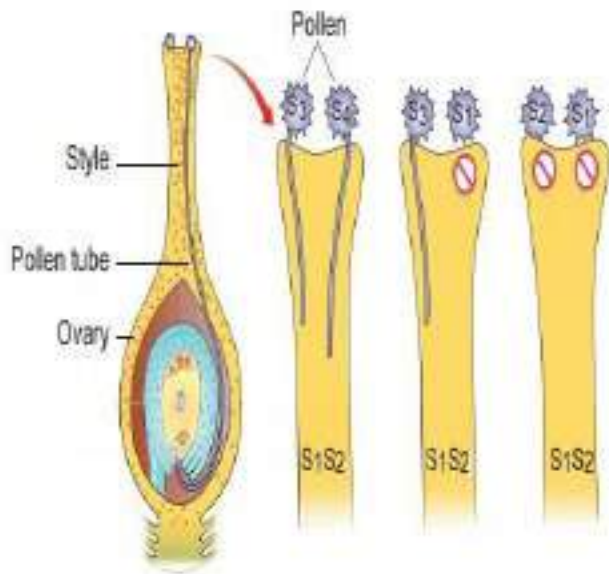
- 1. Homologous DNA molecules are paired side by side with their duplicated copies of DNAs
- 2. One strand of both DNAs cut in one place by the enzyme **endonuclease**.
- 3. The cut strands cross and join the homologous strands forming the **Holliday structure** or **Holliday junction**.



- 4. The Holliday junction migrates away from the original site, a process called **branch migration**, as a result heteroduplex region is formed.
- 5. DNA strands may cut along through the vertical (V) line or horizontal (H) line.
- 6. The vertical cut will result in heteroduplexes with recombinants.
- 7. The horizontal cut will result in heteroduplex with non recombinants.

**9. How is *Nicotiana* exhibit self-incompatibility. Explain its mechanism.**

- ▶ Self-sterility means that the pollen from a plant is unable to germinate on its own stigma and will not be able to bring about fertilization in the ovules of the same plant.
- ▶ **East (1925)** observed multiple alleles in *Nicotiana* which are responsible for self-incompatibility or self-sterility. The gene for self-incompatibility can be designated as S, which has allelic series S1, S2, S3, S4 and S5.



**Figure: 3.17** The self-incompatibility in relation to its genotype in tobacco

Female parent (Stigma spot)	Male parent (Pollen source)		
	$S_1S_2$	$S_2S_3$	$S_3S_4$
$S_1S_2$	Self Sterile	$S_3S_2$ $S_3S_1$	$S_3S_1$ $S_3S_2$ $S_4S_1$ $S_4S_2$
$S_2S_3$	$S_1S_2$ $S_1S_3$	Self Sterile	$S_4S_2$ $S_4S_3$
$S_3S_4$	$S_1S_3$ $S_1S_4$ $S_2S_3$ $S_2S_4$	$S_2S_3$ $S_2S_4$	Self Sterile

**Table: 3.5.** Different combinations of progeny in self-incompatibility



The cross-fertilizing tobacco plants were not always homozygous as  $S_1S_1$  or  $S_2S_2$ , but all plants were heterozygous as  $S_1S_2$ ,  $S_3S_4$ ,  $S_5S_6$ .

When crosses were made between different  $S_1S_2$  plants, the pollen tube did not develop normally.

- ▶ But effective pollen tube development was observed when crossing was made with other than  $S_1S_2$  for example  $S_3S_4$ .
- ▶ When crosses were made between seed parents with  $S_1S_2$  and pollen parents with  $S_2S_3$ , two kinds of pollen tubes were distinguished.
- ▶ Pollen grains carrying  $S_2$  were not effective, but the pollen grains carrying  $S_3$  were capable of fertilization.
- ▶ Thus, from the cross  $S_1S_2 \times S_3S_4$ , all the pollens were effective and four kinds of progeny resulted:  $S_1S_3$ ,  $S_1S_4$ ,  $S_2S_3$  and  $S_2S_4$ .

#### 10. How sex is determined in monoecious plants. write their genes involved in it.

- ▶ **Sex determination in maize :**
- ▶ Zea mays (maize) is an example for monoecious, which means male and female flowers are present on the same plant. There are two types of inflorescence.

- ▶ The terminal inflorescence which bears staminate florets develops from shoot apical meristem called **tassel**.
- ▶ The lateral inflorescence which develop pistillate florets from axillary bud is called **ear or cob**.
- ▶ Unisexuality in maize occurs through the selective abortion of stamens in ear florets and pistils in tassel florets.
- ▶ A substitution of two single gene pairs '**ba**' for barren plant and '**ts**' for tassel seed makes the difference between monoecious and dioecious (rare) maize plants.
- ▶ The allele for barren plant (ba) when homozygous makes the stalk staminate by eliminating silk and ears.
- ▶ The allele for tassel seed (ts) transforms tassel into a pistillate structure that produce no pollen. Most of these mutations are shown to be defects in gibberellin biosynthesis. Gibberellins play an important role in the suppression of stamens in florets on the ears.

Table: (Sex determination in Maize (Superscript(\*) denotes dominant character)

<b>Genotype</b>	<b>Dominant / recessive</b>	<b>Modification</b>	<b>Sex</b>
ba/ba ts/ts	Double recessive	Lacks silk on the stalk, but transformed tassel to pistil	Rudimentary female
ba/ba ts*/ts*	Recessive and dominant	Lacks silk and have tassel	Male
ba/ba ts*/ts*	Double dominant	Have both tassel and cob	Monoecious
ba*/ba* ts/ts	Dominant and recessive	Bears cob and lacks tassel	Normal female

### 11. What is gene mapping? Write its uses.

- ▶ The diagrammatic representation of position of genes and related distances between the adjacent genes is called **genetic mapping**. It is directly proportional to the frequency of recombination between them. It is also called as **linkage map**
- ▶ **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.

### 12. Mention the name of man-made cereal. How it is formed ?

- ▶ **Triticale**, the successful first man made cereal. Depending on the ploidy level Triticale can be divided into three main groups.

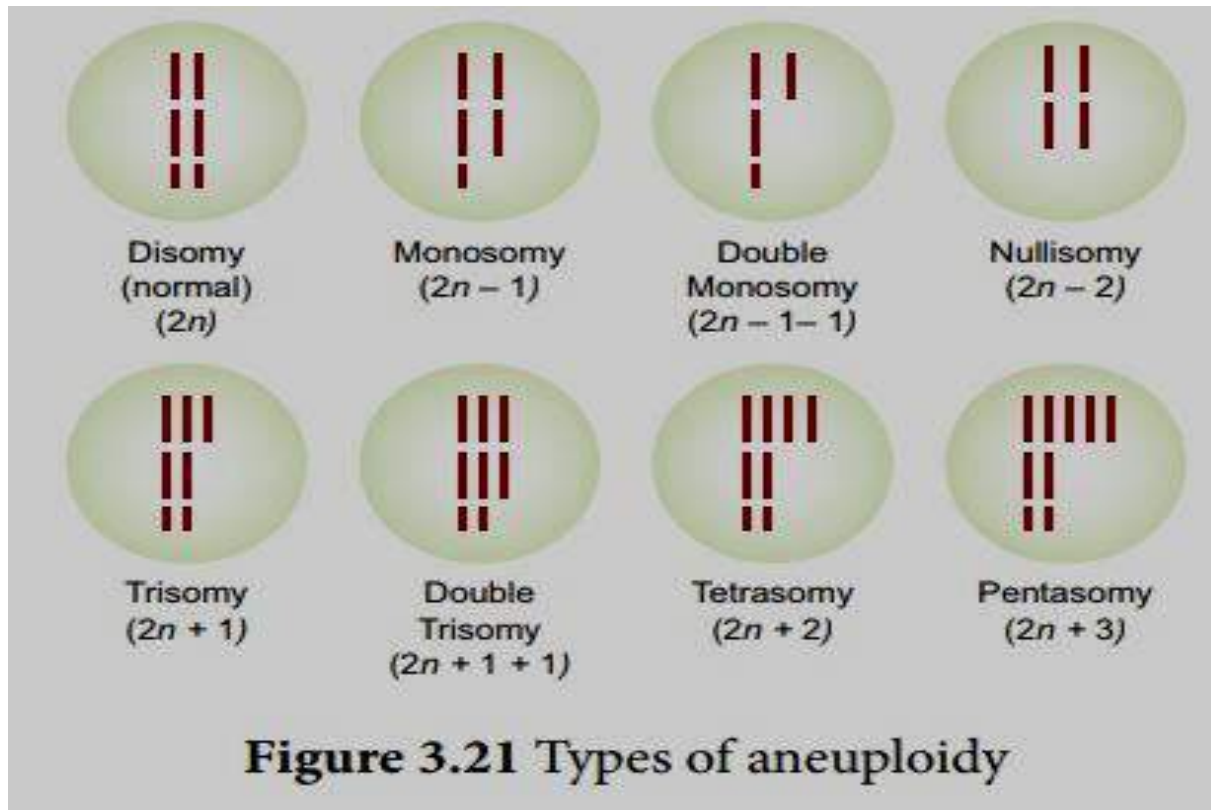
(i). Tetraploidy: Crosses between diploid wheat and rye.

(ii). Hexaploidy: Crosses between tetraploid wheat *Triticum durum* (macaroni wheat) and rye

(iii). Octoploidy: Crosses between hexaploid wheat *T. aestivum* (bread wheat) and rye

Hexaploidy Triticale hybrid plants demonstrate characteristics of both macaroni wheat and rye. For example, they combine the high-protein content of wheat with rye's high content of the amino acid lysine, which is low in wheat.

**12. Draw the diagram of different types of aneuploidy.**



## UNIT – VIII BIOTECHNOLOGY

### Chapter – 4 PRINCIPLES AND PROCESS OF BIOTECHNOLOGY

#### EVALUATION ONE MARKS

1. Restriction enzymes are **Essential tools in genetic engineering , Nucleases that cleave DNA at specific sites** (or) Both b and c
2. Plasmids are **confer resistance to antibiotics**
3. EcoRI cleaves DNA at **GAATTC**
4. Genetic engineering is **hybridization of DNA of one organism to that of the others.**
5. Consider the following statements:
  - i) Recombinant DNA technology is popularly known as genetic engineering is a stream of biotechnology which deals with the manipulation of genetic materials by man invitro ,
  - ii) pBR322 is the first artificial cloning vector developed in 1977 by Boliver and Rodriguez from E.coli plasmid ,
  - iii) Restriction enzymes belongs to a class of enzymes called nucleases.

Choose the correct option regarding above statemets.

**Ans : I, ii and iii**

6. The process of recombinant DNA technology has the following steps
  - I. amplication of the gene
  - II. Insertion of recombinant DNA into the host cells
  - III. Cutting of DNA at specific location using restriction enzyme .
  - IV. Isolation of genetic material (DNA) Pick out the correct sequence of step for recombinant DNA technology. **Ans : IV, III, I, II**
7. Which one of the following palindromic base sequence in DNA can be easily cut at about the middle by some particular restriction enzymes? **5' GAATTC 3' 3' CTTAAG 5'**
8. pBR 322, BR stands for **Plasmid Boliver and Rodriguez**
9. Which of the following one is used as a Biosensors? **enzymes**
10. In which techniques Ethidium Bromide is used? **Agrose Gel Electroporosis**
11. **Assertion** : Agrobacterium tumifaciens is popular in genetic engineering because this bacteriumis associated with the root nodules of all cereals and pulse crops

**Reason:** A gene incorporated in the bacterial chromosomal genome gets atomatically transferred to the cross with which bacterium is associated.



**iv) Both assertion and reason are false**

12. Which one of the following is not correct statement. **Ti plasmid causes the bunchy top disease**

13. An analysis of chromosomal DNA using the southern hybridisation technique does not use **polymerase chain reaction**

14. An antibiotic gene in a vector usually helps in the selection of **transformed cells**

15. Some of the characteristics of Bt cotton are **high yield and resistant to boll worms**

16. Match the following :

	Column A	Column B	
i)	Exonuclease	a. add or remove phosphate	3
ii)	Endonuclease	b. binding the DNA fragments	4
iii)	Alkaline Phosphatase	c. cut the DNA at terminus	1
iv)	Ligase	d. cut the DNA at middle	2

**Answer the following:**

**1. How do you use the biotechnology in modern practice?**

In modern practice, biotechnology is used in the development of herbicide resistance plants, improved crop varieties, producing pharma products like insulin, developing vaccines, diagnosing genetic diseases and designing drugs etc.

**2. What are the materials used to grow microorganism like Spirulina?**

Spirulina can be grown easily on materials like waste water from potato processing plants (containing starch), straw, molasses, animal manure and even sewage, to produce large quantities.

**3. You are working in a biotechnology lab with a bacterium namely E.coli.**

The DNA nucleotide sequence can be cut using Restriction endonucleases (RE).

Restriction endonucleases – EcoRI cuts the DNA at GAATTC – CTTAAG sequence, producing sticky ends.

**4. What are the enzymes you can use to cut terminal end and internal phosphodiester bond of nucleotide sequence?**

Restriction exonucleases are the restriction enzymes used to cut nucleotides from the terminal end of DNA.

Whereas, restriction endonucleases cut the internal phosphodiester bond with DNA molecule.

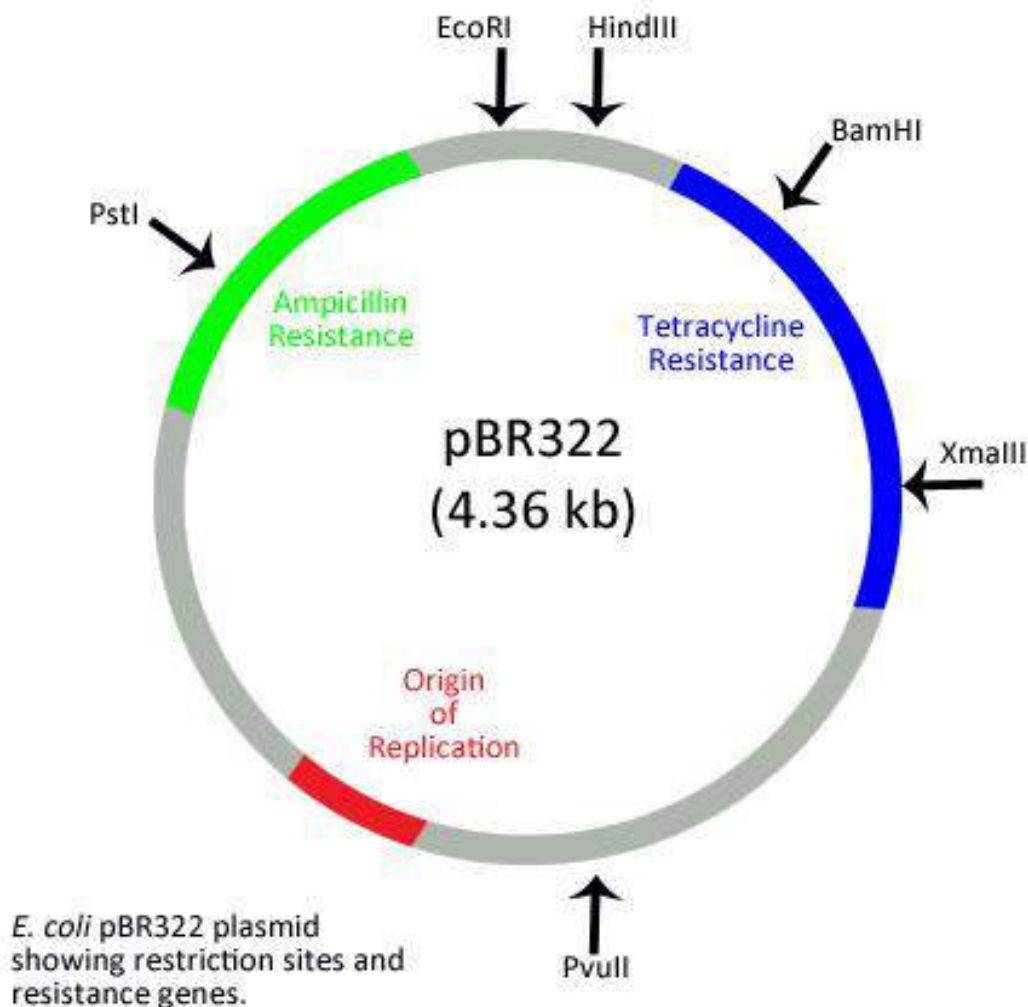
**5. Name the chemicals used in gene transfer.**

Polyethylene Glycol (PEG) and Dextran Sulphate.

**6. What do you know about the word pBR322?**

► **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 **B**oliver and **R**odriguez who developed this plasmid.
- The number **322** is the number of plasmid developed from their laboratory. It contains amp<sup>R</sup> and tet<sup>R</sup> two different antibiotic resistance genes and recognition sites for several restriction enzymes. (*Hind III*, *EcoRI*, *BamH I*, *Sal I*, *Pvu II*, *Pst I*, *Cla I*), ori and antibiotic resistance genes. Rop codes for the proteins involved in the replication of the plasmid.



**7. Mention the application of Biotechnology.**

► **Applications of Biotechnology :**

- • Biotechnology is one of the most important applied interdisciplinary sciences of the **21st century**. It is the trusted area that enables us to find the beneficial way of life.
- • Biotechnology has wide applications in various sectors like agriculture, medicine, environment and commercial industries.

- ▶ • This science has an invaluable outcome like **transgenic varieties** of plants e.g. transgenic cotton (Bt-cotton), rice, tomato, tobacco, cauliflower, potato and banana.
  - The development of transgenics as pesticide resistant, stress resistant and disease resistant varieties of agricultural crops is the immense outcome of biotechnology.
  - The synthesis of vaccines, enzymes, antibiotics, dairy products and beverages are the products of biotech industries.
  - **Biochip** based biological computer is one of the successes of biotechnology.
  - Genetic engineering involves genetic manipulation, tissue culture involves aseptic cultivation of totipotent plant cell into plant clones under controlled atmospheric conditions.
- **Single cell protein** from *Spirulina* is utilized in food industries.
- Production of **secondary metabolites**, biofertilizers, biopesticides and enzymes.
- Biomass energy, biofuel, Bioremediation, phytoremediation for environmental biotechnology.
- The synthesis of **human insulin** and blood protein in *E.coli* and utilized for insulin deficiency disorder in human is a breakthrough in biotech industries in medicine.

#### **8. What are restriction enzyme. Mention their type with role in Biotechnology.**

Restriction enzymes are the enzymes of bacterial origin which cleaves DNA into fragments at or near specific recognition sites within DNA molecules.

This principle is used in biotechnology to cut and insert the desired gene (gene of interest) thereby generating an rDNA with desirable characters.

#### **9. Is there any possibilities to transfer a suitable desirable gene to host plant without vector? Justify your answer.**

Yes, it is possible to transfer a suitable desired gene to a host plant using certain chemical, microinjection method, electroporation or by biolistics.

#### **10. How will you identify a vectors?**

##### **Properties of Vectors :**

- ▶ Vectors are able to replicate autonomously to produce multiple copies of them along with their DNA insert in the host cell.
  - It should be small in size and of low molecular weight, less than 10 Kb (kilo base pair) in size so that entry/transfer into host cell is easy.
  - Vector must contain an origin of replication so that it can independently replicate within the host.
  - It should contain a suitable marker such as antibiotic resistance, to permit its detection in transformed host cell.

- Vector should have unique target sites for integration with DNA insert and should have the ability to integrate with DNA insert it carries into the genome of the host cell.

Most of the commonly used cloning vectors have more than one restriction site.

These are Multiple Cloning Site (MCS) or polylinker.

Presence of MCS facilitates the use of restriction enzyme of choice.

### 11. Compare the various types of Blotting techniques.

	<b>Southern blotting</b>	<b>Northern blotting</b>	<b>Western blotting</b>
Name	Southern name of the inventor	Northern a misnomer	Western a misnomer
Separation of	DNA	RNA	Proteins
Denaturation	Needed	Non needed	Needed
Membrane	Nitrocellulose/nylon	Amino benzyloxymethyl	Nitrocellulose
Hybridisation	DNA-DNA	RNA-DNA	Protein-antibody
Visualising	Autoradiogram	Autoradiogram	Dark room

### 12. Write the advantages of herbicide tolerant crops.

#### **Advantages of Herbicide Tolerant Crops :**

- Weed control improves higher crop yields;
- Reduces spray of herbicide;
- Reduces competition between crop plant and weed;
- Use of low toxicity compounds which do not remain active in the soil; and
- The ability to conserve soil structure and microbes.

### 13. Write the advantages and disadvantages of Bt cotton.

#### **Advantages :**

The advantages of Bt cotton are:

- Yield of cotton is increased due to effective control of bollworms.
- Reduction in insecticide use in the cultivation of Bt cotton
- Potential reduction in the cost of cultivation.

#### **Disadvantages :**

Bt cotton has some limitations

- Cost of Bt cotton seed is high.
- Effectiveness up to 120 days after that efficiency is reduced
- Ineffective against sucking pests like jassids, aphids and whitefly.
- Affects pollinating insects and thus yield.

#### **14. What is bioremediation? give some examples of bioremediation.**

##### **Bioremediation :**

It is defined as the use of microorganisms or plants to clean up environmental pollution. It is an approach used to treat wastes including wastewater, industrial waste and solid waste.

Bioremediation process is applied to the removal of oil, petrochemical residues, pesticides or heavy metals from soil or ground water.

In many cases, bioremediation is less expensive and more sustainable than other physical and chemical methods of remediation. Bioremediation process is a cheaper and eco-friendly approach and can deal with lower concentrations of contaminants more effectively.

The strategies for bioremediation in soil and water can be as follows:

- Use of indigenous microbial population as indicator species for bioremediation process.
- Bioremediation with the addition of adapted or designed microbial inoculants.
- Use of plants for bioremediation - green technology.

#### **15. Write the benefits and risk of Genetically Modified Foods.**

##### **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.
- Adverse effect in immune system because of bacterial protein.
- Loss of viability of seeds show in terminator seed technology of GM crops.

# UNIT – VIII BIOTECHNOLOGY

## Chapter – 5 PLANT TISSUE CULTURE

### EVALUATION ONE MARKS

1. Totipotency refers to **capacity to generate a whole plant from any plant cell / explant.**
2. Micro propagation involves **vegetative multiplication of plants by using small explants.**
3. Match the following :

#### Column A

#### Column B

- |                      |  |          |
|----------------------|--|----------|
| 1) Totipotency       | A) Reversion of mature cells into meristem               | <b>2</b> |
| 2) Dedifferentiation | B) Biochemical and structural changes of cells           | <b>4</b> |
| 3) Explant           | C) Properties of living cells develops into entire plant | <b>1</b> |
| 4) Differentiation   | D) Selected plant tissue transferred to culture medium   | <b>3</b> |
4. The time duration for sterilization process by using autoclave is \_\_\_\_\_ minutes and the temperature is \_\_\_\_\_ **15 to 30 minutes and 121° C**
  5. Which of the following statement is correct **Callus undergoes differentiation and produces somatic embryoids.**
  6. Select the incorrect statement from given statement : **Anti-carcinogenic property is not seen in Catharanthus roseus.**
  7. Virus free plants are developed from **Meristem culture**
  8. The prevention of large scale loss of biological integrity **Bioethics**
  9. Cryopreservation means it is a process to preserve plant cells, tissues or organs **at very low temperature of -196 by using liquid nitrogen**
  10. Solidifying agent used in plant tissue culture is **Agar**

### Answer the following:

1. What is the name of the process given below? Write its 4 types.

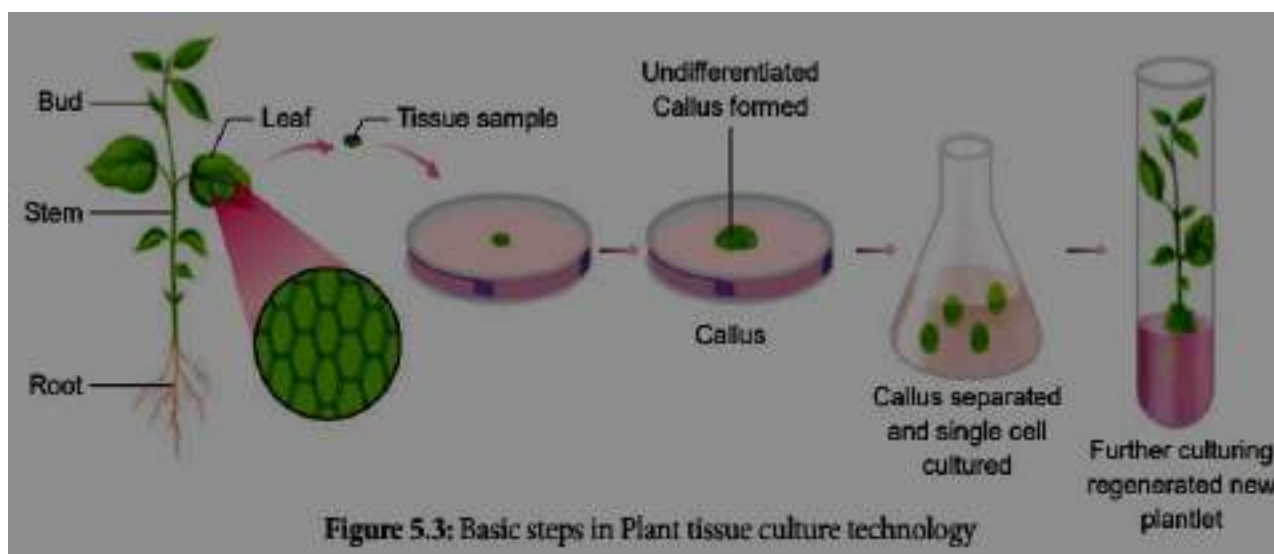


Figure 5.3: Basic steps in Plant tissue culture technology

The Name of the process is “ Plant tissue culture (PTC).

Based on the explant used, the PTC are of 4 types:

- a) Organ culture
- b) Meristem culture
- c) Protoplast culture
- d) Cell culture

**2. How will you avoid the growing of microbes in nutrient medium during culture process? What are the techniques used to remove the microbes?**

- ▶ The microbial growth in culture medium can be overcome by autoclaving the medium at 121° C (15 psi) for 15 to 30 minutes.
- ▶ Chemical sterilization using chemicals, sterilizing using UV radiation.
- ▶ Alcoholic sterilization using ethanol, autoclaving and filtration etc., are the various techniques used to remove microbes.

**3. Write the various steps involved in cell suspension culture.**

**Step 1 :** Growing of cell / callus in medium (single or aggregates).

**Step 2 :** Transfer of callus to a liquid medium.

**Step 3 :** Agitation of callus using rotary shaker.

**Step 4 :** Filtration and separation of cells.

**4. What do you mean Embryoids? Write its application.**

▶ **Somatic Embryogenesis :**

▶ Somatic embryogenesis is the formation of embryos from the callus tissue directly and these embryos are called **Embryoids** or from the *in vitro* cells directly form pre-embryonic cells which differentiate into embryoids.

▶ **Applications :**

- ▶ • Somatic embryogenesis provides potential plantlets which after hardening period can establish into plants.
- ▶ • Somatic embryoids can be used for the production of synthetic seeds.
- ▶ • Somatic embryogenesis is now reported in many plants such as *Allium sativum*, *Hordeum vulgare*, *Oryza sativa*, *Zea mays* and this possible in any plant.

**5. Give the examples for micro propagation performed plants .**

Pineapple, banana, strawberry and potato

**6. Explain the basic concepts involved in plant tissue culture.**

## **Basic concepts of Tissue Culture :**

- ▶ Basic concepts of plant tissue culture are **totipotency, differentiation, dedifferentiation and redifferentiation.**

### **i) Totipotency :**

- ▶ The property of live plant cells that they have the genetic potential when cultured in nutrient medium to give rise to a complete individual plant.

### **ii) Differentiation :**

- ▶ The process of biochemical and structural changes by which cells become specialized in form and function.

### **iii) Redifferentiation :**

- ▶ The further differentiation of already differentiated cell into another type of cell.
- ▶ For example, when the component cells of callus have the ability to form a whole plant in a nutrient medium, the phenomenon is called redifferentiation.

### **iv) Dedifferentiation :**

- ▶ The phenomenon of the reversion of mature cells to the meristematic state leading to the formation of callus is called dedifferentiation.
- ▶ These two phenomena of redifferentiation and dedifferentiation are the inherent capacities of living plant cells or tissue. This is described as totipotency.

## **7. Based on the material used, how will you classify the culture technology? Explain it.**

Based on the explants some other plant tissue culture types are ,

- 1. Organ culture** - Embryos, anthers, roots and shoots part are used
- 2. Meristem culture** - Meristematic tissues are used
- 3. Protoplast culture** - Protoplasts are used
- 4. Cell culture** - Single cells or aggregate of cells from callus are used

## **8. Give an account on Cryopreservation.**

### **Cryopreservation (–195.C) :**

- ▶ Cryopreservation, also known as Cryo-conservation, is a process by which protoplasts, cells, tissues, organelles, organs, extracellular matrix, enzymes or any other biological materials are subjected to preservation by cooling to very low temperature of  $-196^{\circ}\text{C}$  using liquid nitrogen.



- ▶ At this extreme low temperature any enzymatic or chemical activity of the biological material will be totally stopped and this leads to preservation of material in dormant status
- ▶ Later these materials can be activated by bringing to room temperature slowly for any experimental work.
- ▶ Protective agents like dimethyl sulphoxide, glycerol or sucrose are added before cryopreservation process.
- ▶ These protective agents are called cryoprotectants, since they protect the cells, or tissues from the stress of freezing temperature.

**9. What do you know about Germplasmconservation. Describe it**

- ▶ **Germplasm Conservation :**
- ▶ Germplasm conservation refers to the conservation of living genetic resources like pollen, seeds or tissue of plant material maintained for the purpose of selective plant breeding, preservation in live condition and used for many research works.
- ▶ Germplasm conservation resources is a part of collection of seeds and pollen that are stored in seed or pollen banks, so as to maintain their viability and fertility for any later use such as hybridization and crop improvement.
- ▶ Germplasm conservation may also involve a gene bank, DNA bank of elite breeding lines of plant resources for the maintenance of biological diversity and also for food security.

**10. Write the protocol for artificial seed preparation.**

**Development of callus through PTC**



**Induction of somatic embryogenesis**



**Maturation of embryoids**



**Encapsulation of embryoids using agrose + sodium alginate**



**Artificial seeds / synthetic seed**

Later these seeds are grown in vitro medium and converted into plantlets.

These plantlets require a hardening period and then shifted to normal environment condition.

## UNIT – IX PLANT ECOLOGY

### Chapter – 6

### PRINCIPLES OF ECOLOGY

CLASS : XII

### EVALUATION ONE MARKS

1. Arrange the correct sequence of ecological hierarchy starting from lower to higher level.

**Community → ecosystem----- Landscape → biome**

2. Ecology is the study of an individual species is called **Autecology** , **species ecology** (or) **ii and iii**

3. A specific place in an ecosystem, where an organism lives and performs its functions is **niche**

4. Read the given statements and select the correct option. **Hydrophytes possess aerenchyma to support themselves in water, Seeds of *Viscum* are positively photoblastic as they germinate only in presence of light** ( or ) **I and ii only**

5. Which of the given plant produces cardiac glycosides? *Calotropis*

6. Read the given statements and select the correct option. **Loamy soil is best suited for plant growth as it contains a mixture of silt, sand and clay. The process of humification is slow in case of organic remains containing a large amount of lignin and cellulose, Capillary water is the only water available to plant roots as it is present inside the micropores** (or) **I, ii and iii only**

7. Read the given statements and select the correct option.

**Statement A** : Cattle do not graze on weeds of *Calotropis*.

**Statement B** : *Calotropis* have thorns and spines, as defense against herbivores.

**Statement A is correct but statement B is incorrect.**

8. In soil water available for plants is **capillary water**

9. Read the following statements and fill up the blanks with correct option.

- i) Total soil water content in soil is called **Holard**
- ii) Soil water not available to plants is called **Echard**
- iii) Soil water available to plants is called **Chresard**

10. Column I represent the size of the soil particles and Column II represents type of soil components. Which of the following is correct match for the Column I and Column II

**Column – I**

**Column - II**

**I). 0.2 to 2.00 mm**

**i) Slit soil                      3**

**II) Less than 0.002 mm**

**ii) Clayey soil                      2**

**III) 0.002 to 0.02 mm**

**iii) Sandy soil                      1**

**IV) 0.002 to 0.2 mm**

**iv) Loamy soil                      4**

11. The plant of this group are adapted to live partly in water and partly above substratum and free from water  
**Halophytes**

12. Identify the A, B, C and D in the given table

Interaction	Effects on species X	Effects on species Y
Mutualism	A	(+)
B	(+)	(-)
Competition	(-)	C
D	(-)	0

**SAns : A = (+), B = Parasitism , C = (-), D = Amensalism**

13. *Ophrys* an orchid resembling the female of an insect so as to able to get pollinated is due to phenomenon of **Mimicry**

14. A free living nitrogen fixing cyanobacterium which can also form symbiotic association with the water fern *Azolla Anabaena*

15. Pedogenesis refers to **Soil**

16. Mycorrhiza promotes plant growth by **absorbing inorganic ions from soil**

17. Which of the following plant has a non-succulent xerophytic and thick leathery leaves with waxy coating ***Calotropis***

18. in a fresh water environment like pond rooted autotrophs are ***Nymphaea and typha***

19. Match the following and choose the correct combination from the options given below:

**Column I (Interaction)**

**Column II (Examples)**

I. Mutualism	i). <i>Trichoderma</i> and <i>Penicillium</i>	<b>5</b>
II. Commensalism	ii). <i>Balanophora</i> , <i>Orobanche</i>	<b>3</b>
III. Parasitism	iii). <i>Orchids</i> and <i>Ferns</i>	<b>2</b>
IV. Predation	iv). <i>Lichen</i> and <i>Mycorrhiza</i>	<b>1</b>
V. Amensalism	v). <i>Nepenthes</i> and <i>Diaonaea</i>	<b>4</b>

20. Strong, sharp spines that get attached to animal's feet are found in the fruits of ***Argemone***

21. Sticky glands of *Boerhaavia* and *Cleome* support **Zoochory**

**Answer the following:**

**1. Define ecology.**

“Ecology is the study of the reciprocal relationship between living organisms and their environment.”

**2. What is ecological hierarchy? Name the levels of ecological hierarchy.**

The interaction of organisms with their environment results in the establishment of grouping of organisms which is called **ecological hierarchy** or ecological levels of organization.

Biosphere → Biome → Landscape → Ecosystem → Community → Population → Individual organism

**3. What are ecological equivalents? Give one example .**

Taxonomically different species occupying similar habitats (Niches) in different geographical regions are called **Ecological equivalents**.

Examples : Certain species of epiphytic orchids of Western Ghats of India differ from the epiphytic orchids of South America. But they are epiphytes.

#### 4. Distinguish habitat and niche.

S. No.	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.

#### 5. Why are some organisms called as eurythermals and some others as stenohaline ?

- ▶ **1. Eurythermal:** Organisms which can tolerate a wide range of temperature fluctuations. Example: *Zostera* (A marine Angiosperm) and *Artemisia tridentata*.
- ▶ **2. Stenothermal:** Organisms which can tolerate only small range of temperature variations. Example: Mango and Palm (Terrestrial Angiosperms).

#### 6. 'Green algae are not likely to be found in the deepest strata of the ocean'. Give at least one reason.

As the name indicates, green algae possess photosynthetic pigments which use the light as energy source for survival and they are not found in deepest sea since there is lack of light.

#### 7. What is Phytoremediation ?

Phytoremediation refers to the using of living green plants to overcome soil or water contamination. E.g: growing *Eichhornia* in cadmium enriched soil reduces the level of cadmium.

#### 8. What is Albedo effect and write their effects?

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, SO<sub>2</sub> 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**.

#### 9. The organic horizon is generally absent from agricultural soils because tilling, e.g., plowing, buries organic matter. Why is an organic horizon generally absent in desert soils ?

organic horizon is generally absent in desert because of low content of organic matter due to scarcity of plant and animal remains or excreta.

**10. Soil formation can be initiated by biological organisms. Explain how?**

Soil formation is initiated by the weathering process. Biological weathering takes place when organisms like bacteria, fungi, lichens and plants help in the breakdown of rocks through the production of acids and certain chemical substances.

**11. Sandy soil is not suitable for cultivation. Explain why?**

Sandy soil has a high porosity leading to decreased water retention hence unfit for cultivation.

**12. Describe the mutual relationship between the fig and wasp and comment on the phenomenon that operates in this relationship.**

Wasp present in the fig is an example of mutualism where both the interacting species are benefitted from the obligate association. Wasps acts as a pollinating agents for figs inturn larvae of wasps are nourished and protected by fruit of figs.

**13. Lichen is considered as a good example of obligate mutualism. Explain.**

Lichen is a mutual association of an alga and a fungus, where the algal partner nourishes and provides shelter to fungi, inturn fungi confers protection from bacterial infections and also maintains moisture for algal growth.

**14. What is mutualism? Mention any two example where the organisms s**

Mutualism is an interaction between two species of organisms in which both are benefitted from the obligate association.

Nitrogen fixing cyanobacteria associated with Azolla (a fern) and Rhizobium found in the root nodules of leguminous plant are used in the field of agriculture to increase the soil fertility.

**15. List any two adaptive features evolved in parasites enabling them to live successfully on their host?**

Presence of haustorial roots inside the host plant to absorb nutrients.

**16. Mention any two significant roles of predation plays in nature.**

Predation maintains the stability of food chain in an ecosystem. Population of the insects and small animals are in control due to predation or else it may lead to overgrazing and browsing thereby altering the vegetation.

**17. How does an orchid *Ophrys* ensures its pollination by bees ?**

The plant, *Ophrys* an orchid, the flower looks like a female insect to attract the male insect to get pollinated by the male insect and it is otherwise called 'floral mimicry'.

**18. Water is very essential for life. Write any three features for plants which enable them to survive in water scarce environment.**

- a) Presence of highly developed root system to absorb water
- b) Stems and leaves are covered with waxing coating or dense hairs to avoid transpirational loss.
- c) Modified leavers generally leathery and shiny to reflect light and heat.

**19. Why do submerged plants receive weak illumination than exposed floating plants in a lake?**

Submerged plants like *Vallisneria* receive dim illumination because majority of the light are reflected back by the water surface whereas, the floating hydrophytes receive and absorb maximum light as they are on the water surface.

**20. What is vivipary? Name a plant group which exhibits vivipary.**

Vivipary is the phenomenon, where the seeds germinate and then starts developing to some extent before they detach from the parent plant body.

In plant, it is noticed in Halophytes like Rhizophora.

**21. What is thermal stratification? Mention their types.**

It is usually found in aquatic habitat.

The change in the temperature profile with increasing depth in a water body is called **thermal stratification**.

There are three kinds of thermal stratifications.

1. **Epilimnion**– The upper layer of warmer water.
2. **Metalimnion**– The middle layer with a zone of gradual decrease in temperature.
3. **Hypolimnion** - The bottom layer of colder water.

**22. How is rhytidome act as the structural defence by plants against fire?**

Rhytidome is the structural defense by plants against fire. The outer bark of trees which extends to the last formed periderm is called rhytidome. It is composed of multiple layers of suberized periderm, cortical and phloem tissues. It protects the stem against fire, water loss, invasion of insects and prevents infection by microorganisms.

**23. What is myrmecophily?**

Sometimes, ants take their shelter on some trees such as Mango, Litchi, Jamun and Acacia etc. these ants act as body guards of the plants against any disturbing agent and the plants in turn provide food and shelter to these ants. This phenomenon is known as Mymecophil.

**24. What is seed ball?**

Seed ball is an ancient Japanese technique of encasing seeds in a mixture of clay and soil humus (also in cow dung) and scattering them on to suitable ground, not planting of trees manually. This method is suitable for barren and degraded lands for tree regeneration and vegetation before monsoon period where the suitable dispersal agents become rare.

**25. How is anemochory differ from zoochory?**

S. No.	Anemochory	Zoochory
1.	Anemochory refers to the seed dispersal by wind	Zoochory refers to the seed dispersal by animals
2.	Anemochory seeds are very minute and may have wings or feathery appendages for dispersal.	Zoochory seeds and fruits are very fleshy and succulent and sticky they may have hooks to adhere to the body of animals.

3.

E.g: Orchids

E.g: Mango

## 26. What is co evolution?

The interaction between organisms, when continues for generations, involves reciprocal changes in genetic and morphological characters of both organisms. This type of evolution is called Co-evolution. It is a kind of co- adaptation and mutual change among interactive species.

- ▶ Examples: • Corolla length and proboscis length of butterflies and moths (*Habenaria* and Moth ).
- ▶ • Bird's beak shape and flower shape and size.

## 27. Explain Raunkiaer classification in the world's vegetation based on the temperature.

**Raunkiaer** classified the world's vegetation into the following four types. They are megatherms, mesotherms, microtherms and hekistotherms.

## 28. List out the effects of fire to plants.

### Effects of fire

- ▶ • Fire has a direct lethal effect on plants
- ▶ • Burning scars are the suitable places for the entry of parasitic fungi and insects
- ▶ • It brings out the alteration of light, rainfall, nutrient cycle, fertility of soil, pH, soil flora and fauna
- ▶ • Some fungi which grow in soil of burnt areas called pyrophilous.
- ▶ Example: *Pyronemaconfluens*.

## 29. What is soil profile? Explain the characters of different soil horizons.

- ▶ Soil is commonly stratified into horizons at different depth. These layers differ in their physical, chemical and biological properties. This succession of super imposed horizons is called soil profile.

<b>Horizon</b>	<b>Description</b>
O-Horizon (Organic horizon) Humus	It consists of fresh or partially decomposed organic matter. O1- Freshly fallen leaves, twigs, flowers and fruits O2- Dead plants, animals and their excreta decomposed by micro-organisms. Usually absent in agricultural and deserts.
A-Horizon (Leached horizon) Topsoil-Often rich in humus and minerals.	It consists of top soil with humus, living creatures and in –organic minerals. A1-Dark and rich in organic matter because of mixture of organic and mineral matters. A2- Light coloured layer with large sized mineral particles.
B-Horizon (Accumulation horizon) (Subsoil- Poor in humus, rich in minerals)	It consists of iron, aluminium and silica rich clay organic compounds.
C-Horizon (Partially weathered horizon) Weathered rock Fragments – Little or no plant or animal life.	It consists of parent materials of soil, composed of little amount of organic matters without life forms.
R-Horizon (Parent material) Bedrock	It is a parent bed rock upon which underground water is found.

### 30. Give an account of various types of parasitism with examples.

**Parasitism:** It is an interaction between two different species in which the **smaller partner** (parasite) obtains food from the **larger partner** (host or plant). So the parasitic species is benefited while the host species is harmed. Based on the host-parasite relationship, parasitism is classified into two types they are holoparasite and hemiparasite.

#### i) Holoparasites :

- ▶ The organisms which are dependent upon the host plants for their entire nutrition are called **Holoparasites**. They are also called **total parasites**.
- ▶ Examples:



- ▶ • *Cuscuta* is a total stem parasite of the host plant *Acacia*, *Duranta* and many other plants. *Cuscuta* even gets flower inducing hormone from its host plant.
- ▶ • *Balanophora*, *orobanche* and *Refflesia* are the total root parasites found on higher plants.

## ii) Hemiparasites :

- ▶ The organisms which derive only water and minerals from their host plant while synthesizing their own food by photosynthesis are called **Hemiparasites**. They are also called **partial parasites**.

Examples :

- ▶ • *Viscum* and *Loranthus* are **partial stem parasites**.
- ▶ • *Santalum* (Sandal Wood) is a **partial root parasite**.
- ▶ The parasitic plants produce the **haustorial roots** inside the host plant to absorb nutrients from the vascular tissues of host plants.

## 31. Explain different types of hydrophytes with examples.

### ▶ Hydrophytes :

- ▶ The plants which are living in water or wet places are called hydrophytes. According to their relation to water and air, they are sub-divided into following categories: i) Free floating hydrophytes, ii) Rooted- floating hydrophytes, iii) Submerged floating hydrophytes, iv) Rooted -submerged hydrophytes, v) Amphibious hydrophytes.

### ▶ i. Free floating hydrophytes:

- ▶ These plants float freely on the surface of water. They remain in contact with water and air, but not with soil. Examples: *Eichhornia*, *Pistia* and *Wolffia* (smallest flowering plant).

- ▶ **ii. Rooted floating hydrophytes:** In these plants, the roots are fixed in mud, but their leaves and flowers are floating on the surface of water. These plants are in contact with soil, water and air. Examples: *Nelumbo*, *Nymphaea*, *Potamogeton* and *Marsilea*.

- ▶ Lotus seeds showing highest longevity in plant kingdom.

### ▶ iii. Submerged floating hydrophytes:

- ▶ These plants are completely submerged in water and not in contact with soil and air.
- ▶ Examples: *Ceratophyllum* and *Utricularia*.
- ▶ **iv. Rooted- submerged hydrophytes:**
- ▶ These plants are completely submerged in water and rooted in soil and not in contact with air.
- ▶ Examples: *Hydrilla*, *Vallisneria* and *Isoetes*.
- ▶ **v. Amphibious hydrophytes (Rooted emergent hydrophytes):**
- ▶ These plants are adapted to both aquatic and terrestrial modes of life. They grow in shallow water.
- ▶ Examples: *Ranunculus*, *Typha* and *Sagittaria*.

### **32. Enumerate the anatomical adaptations of xerophytes.**

#### **Anatomical adaptations :**

- ▶ • Presence of multilayered epidermis with heavy cuticle to prevent water loss due to transpiration.
- ▶ • Hypodermis is well developed with sclerenchymatous tissues.
- ▶ • Sunken shaped stomata are present only in the lower epidermis with hairs in the sunken pits.
- ▶ • Scotoactive type of stomata found in succulent plants .
- ▶ • Vascular bundles are well developed with several layered bundle sheath.
- ▶ • Mesophyll is well differentiated into palisade and spongy parenchyma.
- ▶ • In succulents the stem possesses a water storage region.

### **33. List out any five morphological adaptations of halophytes.**

#### **Morphological adaptations :**

- ▶ • The temperate halophytes are herbaceous but the tropical halophytes are mostly bushy
- ▶ • In addition to the normal roots, many stilt roots are developed

- ▶ • A special type of negatively geotropic roots called **pneumatophores** with **pneumatodes** to get sufficient aeration are also present. They are called breathing roots.

Example: *Avicennia*

- ▶ • Presence of thick cuticle on the aerial parts of the plant body
- ▶ • Leaves are thick, entire, succulent and glossy. Some species are **aphyllous**(without leaves).

### 34. What are the advantages of seed dispersal?

#### Advantages of seed dispersal :

- ▶ • Seeds escape from mortality near the parent plants due to predation by animals or getting diseases and also avoiding competition.
- ▶ • Dispersal also gives a chance to occupy favourable sites for growth.
- ▶ • It is an important process in the movement of plant genes particularly this is the only method available for self-fertilized flowers and maternally transmitted genes in outcrossing plants.
- ▶ • Seed dispersal by animals help in conservation of many species even in human altered ecosystems.
- ▶ • Understanding of fruits and seed dispersal acts as a key for proper functioning and establishment of many ecosystems from deserts to evergreen forests and also for the maintenance of biodiversity conservation and restoration of ecosystems.

### 35. Describe dispersal of fruit and seeds by animals.

#### Dispersal by Animals (Zoochory) :

- ▶ Birds and mammals, including human beings play an efficient and important role in the dispersal of fruit and seeds. They have the following devices.

**i. Hooked fruit:** The surface of the fruit or seeds have hooks, (*Xanthium*), barbs (*Andropogon*), spines (*Aristida*) by means of which they adhere to the body of animals or clothes of human beings and get dispersed.

#### **ii. Sticky fruits and seeds:**

- ▶ **a.** Some fruits have sticky glandular hairs by which they adhere to the fur of grazing animals. Example: *Boerhaavia* and *Cleome*.

► **b.** Some fruits have viscid layer which adhere to the beak of the bird which eat them and when they rub them on to the branch of the tree, they disperse and germinate. Example: *Cordia* and *Alangium*

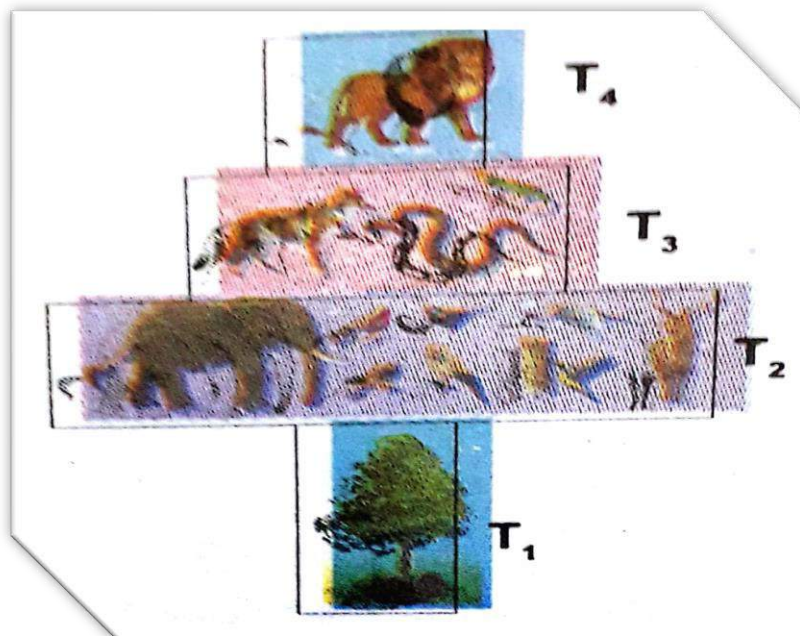
**iii. Fleshy fruits :** Some fleshy fruits with conspicuous colours are dispersed by human beings to distant places after consumption. Example: Mango and *Diplocyclos*.

## UNIT – IX PLANT ECOLOGY

### Chapter – 7 ECOSYSTEM

#### EVALUATION ONE MARKS

1. Which of the following is not a abiotic component of the ecosystem? **Bacteria**
2. Which of the following is / are not a natural ecosystem? **Rice field**
3. Pond is a type of **fresh water ecosystem**
4. Pond ecosystem **self sufficient and self regulating**
5. Profundal zone is predominated by heterotrophs in a pond ecosystem, because of **no effective light penetration**
6. Solar energy used by green plants for photosynthesis is only **2 – 10%**
7. Which of the following ecosystem has the highest primary productivity? **forest ecosystem**
8. Ecosystem consists of **decomposers, producers, consumers (or) all of the above**
9. Which one is in descending order of a food chain **Tertiary consumers ---- Secondary consumers ---- Primary consumers ---- Producers**
10. Significance of food web is / are **it shows patterns of energy transfer, it explains species interaction (or) b and c**
11. The following diagram represents :



**pyramid of number in a forest ecosystem**

12. Which of the following is / are not the mechanism of decomposition **Anabolism**
13. Which of the following is not a sedimentary cycle **Nitrogen cycle**

14. Which of the following are not regulating services of ecosystem services **Genetic resources, Recreation and aesthetic values (or) I and ii**

**Answer the following:**

1. **Productivity of profundal zone will be low. Why?**

The producers of the pond ecosystem depends of phytoplankton through photosynthesis. Profundal zone lies below the limnetic zone with no effective light penetration, hence productivity rate is very low.

2 . **Discuss the gross primary productivity is more efficient than net primary productivity.**

S. No.	Gross primary productivity (GPP)	Net primary productivity (NPP)
1.	It refers to the total amount of food energy or organic matter produced in an ecosystem by autotrophs.	It refers to the amount of energy that remain in autotrophs after respiration loss.
2.	$GPP = NPP + \text{Respiration}$	$NPP = GPP - \text{Respiration}$

3. **Pyramid of energy is always upright. Give reasons.**

The energy pyramid represents a successive energy flow at each trophic level in an ecosystem.

There is a gradual decrease in energy transfer at successive tropic levels from producers to higher levels, hence the pyramid of energy is always upright.

4. **what will happen if all producers are removed from ecosystem?**

Producers are the autotrophs which occupy the first tropic level in an ecosystem.

The energy produced by them is utilized by the herbivores and then by carnivores, thereby maintaining the stability of ecosystem.

If producers are removed from an ecosystem, it would lead to starvation and death of herbivores and subsequently the carnivores, thus terminating the entire food web.

5. **Construct the food chain with the following data.**

Hawk, plants, frog, snake, grasshopper.

Plants ----- Grasshopper ----- Frog ----- Snake----- Hawk

6. **Name of the food chain which is generally present in all type of ecosystem. Explain and write their significance.**

❖ **Detritus food chain is common in all type of ecosystem.**

- ❖ In detritus food chain, the dead remains of plant and animals or their excreta are broken down by detritivores and the organic and inorganic substances are returned back to environment.
- ❖ Thus maintaining the continuity of various biogeochemical cycles.
- ❖ Also microbes growing on detritus make the soil nutritious for consumers.

**7. Shape of pyramid in a particular ecosystem is always different in shape. Explain with example.**

In a forest ecosystem the pyramid of number is spindle in shape, it is because the base (T1) of the pyramid occupies large sized trees (producers) which are lesser in number.

Herbivores (T2) (fruit eating birds, elephant, deer) occupying second trophic level, are more in number than the producers. In final trophic level (T4), tertiary consumers (lion) are lesser in number than the secondary consumer (T3) (fox and snake).

**8. Generally human activities are against to the ecosystem, where as you a student how will you help to protect ecosystem?**

- Buy and use only ecofriendly products and recycle them.
- Grow more trees.
- Choose sustained farm products (vegetables, fruits, greens, etc.)
- Reduce the use of natural resources.
- Recycle the waste and reduce the amount of waste you produce.
- Reduce consumption of water and electricity.
- Reduce or eliminate the use of household chemicals and pesticides.
- Maintain your cars and vehicles properly. (in order to reduce carbon emission)
- Create awareness and educate about ecosystem protection among your friends and family members.

**9. Generally in summer the forest are affected by natural fire. Over a period of time it recovers itself by the process of successions .**

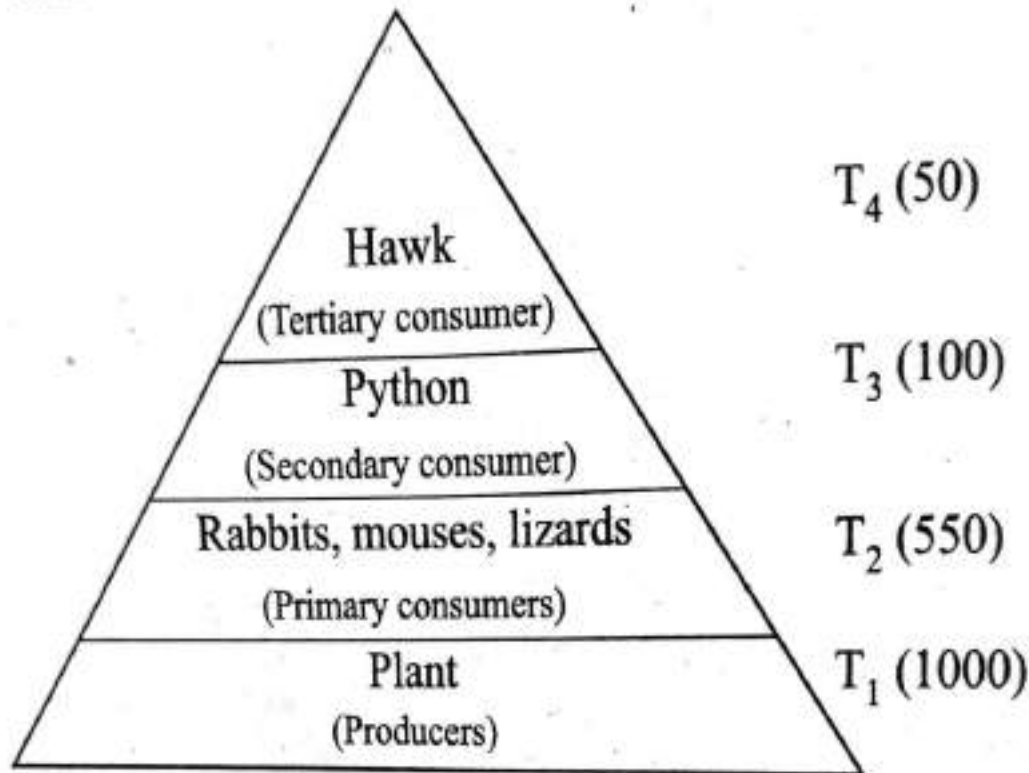
**Find out the types of succession and explain.**

- ❖ Process of succession – secondary succession.
- ❖ The development of a plant community in an area where an already developed community has been destroyed by natural causes is known as secondary succession.
- ❖ This type of succession takes less time to occur.

**10. Draw a pyramid from following details and explain in brief.**

- ❖ Quantities of organisms are given-Hawks-50, plants-1000, rabbit and mouse-250 +250, pythons and lizard- 100 + 50 respectively.

- ❖ The pyramid produced is an upright pyramid of numbers where there is a gradual decrease in number of organisms at each trophic level from T<sub>1</sub> to T<sub>4</sub>. This is an example for grassland ecosystem.



**11. Various stages of succession are given below. From that rearrange them accordingly. Find out the type of succession and explain in detail.**

- ❖ Reed-swamp stage, phytoplankton stage, shrub stage, submerged plant stage, forest stage, submerged free floating stage, marsh meadow stage.

1. Phytoplankton stage :

- ❖ It is the first stage of succession consisting of the pioneer community like blue green algae, green algae, diatoms, bacteria, etc., The colonization of these organisms enrich the amount of organic matter and nutrients of pond due to their life activities and death. This favors the development of the next seral stages.

2. Submerged plant stage :

- ❖ As the result of death and decomposition of planktons, silt brought from land by rain water, lead to a loose mud formation at the bottom of the pond. Hence, the rooted submerged hydrophytes begin to appear on the new substratum. Example: *Chara*, *Utricularia*, *Vallisneria* and *Hydrilla* etc. The death and decay of these plants will build up the substratum of pond to become shallow. Therefore, this habitat now replaces another group of plants which are of floating type.

3. Submerged free floating stage :

- ❖ During this stage, the depth of the pond will become almost 2-5 feet. Hence, the rooted hydrophytic plants and with floating large leaves start colonising the pond. Example: Rooted floating plants like *Nelumbo*, *Nymphaea* and *Trapa*. Some free floating species like *Azolla*, *Lemna*, *Wolffia* and *Pistia* are also present in this stage. By death and decomposition of these plants, further the pond becomes more shallow. Due to this reason, floating plant species is gradually replaced by another species which makes new seral stage.

4. Reed-swamp stage :



- ❖ It is also called an amphibious stage. During this stage, rooted floating plants are replaced by plants which can live successfully in aquatic as well as aerial environment. Example: *Typha*, *Phragmites*, *Sagittaria* and *Scirpus* etc. At the end of this stage, water level is very much reduced, making it unsuitable for the continuous growth of amphibious plants.

#### 5. Marsh meadow stage :

- ❖ When the pond becomes swallowed due to decreasing water level, species of Cyperaceae and Poaceae such as *Carex*, *Juncus*, *Cyperus* and *Eleocharis* colonise the area. They form a mat-like vegetation with the help of their much branched root system. This leads to an absorption and loss of large quantity of water. At the end of this stage, the soil becomes dry and the marshy vegetation disappears gradually and leads to shrub stage.

#### 6. Shrub stage :

- ❖ As the disappearance of marshy vegetation continues, soil becomes dry. Hence, these areas are now invaded by terrestrial plants like shrubs (*Salix* and *Cornus*) and trees (*Populus* and *Alnus*). These plants absorb large quantity of water and make the habitat dry. Further, the accumulation of humus with a rich flora of microorganisms produce minerals in the soil, ultimately favouring the arrival of new tree species in the area.

#### 7. Forest stage :

- ❖ It is the climax community of hydrosere. A variety of trees invade the area and develop any one of the diverse type of vegetation. Example: Temperate mixed forest (*Ulmus*, *Acer* and *Quercus*), Tropical rain forest (*Artocarpus* and *Cinnamomum*) and Tropical deciduous forest (*Bamboo* and *Tectona*).

## UNIT – IX PLANT ECOLOGY

### Chapter – 8 ENVIRONMENTAL ISSUES

#### EVALUATION ONE MARKS

1. Which of the following would most likely help to slow down the greenhouse effect **redesigning landfill dumps to allow methane to be collected.**

2. With respect to Eichhornia

Statement A : it drains off oxygen from water and is seen growing in standing water.

Statement B : it is an indigenous species of our country

**Statement A is correct and statement B is wrong.**

3. Find the wrongly matched pair.

**Sacred groves - Saintri hills of Rajasthan**

4. Depletion of which gas in the atmosphere can lead to an increased incidence of skin cancer? **Ozone**

5. One green house gas contributes 14% of total global warming and another contributes 6%. These are respectively identified as **CFCs and N<sub>2</sub>O**

6. One of the chief reasons among the following for the depletion in the number of species making endangered is **habitat destruction**

7. Deforestation means **removal of plants and trees**

8. Deforestation does not lead to **Quick nutrient cycling**

9. The unit for measuring ozone thickness **Dobson**

10. People's movement for the protection of environment in Sirsi of Karnataka is **Chipko movement**

11. The plants which are grown in silvopasture system are **Sesbania and Acacia**

**Answer the following:**

**1. What is ozone hole?**

The decline in the thickness of the ozone layer over restricted area is called Ozone hole.

**2. Give four examples of plants cultivated in commercial agroforestry.**

Casuarina, Eucalyptus, Teak, Malai vembu.

**3. Expand CCS.**

Carbon Capture and Storage.

**4. How do forests help in maintaining the climate?**

Forests play a major role in regulating the CO<sub>2</sub> level in the atmosphere. As the result global warming is highly reduced.

**5. How do sacred groves help in the conservation of biodiversity?**

These are the patches or grove of cultivated trees which are community protected and are based on strong religious belief systems which usually have a significant religious connotation for protecting community. Each grove is an abode of a deity mostly village God or Goddesses like Aiyanar or Amman. 448 grooves were documented throughout Tamil Nadu, of which 6 grooves (Banagudi shola, Thirukurungudi and Udaiyankudikadu, Sittannaval, Puthupet and Devadanam) were taken up for detailed floristic and

faunistic studies. These groves provide a number of ecosystem services to the neighbourhood like protecting watershed, fodder, medicinal plants and micro climate control.

**6. Which one gas is most abundant out of the four commonest greenhouse gases? Discuss the effect of this gas on the growth of plants?**

Carbondioxide is the most abundant greenhouse gas. Increase in CO<sub>2</sub> level in the air decreases the uptake of nitrogen components leading to protein deficiency and chlorophyll formation.

**7. Suggest a solution to water crisis and explain its advantages.**

Rainwater harvesting is the accumulation and storage of rain water for reuse in-site rather than allowing it to run off. Rainwater can be collected from rivers, roof tops and the water collected is directed to a deep pit. The water percolates and gets stored in the pit. RWH is a sustainable water management practice implemented not only in urban area but also in agricultural fields, which is an important economical cost effective method for the future.

**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.
- No land is wasted for storage purpose and no population displacement is involved.
- Storing water underground is an eco-friendly measure and a part of sustainable water storage strategy for local communities.

**8. Explain afforestation with case studies.**

Afforestation is planting of trees where there was no previous tree coverage and the conversion of non-forested lands into forests by planting suitable trees to retrieve the vegetation.

Example: Slopes of dams afforested to reduce water run-off, erosion and siltation. It can also provide a range of environmental services including carbon sequestration, water retention.

**The Man who Single Handedly Created a Dense Forest:**

Jadav “Molai” Payeng (born 1963) is an environmental activist has single-handedly planted a forest in the middle of a barren wasteland. This Forest Man of India has transformed the world’s largest river island, Majuli, located on one of India’s major rivers, the Brahmaputra, into a dense forest, home to rhinos, deers, elephants, tigers and birds. And today his forest is larger than Central Park.

Former vice-chancellor of Jawahar Lal Nehur University, Sudhir Kumar Sopory named Jadav Payeng as Forest Man of India, in the month of October 2013. He was honoured at the Indian Institute of Forest Management during their annual event ‘Coalescence’. In 2015, he was honoured with Padma Shri, the fourth highest civilian award in India. He received honorary doctorate degree from Assam Agricultural University and Kaziranga University for his contributions.

**9. What are the effects of deforestation and benefits of agroforestry?**

Effects of deforestation:

- Burning of forest wood release stored carbon, a negative impact just opposite of carbon sequestration.
- Trees and plants bind the soil particles. The removal of forest cover increases soil erosion and decreases soil fertility. Deforestation in dry areas leads to the formation of deserts.
- The amount of runoff water increases soil erosion and also creates flash flooding, thus moisture and humidity.
- The alternation of local precipitation patterns leading to drought conditions in many regions. It triggers adverse climatic conditions and alters water cycle in ecosystem.
- It decreases the bio-diversity significantly as their habitats are disturbed and disruption of natural cycles.
- Loss of livelihood for forest dwellers and rural people.

- Increased global warming and account for one-third of total CO<sub>2</sub> emission.
- Loss of life support resources, fuel, medicinal herbs and wild edible fruits.

**Benefits of agroforestry:**

- It is an answer to the problem of soil and water conservation and also to stabilize the soil (salinity and water table) reduce landslide and water run-off problem.
- Nutrient cycling between species improves and organic matter is maintained.
- Trees provide micro climate for crops and maintain O<sub>2</sub>- CO<sub>2</sub> balanced, atmospheric temperature and relative humidity.
- Suitable for dry land where rainfall is minimum and hence it is a good system for alternate land use pattern.
- Multipurpose tree varieties like Acacia are used for wood pulp, tanning, paper and firewood industries.
- Agro-forestry is recommended for the following purposes. It can be used as Farm Forestry for the extension of forests, mixed forestry, shelter belts and linear strip plantation.

# UNIT – X PLANT ECOLOGY

## Chapter – 9 PLANT BREEDING

### EVALUATION ONE MARKS

1. Assertion: Genetic variation provides the raw material for selection

Reason: Genetic variations are differences in genotypes of the individuals.

**Assertion is wrong and reason is right.**

2. While studying the history of domestication of various cultivated plants

\_\_\_\_\_ were recognized earlier **Centres of origin**

3. Pick out the odd pair. Clonal selection - Sexually propagated

4. Match Column I with Column II

Column I

Column II

i) William S. Gaud

I) Heterosis

**2**

ii) Shull

II) Mutation breeding

**4**

iii) Cotton Mather

III) Green revolution

**1**

iv) Muller and Stadler

IV) Natural hybridization

**3**

5. The quickest method of plant breeding is **Mutation breeding**

6. Desired improved variety of economically useful crops are raised by

**hybridization**

7. Plants having similar genotypes produced by plant breeding are called **clone**

8. Importing better varieties and plants from outside and acclimatising them to local environment is called **introduction**

9. Dwarfing gene of wheat is **Norin 10**

10. Crosses between the plants of the same variety are called **intra varietal**

11. Progeny obtained as a result of repeat self pollination a cross pollinated crop to called **Pure lien**

12. Jaya and Ratna are the semi dwarf varieties of **rice**

13. Which one of the following are the species that are crossed to give sugarcane varieties with high sugar, high yield, thick stems and ability to grow in the sugarcane belt of North India? **Saccharum barberi and Saccharum officinarum**

14. Match column I (crop) with column II (Corresponding disease resistant variety) and select the correct option from the given codes.

Column I

Column II

I) Cowpea

i) Himgiri

**2**

II) Wheat

ii) Pusa komal

**1**

III) Chilli                      iii) Pusa Sadabahar    **3**

IV) Brassica    iv) Pusa Swarnim        **4**

15. A wheat variety, Atlas 66 which has been used as a donor for improving cultivated wheat, which is rich in **proteins**

16. Which one of the following crop varieties correct matches with its resistance to a disease? Variety Resistance to disease **Pusa Komal - Bacterial blight**

17. Which of the following is incorrectly paired? **Pusa Komal - Brassica**

18. Match list I with list II

<b>List I</b>	<b>List II</b>	
<b>Biofertilizer</b>	<b>Organisms</b>	
i) Free living N <sub>2</sub>	a) Aspergillus	<b>3</b>
ii) Symbiotic N <sub>2</sub>	b) Amanita	<b>4</b>
iii) P Solubilizing	c) Anabaena azollae	<b>2</b>
iv) P Mobilizing	d) Azotobactor	<b>1</b>

**Answer the following:**

**1. Differentiate primary introduction from secondary introduction.**

<b>Primary Introduction</b>	<b>Secondary Introduction</b>
Primary introduction – When the introduced variety is well adapted to the new environment without any alternation to the original genotype.	Secondary introduction – When the introduced variety is subjected to selection to isolate a superior variety and hybridized with a local variety to transfer one or a few characters to them.

**2. How are microbial inoculants used to increase the soil fertility?**

Biofertilizers or microbial inoculants are defined as preparations containing living cells or latent cells of efficient strains of microorganisms that help crop plants uptake of nutrients by their interaction in the rhizosphere when applied through seed or soil.

They are efficient in fixing nitrogen, solubilising phosphate and decomposing cellulose. They are designed to improve the soil fertility, plant growth, and also the number and biological activity of beneficial microorganisms in the soil. They are ecofriendly organic agro inputs and are most efficient and cost effective than chemical fertilizers.

**3. What are the different types of hybridization?**

Types of Hybridization:

According to the relationship between plants, the hybridization is divided into.

- (i) Intravarietal hybridization – The cross between the plants of same variety. Such crosses are useful only in the self-pollinated crops.
- (ii) Intervarietal hybridization – The cross between the plants belonging to two different varieties of the same species and is also known as intraspecific hybridization. This technique has been the basis of improving self-pollinated as well as cross pollinated crops.
- (iii) Interspecific hybridization – The cross between the plants belonging to different species belonging to the same genus is also called intragenic hybridization. It is commonly used for

transferring the genes of diseases, insect, pest and drought resistance from one species to another.

Examples : *Gossypium hirsutum* x *Gossypium arboretum* – Deviraj.

(iv) Intergeneric hybridization – The crosses are made between the plants belonging to two different genera. The disadvantages are hybrid sterility, time consuming and expensive procedure.

Example: *Raphanobrassica* and *Triticale*.

#### **4. Explain the best suited type followed by plant breeders at present?**

Mutation breeding represents a new method of conventional breeding procedures as they have the advantage of improving the defect without losing agronomic and quality character in agriculture and crop improvement. Mutation means the sudden heritable changes in the genotype or phenotype of an organism. Gene mutations are of considerable importance in plant breeding as they provide essential inputs for evolution as well as for re-combination and selection. It is the only method for improving seedless crops.

#### **5. Write a note on heterosis.**

The superiority of the  $F_1$  hybrid in performance over its parents is called heterosis or hybrid vigour. Vigour refers to increase in growth, yield, greater adaptability of resistance to diseases, pest and drought. Vegetative propagation is the best suited measure for maintain hybrid vigour, since the desired characters are not lost and can persist over a period of time. Many breeders believe that its magnitude of heterosis is directly related to the degree of genetic diversity between the two parents. Depending on the nature, origin, adaptability and reproducing ability heterosis can be classified as:

- i) Euheterosis – This is the true heterosis which is inherited and is further classified as:
  - a) Mutational Euheterosis – Simplest type of euheterosis and results from the sheltering or eliminating of the deleterious, unfavourable often lethal, recessive, mutant genes by their adaptively superior dominant alleles in cross pollinated crops.
  - b) Balanced Euheterosis – Well balanced gene combinations which is more adaptive to environmental conditions and agricultural usefulness.

Pseudoheterosis – Also termed as luxuriance. Progeny possess superiority over parents in vegetative growth but not in yield and adaptation, usually sterile or poorly fertile.

#### **6. List out the new breeding techniques involved in developing new traits in plant breeding.**

New Breeding Techniques (NBT) are a collection of methods that could increase and accelerate the development of new traits in plant breeding. These techniques often involve genome editing, to modify DNA at specific locations within the plants to produce new traits in crop plants. The various methods of achieving these changes in traits include the following.

- Cutting and modifying the genome during the repair process by tools like CRISPR/Cas.
- Genome editing to introduce changes in few base pairs using a technique called Oligonucleotide-directed mutagenesis (ODM).
- Transferring a gene from an identical or closely related species (cisgenesis).
- Organising processes that alter gene activity without alternating the DNA itself (epigenetic methods).

## UNIT – X PLANT ECOLOGY

### Chapter – 10 PLANT BREEDING

#### EVALUATION ONE MARKS

1. Consider the following statements and choose the right option.

- i) Cereals are members of grass family.
- ii) Most of the food grains come from monocotyledon.

**Both (i) and (ii) are correct**

2. Assertion: Vegetables are important part of healthy eating.

Reason: Vegetables are succulent structures of plants with pleasant aroma and flavours.

**Assertion is correct, Reason is wrong**

3. Groundnut is native of **Brazil**

4. Statement A: Coffee contains caffeine

Statement B: Drinking coffee enhances cancer

**A is correct, B is wrong**

5. Tectona grandis is coming under family **Lamiaceae**

6. Tamarindus indica is indigenous to **Tropical African region**

7. New world species of cotton **G.barbadense**

8. Assertion: Turmeric fights various kinds of cancer

Reason: Curcumin is an anti-oxidant present in turmeric

**Both are correct**

9. Find out the correctly matched pair. **Dye Lawsonia inermis**

10. Observe the following statements and pick out the right option from the following:

Statement I – Perfumes are manufactured From essential oils.

Statement II – Essential oils are formed at different parts of the plants.

**Both statements are correct**

11. Observe the following statements and pick out the right option from the following:

Statement I: The drug sources of Siddha include plants, animal parts, ores and minerals.

Statement II: Minerals are used for preparing drugs with long shelf-life.

**Both statements are correct**

12. The active principle trans-tetra hydro canabial is present in **Marijuana**

13. Which one of the following matches is correct? **Steveocide - Natural sweetener**



14. The only cereal that has originated and domesticated from the New world.

**Zea mays**

**Answer the following.**

**1. Write the cosmetic uses of Aloe.**

Aloe gel are used as skin tonic. It has a cooling effect and moisturizing characteristics and hence used in preparation of creams, lotions, shampoos, shaving creams, after shave lotions and allied products. It is used in gerontological applications for rejuvenation of aging skin. Products prepared for aloe leaves have multiple properties such as emollient, antibacterial, antioxidant, antifungal and antiseptic. Aloe vera gel is used in skin care cosmetics.

**2. What is pseudo cereal? Give an example.**

The term pseudo-cereal is used to describe foods that are prepared and eaten as a whole grain, but are botanical outliers from grasses. Example: quinoa. It is actually a seed from the *Chenopodium quinoa* plant, belongs to the family Amaranthaceae.

**3. Discuss which wood is better for making furniture.**

Teak wood is the ideal type of wood for making household furnitures because, it is highly durable and shows great resistance against the attack of termites and fungi. Moreover it doesnot split or crack and is a carpenter friendly wood.

**4. A person got irritation while applying chemical dye. What would be your suggestion for alternative?**

If a grey haired person is allergic on using chemical dyes then he can go for natural dyes like Henna. Henna is an organic dye obtained from leaves and young shoots of *Lawsonia inermis*. The principal colouring matter is 'lacosone' which is harmless and causes no irritation on skin.

**5. Name the humors that are responsible for the health of human beings.**

Vatam, Pittam and Kapam.

**6. Give definitions for organic farming?**

Organic farming is an alternative agricultural system in which plants/crops are cultivated in natural ways by using biological inputs to maintain soil fertility and ecological balance thereby minimizing pollution and wastage.

**7. Which is called as the "King of Bitters"? Mention their medicinal importance.**

*Andrographis paniculata* is called as King of Bitters. *Andrographis* is a potent hepatoprotective agent and is widely used to treat liver disorders. Concoction of *Andrographis paniculata* and eight other herbs (*Nilavembu Kudineer*) is effectively used to treat malaria and dengue.

**8. Differentiate bio-medicines and botanical medicines.**

Bio-medicines	Botanical medicines
Medically useful molecules obtained from plants that are marketed as drugs are called Bio-medicines.	Parts of medicinal plants which are modified as powers or pills or other forms and marketed. These are called botanical medicines.

**9. Write the origin and area of cultivation of green gram and red gram.**

	Origin	Cultivation
Green gram.	Maharashtra (India)	Madhya Pradesh, Karnataka and Tamil Nadu.
Red gram.	South India.	Maharashtra, Andhra Pradesh, Madhya Pradesh, Karnataka and Gujarat.

**10. What are millets? What are its types? Give example for each type.**

Millet is the term applied to a variety of very small seeds originally cultivated by ancient people in Africa and Asia. They are gluten-free with less glycemic index.

Types of millet:

- a) Major millets – E.g: Ragi (Eleusine coracanca)
- b) Minor millets – E.g: Foxtail millet (Setaria italic)

**11. If a person drinks a cup of coffee daily it will help him for his health. Is this correct? If it is correct, list out the benefits.**

Yes, drinking coffee in moderation enhances the health of a person. Caffeine enhances releases of acetylcholine in brain, which in turn enhances efficiency. It can lower the incidence of fatty liver diseases, cirrhosis and cancer. It may reduce the risk of type 2 diabetes.

**12. Enumerate the uses of turmeric.**

Turmeric is one of the most important and ancient Indian spices and used traditionally over thousands of years for culinary, cosmetic, dyeing and for medicinal purposes. It is an important constituent of curry powders. Turmeric is used as a colouring agent in pharmacy, confectionery and food industry. Rice coloured with turmeric (yellow) is considered sacred and auspicious which is used in ceremonies. It is also used for dyeing leather, fibre, paper and toys.

Curcumin extracted from turmeric is responsible for the yellow colour. Curcumin is a very good anti-oxidant which may help fight various kinds of cancer. It has anti-inflammatory, anti-diabetic, anti-bacterial, anti-fungal and anti-viral activities. It stops platelets from clotting in arteries, which leads to heart attack.

**13. What is TSM? How does it classified and what does it focuses on?**

TSM stands for Traditional Systems of Medicines India has a rich medicinal heritage. A number of Traditional Systems of Medicine (TSM) are practiced in India some of which come from outside India. TSM in India can be broadly classified into institutionalized or documented and non-institutionalized or oral traditions. Institutionalized Indian systems include Siddha and Ayurveda which the symptoms, disease diagnosis, drugs to cure, preparation of drugs, dosage and diet regimes, daily and seasonal regimes. Non-institutional systems, whereas, do not have such records and or practiced by rural and tribal peoples across India. The knowledge is mostly held in oral form. The TSM focus on healthy lifestyle and healthy diet for maintaining good health and disease reversal.

**14. Write the uses of nuts you have studied?**

Cashews are commonly used for garnishing sweets or curries, or ground into a paste that forms a base of sauces for curries or some sweets. Roasted and raw kernels are used as snacks.

**15. Give an account on the role of Jasminum in perfuming.**

The essential jasmine oil is present in the epidermal cells of the inner and outer surfaces of both the sepals and petals. One ton of Jasmine blossom yields about 2.5 to 3kg of essential oil, comprising 0.25 to 3% of the weight of the fresh flower. Jasmine oil is an essential oil that is valued for its soothing, relaxing and antidepressant qualities.

**16. Give an account of active principle and medicinal values of any two plants you have studies.**

	Plant Name	Active Principle	Medicinal values
a)	Cannabis sativa	Trans-tetrahydrocannabinol (TCH)	Used as pain reliver, reduces hypertension, used to treat glaucoma and cancers and also to treat asthma
b)	Papaver somniferum	Morphine	Used as strong analgesic in surgeries.

### **17. Write the economic importance of rice.**

Rice is the easily digestible calorie rich cereal food which is used as a staple food in Southern and North East India. Various rice products such as Flaked rice (Aval), Puffed rice / parched rice (Pori) are used as breakfast cereal or as snack food in different parts of India. Rice bran oil obtained from the rice bran is used in culinary and industrial purposes. Husks are used as fuel, and in the manufacture of packing material and fertilizer.

### **18. What TSM is widely practiced and culturally accepted in Tamil Nadu? – explain.**

Siddha is the most popular, widely practiced and culturally accepted system in Tamil Nadu. It is based on the texts written by 18 Siddhars. There are different opinions on the constitution of 18 Siddhars. The Siddhars are not only from Tamil Nadu, but have also come from other countries. The entire knowledge is documented in the form of poems in Tamil. Siddha is principally based on the Pancabuta philosophy. According to this system three humors namely Vatham, Pittam and Kapam that are responsible for the health of human beings and any disturbance in the equilibrium of these humors result in ill health. The drug sources of Siddha include plants, animal parts, marine products and minerals. This system is specialized in using minerals for preparing drugs with the long shelf-life. This system specializes in using minerals for preparing drugs with the long shelf-life. This system uses about 800 herbs as source of drugs. Great stress is laid on disease prevention, health promotion, rejuvenation and cure.

### **19. What are psychoactive drugs? Add a note Marijuana and Opium.**

Phytochemicals or drugs from some of the plants alter an individual's mind by producing hallucinations and are known as psychoactive drugs.

#### Marijuana:

Marijuana is obtained from *Cannabis sativa*. The active principle in Marijuana is tetrahydrocannabinol (THC). It is used as a pain killer and to reduce hypertension. It is also used in the treatment of Glaucoma, cancer radiotherapy and asthma, etc.

#### Opium:

Opium is obtained from the exudates of the fruits of *Papaver somniferum* (poppy plants). It is used to induce sleep and relieve pain. Opium yields morphine which is used as a strong analgesic in surgeries.

### **20. What are the King and Queen of spices? Explain about them and their uses.**

#### King of Spices:

Pepper is one of the most important Indian spices referred to as the "King of Spices" and also termed as "Black Gold of India". Kerala, Karnataka and Tamil Nadu are the top producers in India. The characteristic pungency of the pepper is due to the presence of the alkaloid Piperine. There are two types of pepper available in the market namely black and white pepper.

#### Uses:

It is used for flavouring in the preparation of sauces, soups, curry powder and pickles. It is used in medicine as an aromatic stimulant for enhancing salivary and gastric secretions and also as a stomachic. Pepper also enhances the bio-absorption of medicines.

#### Queen of Spices:

Cardamom is called as "Queen of Spices". In India, it is one of the main cash crops cultivated in the Western Ghats, and North Eastern India.

#### Uses:

The seeds have a pleasing aroma and a characteristic warm, slightly pungent taste. It is used for flavouring confectionaries, bakery products and beverages. The seeds are used in the preparation of curry powder, pickles and cakes. Medicinally, it is employed as a stimulant and carminative. It is also chewed as a mouth freshener.

**21. How will you prepare an organic pesticide for your home garden with the vegetables available from your kitchen?**

Step 1: Mix 120g of hot chillies with 110 g of garlic or onion. Chop them thoroughly.

Step 2: Blend the vegetables together manually or using an electric grinder until it forms a thick paste.

Step 3: Add the vegetables paste to 500 ml of warm water. Give the ingredients a stir to thoroughly mix them together.

Step 4: Pour the solution into a glass container and leave it undisturbed for 24 hours. If possible, keep the container in a sunny location. If not, at least keep the mixture in a warm place.

Step 5: Strain the mixture. Pour the solution through a strainer, remove the vegetables and collect the vegetable-infused water and pour into another container. This filtrate is the pesticide. Either discard the vegetables or use it as a compost.

Step 6: Pour the pesticide into a squirt bottle. Make sure that the spray bottle has first been cleaned with warm water and soap to get rid of any potential contaminants. Use a funnel to transfer the liquid into the squirt bottle and replace the nozzle.

Step 7: Spray your plants with the pesticide. Treat the infected plants every 4 to 5 days with the solution. After 3 or 4 treatments, the pest will be eliminated. If the area is thoroughly covered with the solution, this pesticide should keep bugs away from the rest of the season.