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12th Standard



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Preface

I am convinced that it will not be long before the whole world acknowledges the results of my work. To live without experiencing some shame and blushes of admiration would surely be a wretched life.

- Gregor Mendel

Respected Principals, Correspondents, Head Masters / Head Mistresses, Teachers,

From the bottom of our heart, we at SURA Publications sincerely thank you for the support and patronage that you have extended to us for more than a decade.

It is in our sincerest effort we take the pride of releasing **SURA'S Botany** for +2 Standard – Edition 2021 - 2022. This guide has been authored and edited by qualified teachers having teaching experience for over a decade in their respective subject fields. This Guide has been reviewed by reputed Professors who are currently serving as Head of the Department in esteemed Universities and Colleges.

With due respect to Teachers, I would like to mention that this guide will serve as a teaching companion to qualified teachers. Also, this guide will be an excellent learning companion to students with exhaustive exercises and in-text questions in addition to precise answers for textual questions.

In complete cognizance of the dedicated role of Teachers, I completely believe that our students will learn the subject effectively with this guide and prove their excellence in Board Examinations.

I once again sincerely thank the Teachers, Parents and Students for supporting and valuing our efforts.

God Bless all.

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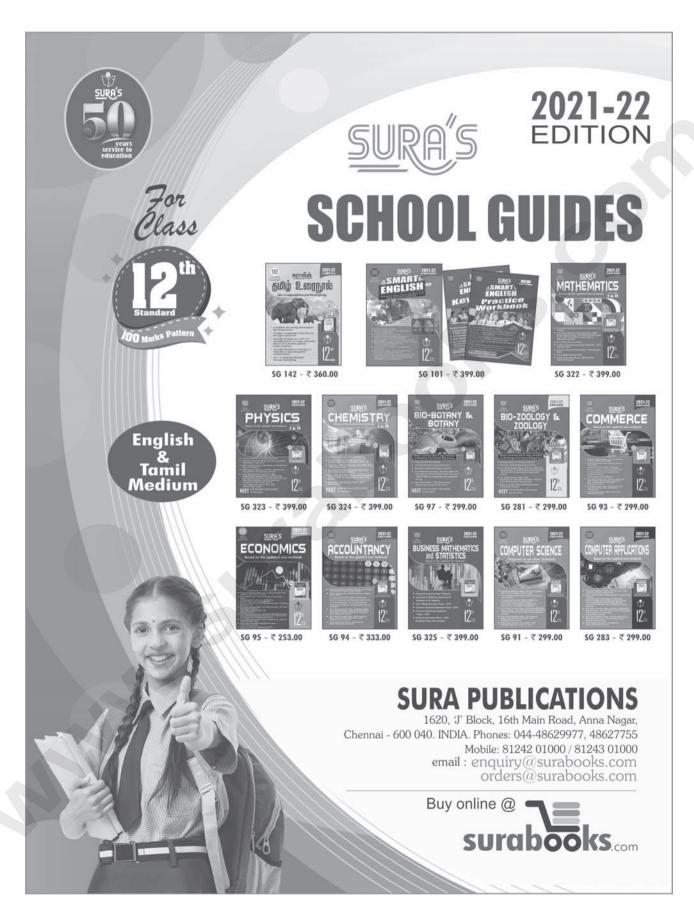
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UNIT VI : Reproduction in Plants



Asexual and Sexual Reproduction in Plants

Chapter Snapshot

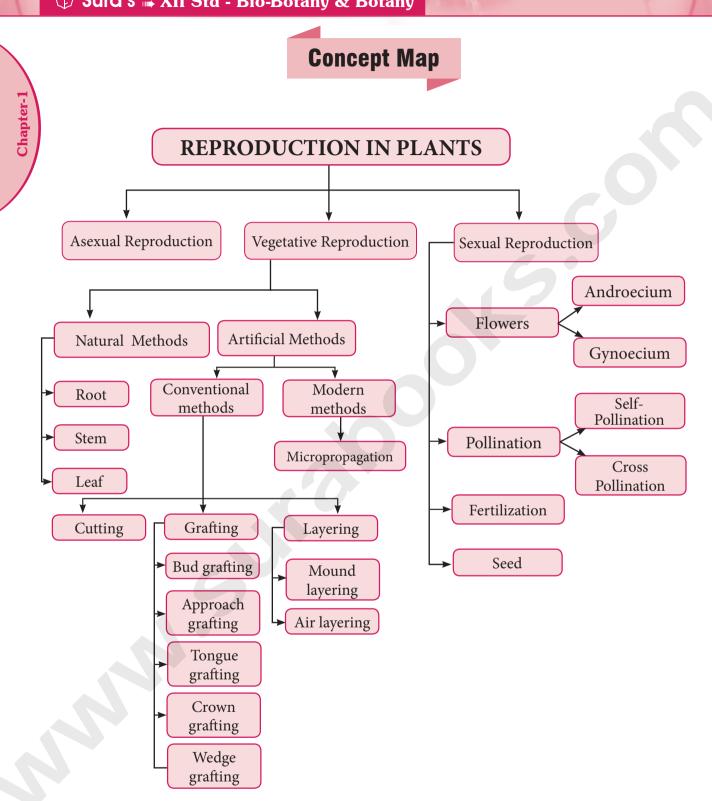
- **1.1** Asexual Reproduction
- 1.2 Vegetative Reproduction 1.2.1 Natural methods
 - **1.2.2** Artificial Methods
- **1.3** Sexual Reproduction
- **1.4 Pre-fertilization Structure and Events**
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- 1.7 Apomixis
- 1.8 Polyembryony
- **1.9** Parthenocarpy



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MUST KNOW DEFINITIONS

Polyembryony	:	Occurrence of more than one embryo in a seed.
Amphimixis	:	Method of reproduction which involves fertilization.
Apomixis	:	Method of reproduction which does not involve fertilization.
Endosperm	:	A triploid nutritive tissue that nourishes the developing embryo.
Microsporogenesis	:	Stages involved in formation of haploid microspores from diploid microspore mother cells.
Embryo sac	:	Oval sac-like structure found in the nucellus of the ovule and acts as female gametophyte.
Megasporogenesis	:	The process of development of a megaspore from a megaspore mother cell.
Pollination	:	Transfer of pollen from anther to stigma.
Self pollination	:	Transfer of pollen from anther to stigma of the same flower.
Cross pollination	:	Transfer of pollen from anther of a flower to the stigma of another flower on the same plant or different plant of the same species.
Double fertilization	:	One sperm fuses with the egg to form the diploid zygote and another sperm fuses with the secondary nucleus to form primary endosperm nucleus which is triploid. This is called double fertilization.
Triple fusion	:	Fusion of sperm with diploid secondary nucleus to form triploid endosperm nucleus.
Radicle	:	Embryonic root is called radicle.
Plumule	:	Embryonic shoot is called plumule.
Apospory	:	The process of embryo sac formation from diploid cells of nucellus as a result of mitosis.
Budding	:	A method of asexual reproduction where small outgrowth (Bud) from a parent cell are produced.
Callus	:	Undifferentiated mass of cells obtained through tissue culture.
Clone	:	Genetically identical individuals.
Endothecium	:	A single layer of hygroscopic, radially elongated cells found below the epidermis of anther which helps in dehiscence of anther.
Fertilization	:	The act of fusion of male and female gamete

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Grafting	:	Conventional method of reproduction where stock and scion are joined to produce new plant.			
Horticulture	:	Branch of plant science that deals with the art of growing fruits, vegetables, flowers and ornamental plants.			
Nucellus	:	The diploid tissue found on the inner part of ovule next to the integuments.			

- **Pollenkitt** : A sticky covering found on the surface of the pollen that helps to attract insects.
- **Regeneration** : Ability of organisms to replace or restore the lost parts.
- **Sporopollenin** : Pollen wall material derived from carotenoids and is resistant to physical and biological decomposition.
- Tapetum:Nutritive tissue for the developing sporogenous tissue.

Transmitting tissue : A single layer of glandular canal cells lining the inner part of style.

TERMINOLOGIES & EXAMPLES

Chapter-1

Conidia	:	Aspergillus and	Stolon	:	Mentha and Fragaria
		Penicillium	Offset	:	Pistia and Eicchornia
Budding	:	Yeast and Hydrilla	Sucker	:	Chrysanthemum
Fragmentation	:	Spirogyra	Bulbil	:	<i>Diascorea</i> and <i>Agave</i>
Gemma	:	Marchantia			
Regeneration	:	Planaria	Epiphyllous Bud	:	Bryophyllum
Binary Fission	:	Bacteria	Root Cutting	:	Malus
Buds in Roots	:	Murraya, Dalbergia and	Stem Cutting	:	Hibiscus, Bougainvillea
		Millingtonia			and Moringa
Tuberous Roots	:	<i>Ipomoea batatus</i> and	Leaf Cutting	:	Begonia and Bryophyllum
		Dahlia	Grafting	:	Citrus, Mango, Apple
Rhizome	:	Musa paradisiaca,	Layering	:	Ixora and Jasminum
		Zingiber officinale and	Pollinium	:	Calotropis
		curcuma longa	Compound Pollen	:	Drosera and Drymis
Corm	:	Amorphophallus and	grain		
		Colocasia	Pollen-10	:	Myosotis
Tuber	:	Solanum tuberosum	micrometer		
Bulb	:	Allium cepa and Lilium	Pollen-200	:	Cucurbitaceae and
Runner	:	Centella asiatica	micrometer		Nyctaginaceae

Orthotropous	:	Piperaceae and
Ovule		Polygonaceae
Anatropous Ovule	:	Dicot and Monocot
Hemianatropous Ovule	:	Primulaceae
Campylotropous Ovule	:	Leguminosae
Amphitropous Ovule	:	Alismataceae
Circinotropous Ovule	:	Cactaceae
Monosporic megaspore	:	Polygonum
Bisporic Megaspore	:	Allium
Tetrasporic Megaspore	:	Peperomia
Cleistogamous flowers	:	<i>Commelina</i> , <i>Viola</i> and <i>Oxalis</i>
Homogamy	:	Mirabilis jalaba, Catharanthus roseus
Monoecious flower	:	Coconut and Bitter gourd
Dioecious flower	:	Borassus and Carica papaya
Protandry	:	Helianthus and Clerodendrum
Protogyny	:	Scrophularia nodosa and Aristolochia bracteata
Distyly	:	Primula
Tristyly	:	Lythrum
Self sterility	:	Abutilon and Passiflora
Anemophily	:	Grasses, Sugarcane, Bamboo, Coconut, Palm and Maize
Hydrophily	:	Vallisneria and Hydrilla

Epihydrophily	:	Vallisneria spiralis and Elodea
Hypohydrophily	:	Zostera marina, Ceratophyllum
Ornithophily	:	Erythrina, Bombax, Syzygium, Bignonia and Strelitzia
Perianth (Fleshy and Edible)	:	Jack fruit
Funiculus - fleshy structure	:	Myristica and Pithecellobium
Nuclear Endosperm	:	Coccinia, Capsella and Arachis
Cellular Endosperm	:	Adoxa, Helianthus and Scoparia
Helobial Endosperm	:	Hydrilla and Vallisneria
Ruminate Endosperm	:	Myristica
Endospermous Seed	:	Wheat, Maize, Barley and Sunflower
Non- Endospermous Seed	:	Bean, Mango, and Cucurbits.
Bulbil	:	Fritillaria imperialis
Adventive Embryony	:	Citrus and Mangifera
Diplospory	:	Eupatorium and Aerva
Apospory	:	Hieracium and Parthenium
Parthenocarpic fruits	:	Banana, Grapes and Papaya
Genetic parthenocarpy	:	Citrus and cucurbita
Environmental parthenocarpy	:	Pear

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EVALUATION

- Chapter-1
- Choose the correct statements from the **7**. following.
 - (a) Gametes are involved in asexual reproduction.
 - (b) Bacteria reproduce asexually by budding.
 - (c) Conidia formation is a method of sexual reproduction.
 - (d) Yeast reproduce by budding.[Ans. (d) Yeast reproduce by budding]

2. An eminent Indian embryologist is

- (a) S.R. Kashyap
- (b) P. Maheswari
- (c) M. S. Swaminathan
- (d) K. C. Mehta [Ans. (b) P. Maheshwari]

3. Identify the correctly matched pair

- (a) Tuber Allium cepa
- (b) Sucker Pistia
- (c) Rhizome Musa
- (d) Stolon Zingiber

[Ans. (c) Rhizome - Musa]

4. Pollen tube was discovered by

- (a) J. G. Kolreuter (b) G. B. Amici
- (c) E. Strasburger (d) E. Hanning

[Ans. (b) G. B. Amici]

5. Size of pollen grain in *Myosotis*

[Govt.MQP-2019]

- (a) 10 micrometer
- (b) 20 micrometer
- (c) 200 micrometer
- (d) 2000 micrometer[Ans. (a) 10 micrometer]

6. First cell of male gametophyte in angiosperm is [Mar-2020]

- (a) Microspore
- (b) Megapore
- (c) Nucleus
- (d) Primary Endosperm Nucleus

[Ans. (a) Microspore]

. Match the following

- I. External Fertilization – (i) Pollen grain II. Androecium – (ii) anther wall III. Male gametophyte - (iii) algae IV. Primary parietal layer - (iv) Stamens III – ii IV – iii (a) I – iv II – i (b) I – iii II – iv III – i IV – ii III – ii IV – i (c) I – iii II – iv II- i (d) I – iii III – iv IV – ii [Ans. (b) I – iii, II – iv, III – i, IV – ii]
- 8. Arrange the layers of anther wall from locus to periphery
 - (a) Epidermis, middle layers, tapetum, endothecium.
 - (b) Tapetum, middle layers, epidermis, endothecium.
 - (c) Endothecium, epidermis, middle layers, tapetum.
 - (d) Tapetum, middle layers endothecium, epidermis.

[Ans. (d) Tapetum, middle layer, endothecium, epidermis]

9. Identify the incorrect pair.

(a)	Sporopollenin	-	Exine of po	llen grai	In
(b)	Tapetum	_	Nutritive	tissue	for
			developing	microsp	ores.
(c)	Nucellus	-	Nutritive		for
			developing	embryo	
(d)	Obturator	-	directs the	1	tube
			into microp	yle	
	[Ans. (c) Ni	ıcel	lus – Nutriti		
			develop	ing emł	oryo]

10. Assertion : Sporopollenin preserves pollen in fossil deposits.

Reason : Sporopollenin is resistant to physical and biological decomposition.

- (a) assertion is true; reason is false
- (b) assertion is false; reason is true
- (c) Both assertion and reason are not true
- (d) Both assertion and reason are true

[Ans. (d) Both assertion and reason are true]

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- **11.** Choose the correct statement(s) about **18**. Coelorhiza is found in tenuinucellate ovule (a) Paddv (b) Bean (a) Sporogenous cell is hypodermal (c) Pea (d) Tridax (b) Ovules have fairy large nucellus [Ans. (a) Paddy] (c) Sporogenous cell is epidermal (d) Ovules have single layer of nucellus tissue **19.** Parthenocarpic fruits lack [Ans. (a) Sporogenous cell is hypodermal & (a) Endocarp (b) Epicarp (d) Ovules have single layer of nucellus tissue] (c) Mesocarp (d) Seed 12. Which of the following represent megagametophyte? [Ans. (d) Seed] (a) Ovule (b) Embryo sac 20. In majority of plants, pollen is liberated at (c) Nucellus (d) Endosperm (a) 1 celled stage (b) 2 celled stage [Ans. (b) Embryo sac] (c) 3 celled stage (d) 4 celled stage **13**. In Haplopappus gracilis, number of [Ans. (b) 2 celled stage] chromosomes in cells of nucellus is 4. What will be the chromosome number in primary **21.** What is reproduction? endosperm cell? Reproduction is a vital process for the Ans. (i) (a) 8 (b) 12 existence of a species. (c) 6 (d) 2 [Ans. (b) 12] It brings suitable changes through variation (ii) **14.** Transmitting tissue is found in _____ in the off springs for their survival on Earth. (a) Micropylar region of ovule Plant reproduction is important for all (iii) (b) Pollen tube wall other organisms. (c) Stylar region of gynoecium (d) Integument 22. Mention the contribution of Hofmeister [Ans. (c) Stylar region of gynoecium] towards Embryology. **15**. The scar left by funiculus in the seed is Ans. In the year of 1848, Hofmeister described the (a) tegmen (b) radicle structure of pollen tetrad. (c) epicotyl (d) hilum 23. List out two sub-aerial stem modifications [Ans. (d) hilum] with example. 16. A plant called X possesses small flower with Runner – Centella asiatica Ans. (i) reduced perianth and versatile anther. The Stolon – Fragaria and Mentha. (ii) probable agent for pollination would be [QY-2019] (a) water (b) air **24.** What is layering? (c) butterflies (d) beetles It is a conventional method (artificial Ans. (i) [Ans. (b) air] method) of plant propagation. The stem of a parent plant is allowed to (ii) **17.** Consider the following statement(s) develop roots while still intact. (i) In Protandrous flowers pistil matures earlier. (iii) When the root develops, the rooted part is (ii) In Protogynous flowers pistil matures earlier. cut and planted to grow as a new plant. (iii) Herkogamy is noticed in unisexual flower. **Example :** *Ixora* and *Jasminum*. (iv) Distyly is present in Primula. (a) (i) and (ii) are correct **25.** What are clones?
 - *Ans.* The individuals formed by asexual reproduction are **morphologically and genetically identical** are called clones.

(b) (ii) and (iv) are correct

(c) (ii) and (iii) are correct

(d) (i) and (iv) are correct

[Ans. (b) (ii) and (iv) are correct]

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Asexual and Sexual Reproduction in Plants

- 26. A detached leaf of *Bryophyllum* produces new 2 plants. How? A
- Ans. (i) Bryophyllum can be reproduced by vegetative propagation by using piece of its stem or leaves.
 - (ii) The leaves of a *Bryophyllum* plant have special buds with notches called epiphyllous buds in their margins which may get detached from the leaves, fall to the ground and then grow to produce a new plant.

27. Differentiate Grafting and Layering.

Ans.

Chapter-1

	Grafting	Layering
1.	Two different plants are	Only parent plant is
	involved.	involved.
2.	Parts of two different	Stem of the parent
	plants are joined and	plant is allowed to
	continue to grow as one	develop roots.
	plant.	
3.	Plant used for grafting	The rooted part is
	is called scion.	cut and grown as a
		new plant.
4.	Shows characteristic of	Results in
	scion.	propagation of
		parent plant.
5.	Eg. Citrus, Mango and	Eg. Ixora and
	Apple.	Jasminum.

28. "Tissue culture is the best method for propagating rare and endangered plant species"- Discuss.

Ans. Micropropagation is one of the best method for propagating rare and endangered plant.

The regeneration of a whole plant can be done from single cell, tissue or small pieces of vegetative structures through tissue culture is called micropropagation.

It's a best method because,

- (i) Plants with desired characteristics can be multiplied in a short duration.
- (ii) Plants produced are genetically identical.
- (iii) It can be carried out in any season.
- (*iv*) Plants which do not produce viable seeds and seeds that are difficult to germinate can be propagated by tissue culture.
- (v) Thus this method is ideal to propagate rare and endangered plants.

29 .	Distinguish Mound layering and Air layering.
Ans.	

	Mound Layering	Air Layering
1.	Lower branch is	The stem is girdled
	bent to the ground	at nodal region
	and buried in the	and hormones
	soil and tip of the	are applied to
	branch is exposed	this region which
	above the soil.	promotes rooting.
2.	Applicable for	Applicable for
	plants with flexible	flexible and
	branches.	non-flexible
		branches.
3.	Hormones are	Hormones are
	not required to	applied to promote
	promote rooting	rooting.
4.	A cut is made in	Branches removed
	parent plant so	from the parent
	the buried part	plant and grown in
	grow into a new	a separate pot or
	plant after root	ground after root
	formation.	formation.

30. Explain the conventional methods adopted in vegetative propagation of higher plants.

Ans. Conventional methods:

Methods of conventional propagation are cutting, grafting and layering.

- (a) Cutting:
 - (*i*) Producing a newplant by cutting the plant parts root, stem and leaf from the parent plant.
 - (ii) The cut part is placed in a suitable medium to produce root and grows into a new plant.
 - (iii) Depending upon the part used they are named as
 - * root cutting (Malus),
 - * stem cutting (*Hibiscus*, *Bougainvillea* and *Moringa*) and
 - * leaf cutting (*Begonia*, *Bryophyllum*).
 - (*iv*) Stem cutting is widely used.

(b) Grafting:

- (*i*) Parts of two different plants are joined and grow as one plant.
- (ii) The plant which is contact with the soil is called stock and the plant used for grafting is called scion.

Examples: Citrus, Mango and Apple.

- (iii) Based on the method of uniting the scion and stock, they are named as bud grafting, approach grafting, tongue grafting, crown grafting and wedge grafting.
- (c) Layering:
 - (*i*) The stem of a parent plant is allowed to develop roots while still intact.
 - (ii) Developed root is cut and planted to grow as a new plant. Examples: *Ixora* and *Jasminum*.
 - **Types:** + Mound layering
 - + Air layering

31. What is Cantharophily?

- *Ans.* The cross pollination of flowers by beetles is called cantharophily. The beetles feed the pollen or on some of the juicy tissues of the flowers.
- **32.** List any two strategy adopted by bisexual flowers to prevent self-pollination.
- *Ans.* Two types of strategies adopted by bisexual flowers to prevent self-pollination.
 - (1) Maturation of stamens and stigmas:

Dichogamy: Anthers and stigmas mature at different times in bisexual flowers.

- (i) **Protandry:** Stamens mature earlier than stigmas. **Examples:** Helianthus and Clerodendrum.
- (ii) **Protogyny:** Stigmas mature earlier than stamens. **Examples:** Scrophularia nodosa and Aristolochia bracteata.

(2) Arrangement of stamens and stigmas:

Herkogamy: Essential organs like stamens and stigmas arranged in a such way that self-pollination becomes impossible.

Example: *Gloriosa superba*: Style is reflexed away from the stamen.

Hibiscus: Stigmas far above the stamen.

33. What is endothelium?

- Ans. (i) It is otherwise known as integumentary tapetum.
 - (ii) In some species, the inner layer of integument may become specialized to perform nutritive function for the embryosac and is called endothelium.
 Example : Asteraceae.
- 34. 'The endosperm of angiosperm is different from gymnosperm'. Do you agree. Justify your answer. [Govt.MQP-2019]
- Ans. Yes I agree.

	Endosperm of Angiosperm	Endosperm of Gymnosperm
1.	It is formed after fertilization.	It is formed before fertilization.
2.	It is a triploid tissue.	It is a haploid tissue.
3.	The function is to nourish the developing embryo.	It acts as the female gametophyte and later acts as nutritive tissue.

Thus the endosperm tissue is different in Angiosperms and gymnosperm.

- **35.** Define the term Diplospory.
- *Ans.* A diploid embryo sac is formed from megaspore mother cell without a regular meiotic division. It is a type of apomixis.

Example: *Eupatorium* and *Aerva*.

- **36.** What is polyembryony? How it can commercially exploited?
- *Ans.* Occurrence of more than one embryo in a seed is called polyembryony.

Commercial application:

- (*i*) The nucellar tissue in *Citrus* are found better clones for Orchards.
- (ii) Embryos from polyembryony are virus free.

Hint: ORCHARDS - A piece of enclosed land planted with fruit trees.

- **37.** Why does the zygote divides only after the division of Primary endosperm cell?
- Ans. (i) Zygote requires nourishment during its development.

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(ii) As mature, fertilized embryo sac offers very little nourishment to the zygote, the primary endosperm cell (PEC) divides and generates the endosperm tissue which nourishes the zygote. Hence the zygote always divides after division of Primary Endosperm Cell (PEC).

38. What is mellitophily?

Chapter-1

- Ans. (i) Pollination of flowers by bees is known as mellitophily.
 - (ii) It is a type of cross-pollination by biotic agencies like bees.

39. 'Endothecium is associated with dehiscence of anther' Justify the statement.

- *Ans. (i)* Endothecium is a single layer of radially elongated cells below the epidermis of anther wall.
 - (ii) The inner tangential wall develops bands or thickenings of α cellulose.
 - (iii) The cells at the junction of two sporangia of an anther lobe lacks thickening and this region is called **stomium**.
 - (*iv*) Stomium along with the hygroscopic nature of endothecium helps in the dehiscence of anther at maturity.

40. List out the functions of Tapetum.

- Ans. (i) It supplies nutrition to the developing microspores.
 - (ii) It contributes sporopollenin through ubisch bodies pollen wall formation.
 - (iii) The pollenkitt material is contributed by tapetal cells and is later transferred to the pollen surface.
 - (iv) Exine proteins responsible for 'rejection reaction' of the stigma are present in exine and derived from tapetal cells.

41. Write short note on Pollen kitt.(OR)What is Pollenkit?[HY-2019]

- Ans. (i) It is a oily layer forming a thick viscous coating pollen surface.
 - (ii) The pollenkitt material is contributed by tapetal cells and made of carotenoids or flavonoids. (Orange or Yellow).
 - (iii) It attracts insects and protects damage from UV radiation.

As mature, fertilized embryo sac offers very **42**. **Distinguish Tenuinucellate and Crassinucellate ovules**.

Ans.

	Tenuinucellate type	Crassinucellate type				
1.	Sporogenous cell is hypodermal with a single layer of nucellar tissue around in the ovule.	sub-hypodermal				
2.	Ovules have very small nucellus.	Ovules have fairly large nucellus.				

Note: These two types of ovules are differentiated based on the position of the sporogenous cell.

43. 'Pollination in Gymnosperms is different from Angiosperms' – Give reasons.

Ans.

	Gymnosperms - Pollination	Angiosperms - Pollination
1.	Direct pollination is seen since pollen are directly deposited on the exposed ovules.	Indirect pollination is seen since pollens are deposited on the stigma of the pistil.
2.	Pollination is by anemophilous mode. (only by wind)	Pollination can be self-pollination or cross-pollination by various agents like air, water, Insects etc.

44. Write short note on heterostyly.

Ans. It is a contrivance of cross-pollination. 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.

(a) Distyly:

(i) The plant produces two forms of flowers, Pin or long style, long stigmatic papillae, short stamens and small pollen grains; Thrum-eyed or short style, small stigmatic papillae, long stamens and large pollen grains. Example: Primula.

- (ii) The stigma of the Thrum-eyed flowers and the anther of the pin lie in same level to bring out pollination.
- (iii) Similarly the anther of Thrum-eyed and stigma of pin ones is found in same height. This helps in effective pollination.

(b) Tristyly:

- (i) The plant produces three kinds of flowers, with respect to the length of the style and stamens.
- (ii) Here, the pollen from flowers of one type can pollinate only the other two types but not their own type.Example : Lythrum.

45. Enumerate the characteristic features of Entomophilous flowers.

- Ans. (i) Flowers are generally large or if small, they are aggregated in dense inflorescence.Examples: Asteraceae flowers.
 - (ii) Flowers are brightly coloured to attract insects.Examples: Poinsettia and Bougainvillea.
 - (iii) Flowers are scented and produce nectar.
 - (iv) Flowers with no secretion of nectar, the pollen is consumed as food or used in building up of its hive by honey bees. Pollen and Nectar are the floral rewards for the visitors.
 - (v) Flowers pollinated by flies and beetles produce foul odour to attract insects.
 - (vi) Juicy cells are pierced and the contents are sucked by the insects.

46. Discuss the steps involved in Microsporogenesis.

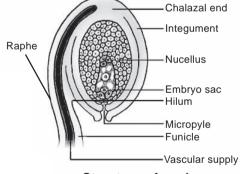
- *Ans.* Formation of haploid microspores from diploid microspore mother cell through meiosis is called **Microsporogenesis**.
 - (*i*) The primary sporogeneous cells undergo mitotic to form **sporogenous tissue**.
 - (ii) The last generation of sporogenous tissue functions as microspore mother cells.
 - (iii) Each microspore mother cell divides meiotically to form a tetrad of four haploid microspores (microspore tetrad).

- (*iv*) Arrangement of microspore tetrad tetrahedral, decussate, linear, T shaped or isobilateral manner are 4 haploid microspore.
- (v) Microspores separate from one another and remain free in the anther locule and develop into pollen grains.
- (vi) In some plants, all the microspores in a microsporangium remain held together called pollinium.

Example: *Calotropis*, Compound pollen grains are found in *Drosera* and *Drymis*.

47. With a suitable diagram explain the structure of an ovule. [Govt.MQP-2019]

- Ans. (i) Ovule is also called megasporangium.
 - (ii) A mature ovule consists of a stalk and a body.Stalk or **funiculus** is present at the base and attaches the ovule to the placenta.
 - (iii) The point of attachment of funicle to the body of the ovule is known as hilum.
 - (iv) In an inverted ovule, the funicle is adnate to the body of the ovule forming a ridge called raphe.



Structure of ovule

- (v) Body of the ovule is made up of central mass of parenchymatous tissue called nucellus, has large reserve food materials.
- (vi) Nucellus is enveloped by one or two protective coverings called integuments.
- (vii) Integuments encloses the nucellus completely but forms a pore at the top called micropyle.

- (viii) Ovule with one or two integuments are said to be **unitegmic** or **bitegmic** ovules.
- (ix) The basal region of the body of the ovule where the nucellus, the integument and the funicle merge is called as chalaza.
- (x) Large, oval, sac-like structure in the nucellus toward the micropylar end called embryo sac or female gametophyte.
- (xi) It develops from the functional megaspore formed within the nucellus.
- (xii) In some species (unitegmic tenuinucellate), the inner layer of the integument may perform the nutritive function for the embryo sac and is called as endothelium or integumentary tapetum Example : Asteraceae.

Two types of ovule based on the position of the sporogenous cell.

- (a) Tenuinucellate type:
 - 1. Sporogenous cell is hypodermal with a single layer of nucellar tissue around it.
 - 2. It has very small nucellus.
- (b) Crassinucellate type:
 - 1. Ovules with subhypodermal sporogenous cell.
 - 2. It has fairly large nucellus.
- (*xiii*) Group of cells at the base of the ovule between the chalaza and embryo sac is called **hypostase**.
- (*xiv*) Thick-walled cells found above the micropylar end above the embryo sac is called **epistase**.
- **48.** Give a concise account on steps involved in fertilization of an angiosperm plant.

Ans. The fusion of male and female gamete is called fertilization.

Steps in fertilization:

- (*i*) Germination of pollen to form pollen tube in the stigma.
- (ii) Growth of pollen tube in the style.

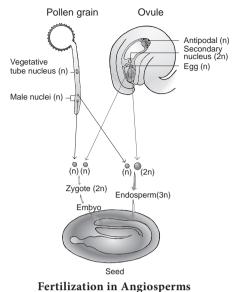
- (iii) Direction of pollen tube towards micropyle of ovule.
- (iv) Entry of the pollen tube into embryo sac.
- (v) Discharge of male gametes.
- (vi) Syngamy.
- (vii) Triple fusion.
- (1) Germination of pollen on stigma:
- (i) The events from pollen deposition on the stigma to entry of pollen tube into the ovule is called **pollen-pistil interaction**. This involves recognition of pollen and promotion / inhibition of germination and growth.
- (ii) If the pollen is compatible with the stigma it germinates to form a tube and facilitated by fluid in wet stigma and pellicle in dry stigma. The compatibility depends on recognition-rejection protein reaction between the pollen and stigma surface.
- (iii) All cytoplasmic contents move to the tip of pollen tube which is hemispherical and transparent. This is called **cap block**.
- (2) Growth of pollen tube in the style:
- (i) The growth of the pollen tube depends on the type of style.
- (ii) Styles may be hollow; solid or semi-solid.
- (iii) The style is lined internally by a single layer of glandular cells called **Transmitting tissue** and provides nourishment for the pollen tube and controls the incompatibility between style and pollen tube.

(3) Entry of pollen tube into the ovule:

The pollen tube enters the ovule through the micropyle (Porogamy) or chalaza (Chalazogamy) or integument (Mesogamy).

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(4) Entry of pollen tube into embryo sac:



- (i) Pollen tube enters the embryo sac at the micropylar end.
- (ii) A structure known as the **obturator** guides the pollen tube towards micropyle of the ovule.
- (iii) After entering into the embryo sac, a pore is formed in the pollen tube wall behind the apex.
- (*iv*) The content of the pollen tube (two male gametes, vegetative nucleus and cytoplasm) are discharged into the synergids into which pollen tube enters. The tube nucleus disorganizes.
- (5) Double fertilization and triple fusion:
- (*i*) Both the male gametes are involved in fertilization is called **double fertilization**.
- (ii) One male gametes fuses with the egg nucleus (syngamy) to form **Zygote**.
- (iii) The second male gamete fuses with the polar nuclei (secondary nucleus) to form primary endosperm nucleus (PEN).
- (*iv*) Fusion of three nuclei is known as triple fusion. This results in formation of endosperm which is the nutritive tissue for the growing embryo.

49. What is Endosperm? Explain the types.[*Sep*-2020] *Ans.* The primary endosperm nucleus (PEN) divides after fertilization 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, 3 types of endosperm are recognized in angiosperms. They are:

(1) Nuclear endosperm:

- (*i*) Primary endosperm nucleus (PEN) divides into two without any wall formation.
- (ii) The subsequent division of these two nuclei are free nuclear so that the endosperm consists of only free nuclei and cytoplasm around them.
- (iii) The nuclei may either remain free or may become separate by walls in later stages.Example: Coccinia, Capsella and Arachis.

(2) Cellular endosperm:

 (i) Primary endosperm nucleus (PEN) divides into 2 nuclei followed by a wall formation. Further divisions are also followed by walls.
 Example: Adoxa, Helianthus and Scoparia.

(3) Helobial endosperm:

- (i) Primary endosperm nucleus (PEN) moves towards the base of the embryo sac and divides into two nuclei.
- (ii) These 2 nuclei are separated by a wall to form a large micropylar chamber and a small chalazal chamber.
- (iii) The nucleus of the micropylar chamber undergoes several free nuclear divisions whereas that of the chalazal chamber may or may not divide.

Example: *Hydrilla* and *Vallisneria*.

Endospermous and Non-endospermous seeds:

- (i) Seeds without endosperms are called nonendospermous or eg- albuminous seeds.
 Examples: Pea, Groundnut and Beans.
- (ii) Seeds with endosperms are called endospermous or albuminous seeds. Example: Paddy, Coconut and Castor.

(iii) Ruminate endosperm:

The endosperm with irregularity and unevenness in its surface forms ruminate endosperm. **Example:** *Areca catechu.*

Ans.

Chapter-1

50. Differentiate the structure of Dicot and † 51. Give a detailed account on parthenocarpy. Monocot seed.

	Dicot seed	Monocot seed				
1.	The seed coat is	The seed coat is				
	distinct from the fruit	fused with the				
	coat or pericarp	pericarp.				
2.	The seed encloses two	The seed encloses				
	cotyledons.	only a single				
		cotyledon.				
3.	The seed coat is	The seed coat is				
	differentiated into	unilayered and is				
	outer testa and inner	inseparable from the				
	tegmen.	pericarp.				
4.	The seeds may or	Most of the monocot				
	may not possess	members possess				
	endosperm. They are	endospermic seeds.				
	known respectively					
	as the endospermic					
	or non-endospermic					
	seeds.					
5.	The two cotyledons	The embryo is found				
	enclose the	in the cotyledon.				
	embryonic axis in					
	between them.					
6.	In the endospermic	The endosperm				
	seed, the endosperm	is found above				
	encloses the embryo.	the embryo. The				
	0	endosperm and the				
		embryo are separated				
		by the epithelium.				
7.	The embryonic root	The radicle is				
	and shoot are not	protected by a sheath				
	covered by sheaths.	called coleorhiza and				
		plumule is protected				
		by coleoptile.				

Add a note on its significance.

Ans. Parthenocarpy:

- Fruit like structures develop from the ovary (i) without the act of fertilization. Such fruits are called **parthenocarpic fruits**.
- (ii) Many commercial fruits are made seedless. **Example:** Banana, Grapes and Papaya.
- (iii) Nitsch in 1963, classified parthenocarpy into:
- (a) Genetic parthenocarpy:

Parthenocarpy arises due to hybridization or mutation.

Example: Citrus and Cucurbita.

(b) Environmental parthenocarpy:

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

Example: low temperature for 3-19 hours induces parthenocarpy in Pear.

Chemically induced parthenocarpy: (c)

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

Significance:

- Have great significance in horticulture. (i)
- (ii) Have great commercial importance.
- (iii) Used for the preparation of jams, jellies, sauces, fruit drinks etc.
- (iv) High proportion of edible part is available due to the absence of seeds.

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BOTANY LONG VERSION QUESTIONS (FOR PURE SCIENCE GROUP)

LONG VERSION EVALUATION

Q.No. 1 to 11 Refer Evaluation.

- **12.** The correct order of haploid, diploid and triploid structure is fertilized embryosac is
 - (a) Synergid, zygote and PEN
 - (b) Synergid, antipodal and polar nuclei
 - (c) Antipodal, synergid and PEN
 - (d) Synergid, polar nuclei and zygote [*Ans.* (a) Synergid, zygote and PEN]
- **13**. Refer Evaluation Q.No. 12
- 14. Refer Evaluation Q.No. 13
- **15.** Refer Evaluation Q.No. 14
- **16.** Refer Evaluation Q.No.15
- **17.** Refer Evaluation Q.No.16
- **18.** Refer Evaluation Q.No. 17

19. Ruminate endosperm is found in

- (a) Cocos (b) Areca
- (c) Vallisneria (d) Arachis

[Ans. (b) Areca]

20. Refer Evaluation Q.No.18

21. Caruncle develops from

- (a) funicle
- (c) integument

(b) nucellus(d) embryo sac

[Ans. (c) integument]

- **22**. Refer Evaluation Q.No. 19
- **23.** Refer Evaluation Q.No. 20
- **24.** Refer Evaluation Q.No. 21
- **25.** Refer Evaluation Q.No. 22
- **26.** Refer Evaluation Q.No. 23
- 27. Refer Evaluation Q.No. 24
- **28.** Refer Evaluation Q.No. **25**
- **29.** How do *Dioscorea* reproduce vegetatively?
- Ans. Dioscorea reproduces vegetatively by means of bulbils.
- **30**. Refer Evaluation Q.No. 26
- **31**. Refer Evaluation Q.No. 27

32. Write short notes on approach grafting.

- Ans. (i) Both the scion and stock remain rooted.
 - (ii) Stock is grown in a pot and brought close to the scion.
 - (iii) Both of them should have the same thickness.
 - (iv) A small slice is cut from both and the cut surfaces are brought near and tied together and held by a tape.



Approach grafting

Asexual and Sexual Reproduction in Plants

- (v) 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.
- **33.** Refer Evaluation Q.No. 28
- 34. Refer Evaluation Q.No. 29
- **35.** List down the advantages of conventional methods.

Ans. Advantages of conventional methods

- (i) Plants produced are genetically uniform.
- (ii) Many plants can be produced quickly.
- (iii) Some plants produce little or no seeds; in others, the seeds produced do not germinate. In such cases, plants can be produced in a short period by this method.
- (iv) Some plants can be propagated more economically by vegetative propagation.Example: Solanum tuberosum.
- (v) Two different plants with desirable characters such as disease resistant and high yield can be grafted and grown as a new plant with the same desirable characters.
- **36**. Refer Evaluation Q.No. **30**
- **37.** Highlight the milestones from the history of plant embryology.
- *Ans.* 1682 Nehemiah Grew mentioned stamens as the male organ of a flower.
 - **1694** R.J. Camerarius described the structure of a flower, anther, pollen and ovule.
 - **1761** J.G. Kolreuter gave a detailed account on the importance of insects in pollination.

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Chapter-1

	1824	1	39
		tube.	An
	1848	- Hofmeister described the structure of pollen tetrad.	
	1870	- Hanstein described the development of embryo in <i>Capsella</i> and <i>Alisma</i>	
	1878		
	1884	1 / / /	-
	1898		
	1904		
	1950		40 41
	1964	7 1	42
	1704	haploids from <i>Datura</i> pollen grains.	43
	1991	- E.S. Coen and E. M. Meyerowitz proposed the ABC model to describe the genetics of initiation and	An 4 4
		development of floral parts.	45
	2015		46
		the molecular aspects of pre and post fertilization reproductive development in flowering plants.	47
38 .		cuss the importance of Modern methods in	An
	-	oduction of plants.	Г
Ans.	-	ortance of modern methods:	
	(vi)	Plants with desired characteristics can be multiplied rapidly in a short duration.	
	(vii)	Plants produced are genetically identical.	
		Tissue culture can be carried out in any season to produce plants.	
	(ix)	Plants which do not produce viable seeds and seeds that are difficult to germinate can be propagated by tissue culture.	
	(11)		
	(x)	Rare and endangered plants can be	
	()	propagated.	
	(xi)	Disease free plants can be produced by meristem culture.	
	(xii)	Cells can be genetically modified and	48
		transformed using tissue culture.	49
			50

39. Differentiate secretory and invasive tapetum.

ns.

	Secretory tapetum (parietal/glandular/ cellular)	Invasive tapetum (periplasmodial)
1.	The tapetum retains the original position and cellular integrity	The cells loose their inner tangential and radial walls.
2.	It nourishes the developing microspores.	The protoplast of all tapetal cells coalesces to form a periplasmodium.

- **40**. Refer Evaluation Q.No. **33**
- **41.** Refer Evaluation Q.No. 34
- 42. Refer Evaluation Q.No. 35
- **43.** Name the cell which divides to form male nuclei.
- Ans. Generative cells of Microspore.
- 44. Refer Evaluation Q.No. 36
- **45.** Refer Evaluation Q.No. **37**
- 46. Refer Evaluation Q.No. 38
- **47**. Do you think parthenocarpy and apomixis are different process. Justify?
- **Ans.** Yes. Parthenocarpy and apomixis are different processes.

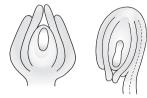
	Parthenocarpy	Apomixis
1.	Formation of fruit from the ovary without the act of fertilization.	Method of reproduction which does not involve union of male and female gemetes.
2.	Formation of fruits without fertilization.	Formation of seeds without fertilization.
3.	Ovary becomes fruit without fertilization, thus fruits are seedless.	Megaspore mother cell does not undergo mieosis or cell from the nucellus develops into the embryo.

- **18.** Refer Evaluation Q.No. **39**
- **49.** Refer Evaluation Q.No. **40**
- **50.** Give examples for Helobial endosperm.
- **Ans.** Hydrilla and Vallisneria.

- **51.** Refer Evaluation Q.No. **41**
- **52.** Refer Evaluation Q.No. 42
- **53.** Refer Evaluation Q.No. 43
- 54. Refer Evaluation Q.No. 44
- **55.** Give short notes on types of ovules. [Mar-2020]

Ans. Types of Ovules:

Ovules are classified into six main types based on the orientation, form and position of the micropyle with respect to funicle and chalaza.





(a) Orthotropous

(b) Anatropous (c) Hemianatropous





(d) Campylotropous

(e) Amphitropous (f) Circinotropous

- (a) Orthotropous:
- (i) Micropyle is at the distal end.
- (ii) Micropyle the funicle and the chalaza lie in one straight vertical line.

Examples: Piperaceae, Polygonaceae

- (b) Anatropous:
- (i) Body of the ovule inverted so that the micropyle and funiculus come to lie very close to each other.

Eg: Dicots and monocots.

- (c) Hemianatropous:
- (i) Body is transverse.
- (ii) It is right angles to the funicle. Example: Primulaceae.
- (d) Campylotropous:
- (i) Body is curved at micropylar end
- (ii) More or less bean shaped.
- (iii) Embryo sac is slightly curved.
- (iv) All the three, hilum, micropyle and chalaza are adjacent to one another, with the micropyle oriented towards the placenta.Example: Leguminosae.

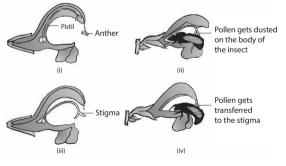
There are two more types of ovules they are:

- (e) Amphitropous:
- (*i*) The distance between hilum and chalaza is less.
- (ii) The curvature of the ovule leads to horseshoe shaped nucellus.Example: some Alismataceae.
- (f) **Circinotropous:** Funiculus is very long and surrounds the ovule. **Example:** Cactaceae.
- **56.** Refer Evaluation Q.No. 45
- **57.** Refer Evaluation Q.No. **46**
- **58.** Refer Evaluation Q.No. **47**

59. Explain the pollination mechanism in *Salvia*.

Ans. Pollination in Salvia (Lever mechanism):

- (i) *Salvia* is adapted for Bee pollination.
- (ii) The flower is protandrous and the corolla is bilabiate with 2 stamens.
- (iii) A lever mechanism helps in pollination.
- (iv) Each anther has an upper fertile lobe and lower sterile lobe separated by a long connective which helps the anthers to swing freely.
- (v) When a bee visits a flower, it sits on the lower lip which acts as a platform.
- (vi) It enters the flower to suck the nectar by pushing its head into the corolla.
- (*vii*) During the entry of the bee into the flower the body strikes against the sterile end of the connective.



Pollination in Salvia - Lever mechanism

- (*viii*) The fertile part of the stamen to descend and strike at the back of the bee.
- (ix) The pollen gets deposited on the back of the bee. When it visits another flower, the pollen gets rubbed on stigma and completes the pollination in *Salvia*.

17

Asexual and Sexual Reproduction in Plants

- **60.** Refer Evaluation Q.No. 48
- **61.** Refer Evaluation Q.No. 49
- 62. Refer Evaluation Q.No. 50
- 63. Refer Evaluation Q.No. 51

Chapter-1

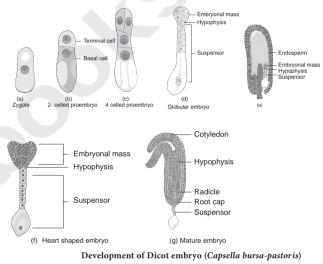
64. Explain the development of a Dicot embryo.

Ans. Development of Dicot embryo:

Development of Dicot embryo (*Capsella bursa-pastoris*) is of Onagrad or crucifer type. The embryo develops at micropylar end of embryo sac.

- (*i*) The Zygote divides into **upper or terminal** cell and **lower or basal cell**.
- (ii) The basal cell divides transversely and the terminal cell divides vertically to form a 4 celled proembryo.
- (iii) A second vertical division right angle to the first one takes place in terminal cell forming a 4 celled stage called quadrant.
- (*iv*) Transverse division in the quadrant results in 8 cells arranged in 2 tiers of 4 each called octant stage.
- (v) Upper tier of 4 cells of the octant is called epibasal or anterior octant and the lower tier of 4 cells constitute hypobasal or posterior octants.
- (vi) A periclinal division in the octants results in the formation of 16 celled stage with 8 cells in the outer and 8 in the inner.
- (vii) The outer 8 cells represent the dermatogen and undergoes anticlinal division to produce epidermis.
- (viii) The inner 8 cells divide by vertical and transverse division to form outer layer of **periblem** which give rise to cortex and a central region of **pleurome** which forms stele. During the development, the 2 cells of the basal cell undergoes several transverse division to form a 6 to 10 celled suspensor.
- (ix) The embryo at this stage become globular and the suspensor helps to push the embryo deep into the endosperm.
- (x) The uppermost cell of the suspensor enlarge to form a haustorium. The lowermost cell of the suspensor is called hypophysis.

- (xi) A transverse division and two vertical division right angle to each other of hypophysis results in the formation of 8 cells.
- (xii) The eight cells are arranged in two tiers of 4 cells each. The upper tier give rise to root cap and epidermis.
- (xiii) At this stage, embryo appears heart shaped, cell divisions in the hypocotyl and cotyledon regions of the embryo results in elongation.
- (xiv) Further development results in curved horse shoe shaped embryo in the embryo sac. The mature embryo has a radicle, hypocotyl, two cotyledons and a plumule.



- **65.** Refer Evaluation Q.No. **52**
- **66.** Refer Evaluation Q.No. **53**

CHOOSE THE CORRECT ANSWERS

PTA Question & Answers

1 MARK

- 1. Which one of the following is not an advantage of micro propagation? [PTA-1]
 - (a) Plants produced are genetically identical
 - (b) Endangered plants can be propagated
 - (c) Sometimes undesirable genetical changes occur
 - (d) Disease free plants can be produced

[Ans. (c) Sometimes undesirable genetical changes occur]



2. Which one of the following statements is not 2. Draw this diagram and label the parts. [PTA-3] true regarding sporopollenin? [PTA-2] (a) Sporopollenin is contributed by both pollen cytoplasm and tapetum Ans. (b) It helps the pollen to withstand against strong acid Plumule (c) Sporopollenin is derived from phycobilins Cotyledon (d) It helps pollen during long period Testa preservation in fossil deposits. [Ans. (c) Sporopollenin is derived from Radicle phycobilins] 3. Which method of artificial vegetative reproduction is good in plants? Give reason 3. In a male gametophyte, the chromosomal number of generative nucleus is (A) and tube for your answer. [PTA-4] nucleus is (B). [PTA-4] Ans. (i) Different plants can be propagated. (a) (A) - (n)(B) - (2n)The method used depends on type of plant, (ii) (b) (A) - (2n) (B) - (n)response of plant, economic reasons etc. (c) (A) - (2n)(B) - (2n)(iii) Therefore no specific method is said (d) (A) – (n) (B) - (n)to be best. Both conventional and [Ans. (d) (A) - (n)(B) - (n)] modern methods here advantages and disadvantages. Eg: Cutting, layering 4. Which one of the following is a dioecious plant? [PTA-5] grafting etc. (a) Coconut (b) Bitter gourd 4. Redraw the diagram and label the parts. (d) Date palm (c) Pea plant 0 [Ans. (d) Date palm] 2 celled proembryo 5. Eyes of potato are referred to [PTA-6] (a) adventitious roots Ans. [PTA-4] (b) axillary buds 0 Terminal cell (c) terminal buds [Ans. (b) axillary buds] (d) intercalary buds Basal cell VERY SHORT ANSWERS 2 MARKS 1. Differentiate bisporic megaspore development 2- celled proembryo from tetrasporic development. [PTA-1] 5. Write the practical application of activation of Ans. nucellar tissue. [PTA-5] Tetrasporic **Bisporic megaspore** Ans. Practical applications: development development The seedlings formed from the nucellar (i) Of the four All the four 1. tissue in Citrus are found better clones for megaspores formed, megaspores are Orchards. two are involved involved in Embryo Embryos are virus free. (ii) sac formation.

Example: Peperomia.

in Embryo sac formation.

Example: Allium.

2.

19

Asexual and Sexual Reproduction in Plants

6. Write any two difference between male gametophyte and female gametophyte. [PTA-6]

s.						
	Male gametophyte	Female gametophyte				
1.	Microspore	Megaspore				
	produces the male	prouces the female				
	gametophyte.	gametophyte.				
2.	It produces male	It produces female				
	gametes.	gametes.				

SHORT ANSWERS

Ans.

Chapter-1

3 MARKS

1. Differentiate heterostyly from herkogamy.

	[PTA-2]
I	Herkogamy
forms of flowersthethat are differentstigin their length ofin sstamens and style.polPollination will takeimpplace only betweenEg:organs of the samethelength.awaEg: Primulaandstig	bisexual flowers essential organs, stamens and gmas, are arranged such a way that self- lination becomes possible. <i>Gloriosa superba</i> , style is reflexed ay from the stamens l in <i>Hibiscus</i> the gmas project far ove the stamens.

2. How does pollen tube grow through a solid style? [PTA-3]

- Ans. (i) It is common among dicots.
 - (ii) It is characterized by the presence of central core of elongated, highly specialised cells called transmitting tissue.
 - (iii) This is equivalent to the lining cells of hollow style and does the same function.
 - (iv) Its contents are also similar to the content of those cells.
 - (v) The pollen tube grows through the intercellular spaces of the transmitting tissue.
- 3. Grafting is a method of production of hybrid plants but not the method of reproduction. Do you agree this statement? Give logic reason for your answer. [PTA-4]
- *Ans.* No. Grafting is a common method of conventional propagation.

- (*i*) In this, parts of two different plants are joined so that they continue to grow as one plant.
- (ii) 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.
- (iii) 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.
- 4. Write the three fusions of Angiosperms plant fertilization. [PTA-6]
- Ans. (i) One of the male gametes fuses with the egg nucleus (syngamy) to form Zygote.
 - (ii) The second gamete migrates to the central cell where it fuses with the polar nuclei or their fusion product.
 - (iii) The secondary nucleus and forms the primary endosperm nucleus (PEN). Since this involves the fusion of three nuclei, this phenomenon is called triple fusion.

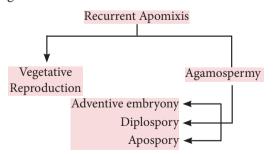
5 MARKS

LONG ANSWERS

1. A reproduction without the involvement of male and female gametes is called apomixis. Give an outline of the method. [PTA-2]

Ans. Recurrent apomixis: It includes vegetative reproduction and agamospermy
 Non recurrent apomixis: Haploid embryo sac developed after meiosis, develops into a embryo without fertilization.

The outline classification of Recurrent apomixis is given below.





Vegetative reproduction: Plants propagate by any part other than seeds

Bulbils – Fritillaria imperialis; Bulbs – Allium; Runner – Mentha arvensis; Sucker - Chrysanthemum.

Agamospermy: It refers to processes by which Embryos are formed by eliminating meiosis and syngamy.

Adventive embryony:

An Embryo arises directly from the diploid sporophytic cells either from nucellus or integument. It is also called sporophytic budding because gametophytic phase is completely absent. Adventive embryos are found in Citrus and Mangifera

Diplospory (Generative apospory): A diploid embryo sac is formed from megaspore mother cell without a regular meiotic division Examples. Eupatorium and Aerva.

Apospory: Megaspore mother cell undergoes the normal meiosis and four megaspores formed gradually disappear. A nucellar cell becomes activated and develops into a diploid embryo sac. This type of apospory is also called somatic apospory. Examples: Hieracium and Parthenium.

- 2. Enumerate the characteristic features of anemophilous plants. [PTA-3]
- *Ans.* Anemophilous plants have the following characteristic features:
 - (i) The flowers are produced in pendulous, catkin-like or spike inflorescence.
 - (ii) The axis of inflorescence elongates so that the flowers are brought well above the leaves.
 - (iii) The perianth is absent or highly reduced.
 - (*iv*) The flowers are small, inconspicuous, colourless, not scented, do not secrete nectar.
 - (v) The stamens are numerous, filaments are long, exerted and versatile.

(vi) Anthers produce enormous quantities of pollen grains are minute, light and dry so that they can be carried to long distances by wind.

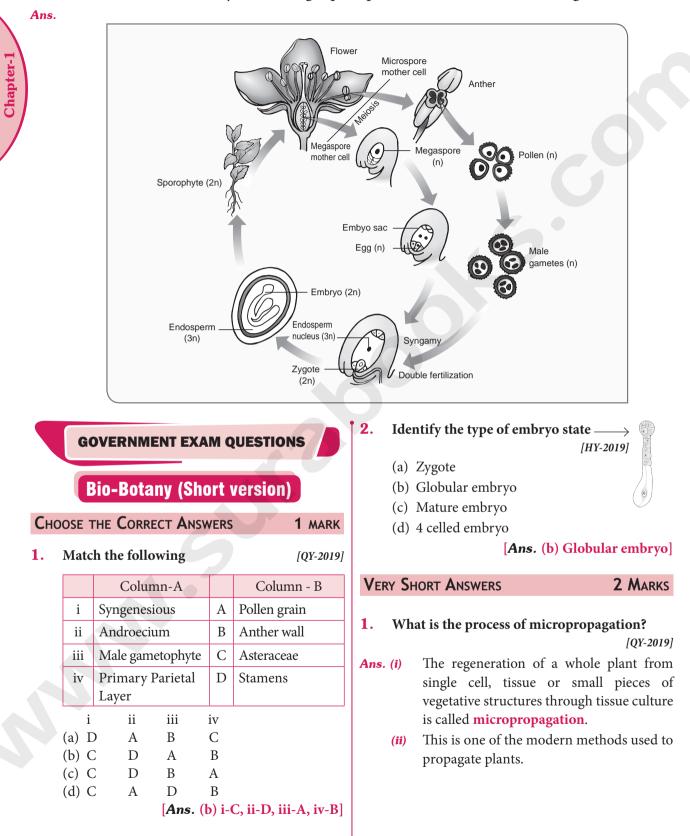
- (vii) In some plants anthers burst violently andrelease the pollen into the air. Example: Urtica.
- (*viii*) Stigmas are comparatively large, protruding, sometimes branched and feathery, adapted to catch the pollen grains. Generally single ovule is present.
- (ix) Plant produces flowers before the new leaves appear, so the pollen can be carried without hindrance of leaves.

3. Describe the structure of dicot seed. [*PTA-5*]

Ans. Structure of a *Cicer* seed as an example for Dicot seed:

- (*i*) The mature seeds are attached to the fruit wall by a stalk called funiculus.
- (ii) The funiculus disappears leaving a scar called hilum. Below the hilum a small pore called micropyle is present.
- (iii) It facilitates entry of oxygen and water into the seeds during germination. Each seed has a thick outer covering called seed coat.
- (iv) The seed coat is developed from integuments of the ovule.
- (v) The outer coat is called testa and is hard whereas the inner coat is thin, membranous and is called tegmen.
- (vi) In Pea plant, the tegmen and testa are fused.
- (vii) Two cotyledons laterally attached to the embryonic axis are present. It stores the food materials in pea whereas in other seeds like castor the endosperm contains reserve food and the cotyledons are thin.
- (*viii*) The portion of embryonal axis projecting beyond the cotyledons is called radicle or embryonic root. The other end of the axis called embryonic shoot is the plumule.
- (*ix*) Embryonal axis above the level of cotyledon is called epicotyl whereas the cylindrical region between the level of cotyledon is called hypocotyl.
- (x) The epicotyl terminates in plumule whereas the hypocotyl ends in radicle.

4. Summarise the whole life cycle of an Angiosperm plant in the form of schematic diagram. [PTA-6]



2. Draw and label the structure of Embryo sac. LONG ANSWERS 5 MARKS Ans. [HY-2019] Filiform apparatus Explain the different mode of entry of pollen 1. Synergids tube into the ovule. [Mar-2020] Egg apparatus 1. Entry of pollen tube into the ovule: There are Eaa three types of pollen tube entry into the ovule. Polar nucleus **Porogamy:** when the pollen tube enters (i) through the micropyle. **Chalazogamy:** when the pollen tube enters (ii) through the chalaza. Antipodal cell Mesogamy: when the pollen tube enters (iii) Structure of Embryo sac through the integument. Pollen tube Draw and mark the parts of first cell of male 3. gametophyte. [Sep-2020] Ans. Exine Intine Nucleus Germ pore Microspore - the first cell of male gametophyte. Pollen tube Pollen tube a) Porogamy b) Chalazogamy c) Mesogamy Path of pollen tube entry into the ovule SHORT ANSWERS 3 MARKS **Botany (Long version)** 1. Draw and label the T.S. of mature anther. Ans. [QY-2019; Mar-2020] CHOOSE THE CORRECT ANSWERS 1 MARK Connective Epidermis 1. From the following which one is the column of Endothecium sterile tissue surrounded by the anther lobe : Middle layer Tapetum [Mar-2020] Stomium (b) pollen chamber (a) periplasmodium Pollen grain (c) connective tissue (d) tapetum [Ans. (c) connective tissue] 2. Cantharophily is : [Sep-2020] Write any three practical applications of 2. (b) Butterflies (a) Bees polyembryony. [Sep-2020] (c) Flies (d) Beetles Ans. Practical applications of polyembryony : [Ans. (d) Beetles] The seedlings formed from the nucellar tissue in Citrus are found better clones for **VERY SHORT ANSWERS** 2 MARKS Orchards. Embryos derived through polyembryony 1. What is called Parthenocarpic fruits? Give an (ii) example. [Mar-2020] are found virus free. Fruit like structures develop from the ovary Ans. (i) (iii) Polyembryony has ecological significance without the act of fertilization. Such fruits as it increases the probability of survival are called parthenocarpic fruits. under different conditions.

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- (ii) They will not have true seeds
- (iii) Example of commercial seedless fruits are Banana, Grapes and Papaya.
- 2. Write the types of cell based on the position of sporogenous cell. [Sep-2020]
- Ans. (i) Tenuinucellate type

Chapter-1

(ii) Crassinucellate type.

SHORT ANSWERS

3 MARKS

[Sep-2020]

- **1**. Define epiphyllous bud.
- *Ans.* Adventious buds develop at the notches of Bryophyllum are called **epiphyllous buds**. They develop into new plants forming a root system and become independent plants when the leaf gets decayed. It is a method of vegetative reproduction.

ADDITIONAL	QUESTIONS	AND	ANSWERS

CHOOSE THE CORRECT ANSWERS I. CHOOSE THE CORRECT ANSWER:

1. How do you call the fertilized ovule?

- (a) Embryo
- (c) Endosperm
- (d) Nutritive tissue [Ans. (a) Embryo]

1 MARK

- 2. Which one of the following is converted into endosperm after fertilization?
 - (a) Egg (b) Funicle
 - (c) Secondary Nucleus (d) Nucellus

[Ans. (c) Secondary Nucleus]

(b) Seed

3. Who initiated embryo culture?

(a) D. A. Johansen	(b) E. Hanning
(c) G. B. Amici	(d) J. G. Kolrecuter

[Ans. (b) E. Hanning]

4. Who discovered the pollen tube?

- (a) G. B. Amici
 (b) E. Strasburger
 (c) Hanstein
 (d) D. A. Johansen
 [Ans. (a) G. B. Amici]
- 5. Name the sac-like structure in the nucellus.
 - (a) Embryo sac

(c) Tapetum

(b) Endothelium(d) Chalaza

[Ans. (a) Embryo sac]

- 6. New plants formed by asexual reproduction method are morphologically and genetically uniform and called as _____.
 - (a) spores
 - (c) clones

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(b) buds(d) gemma

[Ans. (c) Clones]

7. Sexual reproduction of higher plants include _______stages. (a) 2 (b) 4

(d) 5

(a) 2 (c) 3

[Ans. (c) 3]

- 8. Androecium is made up of ____
 - (a) Megasporphyll (b) Pistil
 - (c) Sepals (d) Stamens
 - [Ans. (d) Stamens]
- 9. An example of protandry is _____
 - (a) *Helianthus* and *Borassus*
 - (b) Helianthus and Clerodendron
 - (c) *Scrophularia* and *Aristolochia*
 - (d) Scrophularia and Aristolochia[Ans. (b) Helianthus and Clerodendron]
- **10.** Pollen deposits on another flower of same individual plant is called ______.
 - (a) Geitonogamy
 - (c) Homogamy (d) Cleistogamy

[Ans. (a) Geitonogamy]

(b) Xenogamy

- **11.** Find out the character which is not suitable for anemophilous plants.
 - (a) Spike infloresence (b) Perianth is absent
 - (c) Flowers are small

(c) Malacophily

(d) Scented flowers [Ans. (d) Scented flowers]

12. Pollination by slugs and snails is called _____.

- (a) Ornithophily (b) Entomophily
 - (d) Myrmecophily
 - [Ans. (c) Malacophily]

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1	Y	🖞 Su	ra's	🗰 XII Std - Bio	-Botany & Botany	1
13.	Who proposed doub	le fertilization? and L. Guignard in 1898.	21.	Piston mechanism o	of pollination is found in	
	(b) Carolus Linnaeus	e		(a) Aristolochia	(b) Arum	
	(c) Bentham & Hook				(d) Papilionaceae	
	(d) Engler & Prantl in			(.)	[Ans. (d) Papilionaceae]	
		waschin and L. Guignard	00		-	S
		in 1898]	22.	Apospory is seen in		ex
14.	PEN is referred as			(a) Citrus	(b) Aerva	Asexual
	(a) Primary Endo Nu			(c) Parthenium		
	(b) Primary Endospe				[Ans. (c) Parthenium]	and
	(c) Primary Entry of		23.	Vallisneria Spiralis i	s	
	(d) Post Entry of Nuc			(a) Polygamous	(b) Monoecious	e
	•	nary Endosperm Nucleus]		(c) Dioecious	(d) Prisexual	Sexual
15.		onmental parthenocarpy			[Ans. (c) Dioecious]	
	is	1 17	24.	In adansonia digitata	a, Pollination is carried out	Re
	(a) Citrus	(b) Cucurbita		by		pr
	(c) Pear	(d) Apple		(a) Ant	(b) Bat	O.
		[Ans. (c) Pear]		(c) Water	(d) Wind	
16.	Who classified parth	enocarpy?			[Ans. (b) Bat]	Reproduction
	(a) Nitsch, 1963	(b) Maheswari, 1950	25.		migrates to the central cell	on
	(c) Winkler, 1908	(d) Guignard, 1898		and fuses with the		in
		[Ans. (a) Nitsch, 1963]		(a) polar nuclei		P
17.	The funiculus disar	pears and leaves a scar		(c) obturator	(d) corpusculum	a
	called	·····			[Ans. (a) polar nuclei]	Plants
	(a) Micropyle	(b) Tegmen	26.	Hollow style is also		•
	(c) Testa	(d) Hilum		(a) closed style	•	
		[Ans. (d) Hilum]		(c) open style	(d) semi-solid style [Ans. (c) open style]	
18.	Megaspore arises fro	m .				
	(a) Integument	(b) Nucellus	27.		d the process of syngamy.	
	(c) Placenta	(d) Raphe		(a) E. Strasburger(c) G. B. Amici	(b) E. Hanning (d) Hanstein	
		[Ans. (b) Nucellus]		(c) G. D. Anner	[Ans. (a) E. Strasburger]	
19.	An example for herk	ogamy.	28.	Adventitious buds o	n roots are seen in	
	(a) Aristolochia	(b) Gloriosa		(a) Ipomoea	(b) Pistia	
	(c) primula	(d) Lythrum		(c) Strawberry	(d) Agave	
		[Ans. (b) Gloriosa]			[Ans. (a) Ipomea]	
20.	Pollination by an ant	is called	29.	is an examp	ple for sucker.	
	(a) Malacophily			(a) Dioscorea		
	(b) Entomophily			(b) <i>Chrysanthemum</i>		
	(c) Myrmecophily			(c) Bryophyllum	A	
	(d) Chiropterophily.	[Ans. (c) Myrmecophily]		(d) Murraya	Ans. (b) Chrysanthemum]	

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	30 .	Tur	icated bulk	is see	en is	•	1		А	В	С	D		
		(a)	Scilla		(1	o) Solanum		(a)	iv	i	ii	iii		
		(c)	Allium		()	d) Zingiber		(b)	ii	i	iii	iv		
- 7						[Ans. (c) Allium]	(c)	ii	iv	i	iii		
ter	31.	•	ering is in			N		(d)	i	iii	ii	iv		
Chapter-1		• •	Hibiscus		`	b) Rose			[A	ns. (a) A	-(iv)	; B- (i) C – (ii) D (iii)]
Ö		(C)	Jasminum			d) Citrus Ans. (c) Jasminum	1		-					
	20	т.					- 4.	Α	Tristy	•		(i)	Primula	_
	32.	cell		or an	itner r	nay have polyploid	1	В	Disty	•		(ii)	Vallisneria	
			microspore		(1	b) tapetum		С	Anen	-		(iii)	Lythrum	
			epidermis			d) nucellus		D	Hydr	ophil	y	(iv)	Eichhornia bamboo	
						[Ans. (b) tapetum]		А	В	С	D		
	II.	Ma	тсн тне р	OLLC	WING	i :		(a)	iv	i	ii	iii		
	1.	А	Gemma		(i)	Hydra		(b)	ii	i	iii	iv		
		B	Budding			Aspergillus		(c)	iii	i	iv	ii		
		C	Conidia		(iii)	Marchantia		(d)	i	iii	ii	iv		
		D		ion		Bacteria					Ans	. (c) A	iii, B-i, C – iv, D –i	iil
		D	Binary fiss		(iv)	Бистени]
		(a)	A B iii i	C ii	D		5.	Α	Zoste				Strelitzia	
		(a) (b)		iii	iv iv			В	Orni		•	(ii)	Psychophily	
		(c)		iv	i			С	Bat pollination			(iii)	Sea grass	
		(d)		ii	iv			D	Butte	erflies		(iv)	Zoophily	
			[Ans	s. (a)	A – iii,	B – i, C – ii, D – iv]		А	В	С	D		
	2.	А	Parietal		(i)	Pollen wall]			i	iv	ii		
			tapetum			formation		(b)	ii	i	iii	iv		
		В	Periplasmo	odial	(ii)	Secretory			iii			ii		
			tapetum			tapetum		(d)	i	iii	ii	iv		
		C	Ubisch bo	dies	(iii)	Exine proteins	-			I	Ans.	. (a) A	(a) A-iii, B-i, C – iv, D –ii]	
		D	Rejection reaction		(iv)	Invasive tapetum	6.	А	Rhizo	ome		(i)	Colocasia	
								В	Corn	n		(ii)	Curcuma longa	
		(a)	A B i ii	C iii	D iv			С	Bulb			(iii)	Centella asiatica	
		(a) (b)		iii	iv			D	Runr	ner		(iv)	Allium cepa	
		(c)		i	iii				A	В	С	D		
		(d)		ii	iv			(a)		i	iv	ii		
				[Ans.	(c) A-	ii, B – iv, C-i, D-iii]	(a) (b)		i	iii	iv		
	3.	А	Endotheliu	ım	(i)	Polygonaceae		(c)		i	iv	ii		
		В	Orthotrop	ous	(ii)	Alismataceae		(d)		i	iv	iii		
		С	Amphitro	pous	(iii)	Cactaceae		()						;1
		D	Circinotro	pous	(iv)	Asteraceae				l	Ans.	$(\mathbf{u}) A$	ii, B-i, C – iv, D –ii	ulj
				-		I								

3.

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III. CHOOSE THE CORRECT STATEMENTS:

- 1. An example for root cutting is *Hibiscus*. (I)
 - (II) Scilla is bulbous plant grows in rocky soils.
 - (III) Solanum tuberosum is the example of corm
 - (IV) Adventitious roots store food in Ipomea batatus.
 - (a) I, II correct II, IV wrong
 - (b) I, II wrong III, IV correct
 - (c) I, II,III correct IV wrong
 - (d) IV only [Ans. (d) IV only]
- 2. In 60% of the Angiosperms, pollen is (I) liberated in 3 celled stage.
 - (II) The pollen on reaching the stigma absorbs moisture and swells.
 - (III) Exine grows as pollen tube.
 - (IV) Microspore is a diploid cell.
 - (a) III and IV only (b) I, III and IV only
 - (c) I, II, III and IV (d) II and III only

[Ans. (d) II and III only]

- 3. (I) Ovule is also called microsporangium.
 - (II) Stalk of mature ovule is called integument.
 - (III) Body of an ovule is made up of nucellus
 - (IV) Nucellus is enveloped by one or two coverings called integuments
 - (a) I and II only (b) I and III only
 - (c) I and II only
 - (d) III and IV only [Ans. (d) III and IV only]

IV. CHOOSE THE INCORRECT STATEMENTS:

- 1. (a) The body of the ovule becomes completely inverted in anatropous.
 - (b) The body of the ovule is placed transversely in Hemianatropous.
 - (c) The body of the ovule becomes inverted in amphitropous.
 - (d) The curvature of the ovule leads to horseshoe shape in campylotropous.

[Ans. (b) The body of the ovule placed transversely placed in Hemianatropous]

- (I) Embryosac is otherwise known as female gametophyte.
 - (II) The body of the ovule between the chalaza and embryo sac is called hypostase.

- (III) Tenuinucellate ovules have very small nucellus.
- (IV) The ovule with one integument is said to be monosporic.
- (a) I and II only
- (b) II and III only
- (c) II and IV only
- (d) I and IV only [Ans. (c) II and IV only]
- Mound layering is applied for the plants (I) having flexible branches.
 - (II) Part of the stem is buried in the soil.
 - (III) Two different plants are joined.
 - (IV) It is the method of producing a new plant by cutting the plant.
 - (a) I and III only
 - (b) II and IV only
 - (c) III and IV only
 - (d) I and II only [Ans. (c) III and IV only]

4. "Hydrophily"

- (a) Pollination by wind.
- (b) Pollination by water.
- (c) Epihydrophily is a type of hydrophily.
- (d) Pollen grains can float.

[Ans. (a) Pollination by wind]

5. "Vegetative reproduction"

- (a) A male and female parent is required for propagation.
- (b) New individual plants produced are genetically identical.
- (c) Used to harvest plants in large scale.
- (d) Helps to preserve its own species.

[Ans. (a) A male and female parent is

required for propagation]

6. "Ovule"

- (a) Integument encloses ovule completely.
- (b) The body is made up of nucellus.
- (c) Tenuinucellate ovules has very large nucellus.
- (d) Mature ovule consists of stalk.

[Ans. (c) Tenuinucellate ovules has very large nucellus]

2.

V. Assertion and reason: Directions:

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- (a) Both Assertion and Reason are true and Reason is correct explanation of Assertion.
- (b) Both Assertion and Reason are true but reason is not correct explanation of Assertion.
- (c) Assertion is true; Reason is false.
- (d) Both Assertion and Reason are false.
- **1.** Assertion (A) : Only one parent is required for natural vegetative propagation.

Reason (R) : New individual plants produced are genetically identical.

- [Ans. (a) Both Assertion and Reason are true and Reason is correct explanation of Assertion]
- **2.** Assertion (A) : Pollenkitt is contributed by the tapetum.

Reason (R) : It is chiefly made of xanthophylls and phycobilin.

[Ans. (c) Assertion is true; Reason is false]

3. Assertion (A) : Ruminate endosperm has irregular surface.

Reason (R) : The best example of this is *Areca Catechu*.

[Ans. (b) Both Assertion and Reason are true but reason is not correct explanation of Assertion]

4. Assertion (A) : Parthenocarpy which arises due to mutation is called genetic parthenocarpy.

Reason (R) : Seedless fruits are useful for the preparation of jams.

[Ans. (b) Both Assertion and Reason are true but reason is not correct explanation of Assertion]

VI. C HOOSE THE CORRECT PAIR :

1.	(a)	E. Strasburger	-	Syngamy
	(b)	G. B. Amici	-	Polyembryo
	(c)	Nehemiah	-	Embryo culture
	(d)	D.A. Johansen	-	Pollen tetrad

[Ans. (a) E. Strasburger – Syngamy]

- **2.** (a) Conidia Spirogyra
 - (b) Budding Yeast and Hydra
 - (c) Fragmentation Aspergillus
 - (d) Gemma Penicillium

[Ans. (b) Budding – Yeast and Hydra]

3 .	(a)	Vegetative	-	Begonia
		reproduction		
	(b)	Asexual	-	Dalbergia
		reproduction		
	(a)	Lawaring		Crown graftin

- (c) Layering Crown grafting
- (d) Grafting Mound layering

[Ans. (a) Vegetative reproduction – Begonia]

- **4.** (a) Root cutting-Moringa(b) Stem cutting-Hibiscus
 - (c) Leaf cutting Begonia
 - (d) Grafting Citrus

[Ans. (b) Stem cutting – Hibiscus]

5 .	(a)	Monoecious	-	Date palm
	(b)	Dioecious	-	Coconut
	(c)	Protandry	-	Helianthus

(d) Protogyny - Clerodendrum

[Ans. (c) Protandry – Helianthus]

VII. CHOOSE THE INCORRECT PAIR:

- 1. (a) Dioecious-Borassus(b) Self sterility-Passiflora
 - (c) Heterostyly Hibiscus
 - (d) Protogyny Aristolochia

[Ans. (c) Heterostyly - Hibiscus]

2 .	(a)	Translator	-	Calotropis
	(b)	Pit fall	-	Arum
	(c)	Trap	-	Aristolochia
	(1)	DI		

(d) Piston - Asclepiadaceae

[Ans. (d) Piston – Asclepiadaceae]

🖞 Sura's 🛶 XII Std - Bio-Botany & Botany **3.** (a) Self-Pollination -**ANSWER IN ONE WORD*** Allogamy (b) Monocliny Bisexuality 1. Scientist who reported polyembryony. (c) Cicer Dicot [Ans. E. Strasburger] (d) Maize Scutellum 2. Asexual method of reproduction in Aspergillus / [Ans. (a) Self-Pollination - Allogamy] Penicillium . [Ans. Conidia] **4.** (a) Egg Zygote 3. Organism which reproduces by budding. (b) Nucellus Perisperm [Ans. Yeast / Hydra] (c) Ovary Seed 4. Asexual mode of reproduction in marchantia. (d) Funicle Stalk [Ans. Gemma] [Ans. (c) Ovary - Seed] and genetically 5. Morphologically similar [Ans. Clones] organisms. **5.** (a) Anemophily Maize (b) Entomophily Salvia _ 6. Another name for reproductive propagules. [Ans. Diaspores] (c) Myrmecophily Adansonia 7. which produces vegetative (d) Ornithophily Sterlitzia А plant or adventitious buds on roots. [Ans. (c) Myrmecophily – Adansonia] [Ans. Millingtonia / Murraya / Dalbergia] VIII. CHOOSE THE ODD-MAN OUT & GIVE 8. A weed popularly known as Terror of Bengal. **REASON:** [Ans. Water hyacinth (Eichhornia crassipes)] **1.** (a) Tongue grafting (b) Wedge grafting (c) Mound layering (d) Crown grafting 9. Plants producing tuberous adventitious roots. [Ans. Dahlia / Ipomoea batatus] [Ans. (c) Mound layering] Reason: It is a type of layering whereas other are * Only for quick revision not in pattern types of grafting. **10.** Plants producing a rhizome. 2. (a) Integuments (b) Funiculus [Ans. Musa paradisiaca, Zingiber officinale / (c) Hilum (d) Exine Curcuma longa] [Ans. (d) Exine] **11.** Example of corm. Reason: Exine is a part of pollen grain whereas [Ans. Amorphophallus and Colocasia] others are part of ovule. **12.** Example of tuber. [Ans. Solanum tuberosum] 3. (a) Dermatogen (b) Pleurome (c) Periblem (d) Endosperm **13.** Example of bulb. [Ans. (d) Endosperm] [Ans. Allium cepa and Lillium] **Reason:** It is a part of the seed whereas others are **14.** Example of runner. [Ans. Centella asiatica] parts of embryo. **15.** Example of stolon. Choose the odd man out. 4 [Ans. Mentha and Fragaria] (a) Runner (b) Rhizome **16.** Example of offset. [Ans. Pistia and Eichhornia] (c) Corm (d) Bulb [Ans. (a) Runner] **17.** Example of sucker. [Ans. Chrysanthemum] Reason: It is a sub aerial stem modification whereas **18.** Example of bulbils. others are underground stem modifications. [Ans. Dioscorea and Agave]

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	19.	Plant producing adventitious buds on leaves. [Ans. Bryophyllum]	37.	Cavity in the ovary which bears the ovules. [Ans. Locule]
$\overline{\tau}$	20.	Plant producing epiphyllous buds. [Ans. <i>Scilla</i>]	38.	Another name for megasporangium in a flowering plant. [Ans. Ovule]
oter	21.	Plant whose root cutting can be used for	39.	Stalk of the ovule. [Ans. Funiculus]
Chapter-1		vegetative propagation. [Ans. Malus]	40.	Tissue found in the ovule. [Ans. Nucellus]
)	22.	Artificial method of propagation where two different plants are joined together.	41.	Protective coverings of a ovule. [Ans. Integuments]
		[Ans. Grafting]	42	Female gametophyte in a flowering plant.
	23 .	Regeneration of a whole plant from single cell or	12.	[Ans. Embryo sac]
		tissues. [Ans. Micropropagation]	43.	An ovule which bears horse shoe shaped
	24 .	Property of a single plant cell to form a whole		nucellus. [Ans. Amphitropous]
		plant. [Ans. Totipotency]	44.	Common type of ovule found in majority of the
	25.	Mass of undifferentiated cells formed in tissue culture. [Ans. Callus]		plants. [Ans. Anatropous]
	06		45.	Number of cells and nuclei found in a embryo
	20.	Pollen grains held together, after formation. [Ans. Pollinium]		sac. [Ans. 7 celled and 8 nucleated]
	27 .	Example of a plant with pollinium.	40.	Pollination which occurs without opening of flowers. [Ans. cleistogamy]
		[Ans. Calotropis]	47.	Maturation of anther and stigma at different
	28 .	Example of a plant with compound pollen		times. [Ans. Dichogamy]
	~ ~	grains. [Ans. Drosera]	48.	Pollination by birds. [Ans. Ornithophily]
	29.	The region of a anther wall where dehiscence occurs. [Ans. Stomium]	49 .	Pollination by wind. [Ans. Anemophily]
	30	Layer of anther wall which nourishes the pollen.	50 .	Pollination by animals. [Ans. Zoophily]
	00.	[Ans. Tapetum]	51.	Pollination by water. [Ans. Hydrophily]
	31.	Substance found in exine but absent in germ	52 .	Pollination by bats. [Ans. cheiropterophily]
		pores. [Ans. Sporopollenin]	53.	Another name for cross pollination.
	32 .	Science which deals with study of pollen grains.		[Ans. Xenogamy or Allogamy]
	~ ~	[Ans. Palynology]	54.	Pollination by insects. [Ans. Entomophily]
	33.	Substance of pollen wall which preserves the pollen during fertilization.	55.	Pollination by snails. [Ans. Malacophily]
		[Ans. Sporopollenin]	56.	Pollination by ants. [Ans. Myrmecophily]
	34.	An oily layer found on pollen surface.		
	35	[Ans. Pollenkitt] Name the first cell of male gametophyte of a	J7.	Plant showing pollination by lever mechanism. [Ans. Salvia]
	55.	flowering plant.	58 .	Example of pollination by Trap mechanism. [Ans. Aristolochia]
		[Ans. Pollengrain / microspore]		
	36.	In which stage are the pollen liberated from the anther. [Ans. 2 celled stage]	59.	Example of pollination by pit fall mechanism. [Ans. Arum]

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60.	Example of pollination by clip or translator	81. Protective sheath covering the radicle.
61.	mechanism.[Ans. Asclepiadaceae]Example of pollination by piston mechanism.[Ans. Papilionaceae]	[<i>Ans.</i> Coleorhiza] 82. Protective sheath covering the plumule. [<i>Ans.</i> Coleoptile]
62.	Name of structure formed by union of stigma and androecium. [Ans. Gynostegium]	83. Tissue which forms bulk of maize grain. [<i>Ans.</i> Endosperm]
63.	Relationship between <i>Yucca</i> and moth. [Ans. Obligate mutualism]	84. Reproduction taking place without fusion of gametes. [Ans. Apomixis]
64.	Name given for tip of pollen tube. [Ans. Cap block]	85. Reproduction taking place by fusion of gametes. [<i>Ans.</i> Amphimixis]
65.	Structure which guides the pollen tube towards micropyle of ovule. [Ans. Obturator]	86. Embryo formation without a gametophytic phase. [Ans. Adventive embryony]
66.	Fusion of sperm and egg nucleus. [Ans. Syngamy]	87. Occurrence of more than one embryo is a seed. [<i>Ans.</i> Polyembryony]
67.	Triploid tissue. [Ans. Endosperm]	88. Seedless fruits. [<i>Ans.</i> Parthenocarpic fruits]
68.	Example of caruncle. [Ans. Ricinus communis]	89. Formation of embryos without meiosis and
69.	Example of fruit with fleshy receptacle. [Ans. Pyrus malus (apple)]	syngamy.[Ans. Agamospermy]90. Example of plant showing cleavage polyembryony.[Ans. Orchids]
70.	Remnants of Nucellar tissue in seed. [Ans. Perisperm]	91. Formation of embryo sac from nucellar cell after degradation of megaspores. [Ans. Apospory]
71.	Specialised tissue found in endosperm of cereals which secretes enzymes. [Ans. Aleurone tissue]	VERY SHORT ANSWERS 2 MARKS
72 .	Example for Ruminate endosperm. [Ans. Areca catechu]	 What are diaspores? Ans. The unit of reproductive structure used in propagation is called reproductive propagules
73.	Type of endosperm in coconut water.	or diaspores.
74.	[Ans. Free nuclear endosperm] Type of development of dicot embryo. [Ans. Onagrad or crucifer type]	2. What is asexual reproduction?Ans. The method of reproduction which helps to perpetuate its own species without the
75 .	Fertilized ovule. [Ans. Seed]	involvement of gametes is referred to as asexual reproduction .
76.	Seed coats. [Ans. Testa and tegmen]	3. What is an epiphyllous bud?
77.	Embryonic root. [Ans. Radicle]	Ans. Adventious buds develop at the notches of
78.	Embryonic shoot. [Ans. Plumule]	<i>Bryophyllum</i> are called epiphyllous buds . It is a method of vegetative propagation.
79.	Shield shaped cotyledon found in maize. [Ans. Scutellum]	4. What is a stock?Ans. The plant which is in contact with the soil is
80.	Type of fruit is maize. [Ans. Caryopsis]	called stock in the process of grafting.

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5. What is scion?

Chapter-1

- Ans. (i) The plant part used for grafting is called scion.
 - (ii) It is fixed to the stock which is attached to the soil.

6. Write down the disadvantages of conventional method of propagation of plants.

- *Ans.* (i) Use of virus infected plants as parents produces viral infected new plants.
 - (ii) Vegetative structures used for propagation are bulky and so they are difficult to handle and store.

7. What is palynology?

Ans. (i) Palynology is the study of pollen grains.

- (ii) It helps to identify the distribution of coal and to locate oil fields.
- (iii) Pollen grains reflect the vegetation of an area.

8. What is carrot grass?

- Ans. (i) Parthenium hysterophorus is commonly called Carrot grass and is a native of tropical America.
 - (ii) It was introduced into India as a contaminant along with wheat.
 - (iii) The pollen of this plant cause allergy.

9. What are integuments?

Ans. Ovule is also called **megasporangium** and is protected by one or two coverings called **integuments**.

10. What is the function of funiculus?

Ans. 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.

11. What is hilum?

Ans. The point of attachment of funicle to the **body of the ovule** is known as hilum.

12. What is megasporogenesis?

Ans. The process of development of a megaspore from a megaspore mother cell is called **megasporogenesis** and takes place inside the ovule.

13. What is meant by chasmogamy?

Ans. In majority of angiosperms, the flower opens and exposes its mature anthers and stigma for pollination. Such flowers are called **chasmogamous** and the phenomenon is called **chasmogamy**.

14. What is meant by xenogamy?

Ans. When the pollen (genetically different) deposits on another flower of a different plant of the same species is called **xenogamy**. It is a type of cross pollination.

15. What is meant by anemophily?

- *Ans.* Pollination by wind is called **anemophily**. **Example :** Bamboo.
- **16.** What is malacophily?
- Ans. Pollination of flowers by slugs and snails is called malacophily.

Example: Lemna.

17. Define pollination.

- **Ans.** Transfer of pollen grains from the anther to the stigma of a flower is called pollination.
- 18. What do you mean by cleistogamy?
- Ans. Flowers never open and expose the reproductive organs. Pollination is carried out within the closed flowers. Hence self pollination is ensured.Example: Commelina, Viola and Oxalis.

19. Name two abiotic agents involved in pollination.

- Ans. (i) Anemophily Pollination by wind
 - (ii) Hydrophily Pollination by water

20. Differentiate monoecious and dioecious.

Ans.

Monoecious	Dioecious
Male and female flowers	Male and female flowers
	are produced in different
same plant.	plants.
Ex. Coconut	Ex. Borassus and Carica.

21. Define self sterility / self incompatablity.

Ans. In some plants, when the pollen grains of a flower reaches the stigma of the same flower, It is unable to germinate on it. It is a contrivance for cross pollination.Example: Abutilon.

22. Name the types of endosperm based on \uparrow 27. Draw and label the parts of polyembryony – development.

Nuclear endosperm Ans. (i)

- Cellular endosperm (ii)
- (iii) Helobial endosperm.
- **23**. Differentiate epihydrophily and hypohydrophily

Ans.

Epihydrophily	Hypohydrophily
Pollination occurs at	Pollination occurs inside
the water level.	the water.
Ex: Elodea, vallisneria	Ex: Zostera marina,
	Ceratophyllum

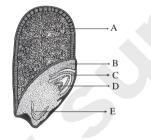
24. What is psychophily?

Ans. Pollination carried out by biotic agents such as butterflies is called psychophily.

25. What are the different types of parthenocarpy?

- Ans. (i) Genetic parthenocarpy.
 - Environmental parthenocarpy. (ii)
 - (iii) Chemically induced parthenocarpy.

26. Identify the parts of L.S. of seed. Name it.



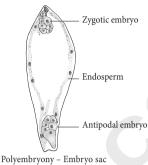
Ans. Monocot seed (L.S)

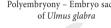
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- A Endosperm _
- С Coleoptile
 - Radicle
- Scutellum B
- Shoot apex D _

embryo sac.

Ans.





28. Define Totipotency.

- Ans. (i) The genetic ability of a plant cell to produce the entire plant under suitable conditions is said to be totipotency.
 - This characteristic feature of a cell is utilized (ii) in horticulture, forestry and industries to propagate plants.

29. Differentiate dichogamy and herkogamy.

Ans. Dichogamy and herkogamy are contrivances for cross pollination.

	Dichogamy	Herkogamy
1.	In bisexual flowers, anthers and stigma mature at different times, thus preventing self pollination.	In bisexual flowers, the stamens and stigmas are arranged in such a way that self- pollination becomes impossible.
2.	Types: Protandry Eg: Helianthus. Types: Protogyny Eg: Aristolocia.	Ex: Gloriosa superba

- **30.** Name two plants which are propagated by roots.
- Ans. Dahlia, Dalbergia.
- **31.** Define tissue culture.
- Ans. The growth of plant tissue in special culture medium under suitable controlled conditions is known as tissue culture.

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32. What is a pollinium?

Ans. In some plants, all the microspores in a microsporangium remain held together called pollinium. **Example:** *Calotropis.*

33. What is stomium?

- Ans. (i) In a anther, cells along the junction of the two sporangia of an anther lobe lack the endothecium and thickenings.
 - (ii) This region is called stomium and helps in dehiscence of anther at maturity.

34. Tapetum is dual in origin. Justify.

Ans. It is derived partly from the peripheral wall layer and partly from the connective tissue of the anther lining the anther locule. Thus, the tapetum is dual in origin.

35. Describe the wall layers of a pollen grain.

Ans. The outer layer called exine is thick and made of cellulose, sporopollenin and pollenkitt. The inner layer intine is thin, uniform and made of pectin.

36. What are germ pores?

Ans. In a pollen grain, the exine is not uniform and thin in certain areas. When these areas are small and round, they are called germ pores. Pollen tube grown through the germ pores.

37. What is pollen calendar?

- Ans. (i) Pollen calendar shows the production of pollen by plants during different seasons.
 - (ii) This benefits the allergic persons.
 - (iii) Pollen grains cause allergic reactions like asthma, bronchitis, hay fever, allergic rhinitis etc.,

38. What is cap block?

- *Ans. (i)* During germination of pollen grain on the stigma all the cytoplasmic contents of the pollen move to the tip of the pollen tube.
 - (ii) The tip appears to be hemispherical, transparent and is called the cap block.
 - (iii) It is cut off from the rest of the pollen by a vacuole.

SHORT ANSWERS

3 MARKS

- **1**. Write the advantages of natural vegetative reproduction.
- Ans. (i) Only one parent is required for propagation.
 - (ii) New individual plants produced are genetically identical.
 - (iii) In some plants, this enables to spread rapidly. Example: Spinifex.
 - (*iv*) Horticulturists and farmers utilize these organs of natural vegetative reproduction for cultivation and to harvest plants in large scale.

2. Write the types of grafting.

- Ans. (i) Bud grafting
 - (ii) Approach grafting
 - (iii) Tongue grafting
 - (iv) Crown grafting
 - (v) Wedge grafting

3. Name the technique used to store pollen grains.

- Ans. (i) Liquid nitrogen (-196°C) is used to preserve pollen in viable condition for prolonged duration.
 - (ii) This technique is called **cryopreservation** and is used to store pollen grains (pollen banks) of economically important crops for breeding programmes.

4. What are the benefits of eating bee pollen?

- *Ans. (i)* Bee pollen is a natural substance and contains high protein, carbohydrate, trace amount of minerals and vitamins.
 - (ii) Therefore, it is used as dietary supplement and is sold as pollen tablets and syrups.
 - (iii) Further, it increases the performance of athletes, race horses and also heals the wounds caused by burns.

5. Write the significance of pollination.

- *Ans.* (i) Pollination is a pre-requisite for the process of fertilisation.
 - (ii) It brings the male and female gametes closer for the process of fertilisation.
 - (iii) Cross-pollination introduces variations in plants due to the mixing up of different genes. These variations help the plants to adapt to the environment and results in speciation.

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Chapter-1

- **6**. Explain about the cutting method of vegetative propagation.
- *Ans. (i)* It is the method of producing new plant by cutting the plant parts such as root, stem, and leaf from the parent plant.
 - (ii) The cut part is placed in a suitable medium for growth. It produces root and grows into a new plant.

Root Cutting -MalusStem cutting -Hibiscus,Bougainvilleaand Moringa.Leaf cutting -Begonia andBryophyllum.

- 7. Give an account of endothecium of anther wall.
- Ans. (i) It is generally a single layer of radially elongated cells found below the epidermis.
 - (ii) The inner tangential walls develop bands.The cells are hygroscopic.
 - (iii) In the anthers of aquatic plants, saprophytes, cleistogamous flowers and extreme parasites endothecial differentiation is absent.
 - (iv) The cells along the junction of the two sporangia of an anther lobe lack these thickenings. This region is called **stomium** and breaks during dehiscence.

8. Define cross-pollination and explain its types.

Ans. Cross-pollination is the transfer of pollens on the stigma of another flower. It is of two types.

(i) Geitonogamy :

When the pollen deposits on another flower of **same individual plant**, it is called geitonogamy. It occurs in plants of monoecious plants.

(ii) Xenogamy :

When the pollen deposits on another flower of a different plant of same species.

9. Mention the advantages of self-pollination.

- Ans. (i) Pollination is almost certain in bisexual flowers.
 - (ii) When the members of the species are uncommon and are separated by large distances, the plant has to depend on self pollination.

(iii) If all the chances of cross – pollination fails, self pollination still takes place and prevent the extinction of the species.

10. Comment on pollination in *ophyrus*.

- Ans. (i) In Bee orchid (*Ophyrus*), the morphology of the flower mimics that of female wasp (*Colpa*).
 - (ii) The male wasp mistakes the flowers for a female wasp and tries to copulate.
 - (iii) This act of pseudocopulation helps in pollination.

11. Explain the types of entry of pollen tube into the ovule.

- Ans. (i) Porogamy: Pollen tube enters through micropyle.
 - (ii) Chalazogamy: Pollen tube enters through chalaza.
 - (iii) Mesogamy: Pollen tube enters through the integument

12. Tabulate any 4 post fertilization changes in a flower.

l	n	S		

A

	Parts before fertilization	After fertilization
1.	Ovary	Fruit
2.	Ovule	Seed
3.	Egg	Zygote
4.	Funicle	Stalk of seed

13. What is perisperm?

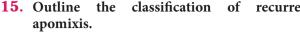
Ans. The nucellar tissue is either absorbed completely by developing embryo sac and embryo or small portion may remain as storage tissue. This remnant of nucellar tissue in the seed is called perisperm.

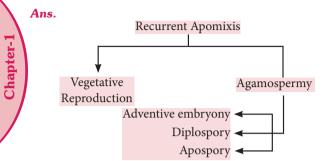
Example: Black pepper and Beetroot.

14. What are the functions of endosperm?

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

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16. Comment on terror of Bengal.

- Water hyacinth (Eicchornia crassipies) is an Ans. (i) invasive need on water bodies like ponds, lakes and reservoirs.
 - (ii) It is popularly called "Terror of Bengal" It spreads rapidly through offset all over the water body and depletes the dissolved oxygen and causes death of other aquatic organisms.

17. Explain the types of embryosac developments.

- Ans. There are 3 types of embryosac development
 - Monosporic: Of the four megaspores formed, (i) usually the chalazal one is functional and other three megaspores degenerate. The functional megaspore forms the female gametophyte or embryo sac. This type of development is called **monosporic** development. **Example:** *Polygonum*.
 - **Bisporic:** Of the four megaspores formed, (ii) if two are involved in embryo sac formation the development is called **bisporic**. Example: Allium.
 - (iii) Tetrasporic: If all the four megaspores are involved in embryo sac formation the development is called **tetrasporic**. **Example:** Peperomia.

18. Comment on Aleurone tissue.

- Ans. (i) Aleurone tissue consists of highly specialised cells of one or few layers which are found around the endosperm of cereals (Barley and Maize)
 - (ii) Aleurone grain contain spherosomes.
 - (iii) During seed germination, cells secrete certain hydrolytic enzymes like amylases.
 - Proteases which digest reserve food material (iv) are present in endosperm cells.

classification of recurrent 19. Describe about the endosperm haustoria.

- Interesting feature of endosperm is the Ans. (i) presence of haustoria.
 - In the case of helobial endosperm, the chalazal (ii) chamber itself acts as a haustorial structure.
 - (iii) In cellular and nuclear endosperm special structures are produced towards micropylar and chalazal ends.
 - These absorb nutrients from other outer (**i**n) tissue or from ovary tissue and supply them to the growing embryo.

20. What is sporopollenin?

- Ans. (i) It is a substance present is exine of pollen grain pollen. It is derived from carotenoids.
 - It helps to withstand high temperature and (ii) is resistant to strong acid, alkali and enzyme action.
 - (iii) It preserves the pollen for long periods in fossil deposits, and it also protects pollen during its journey from anther to stigma.

21. What is the significance of synergids?

- The secrete chemotropic substances that help Ans. (i) to attract the pollen tube.
 - The special cellular thickening called filiform (ii) apparatus of synergids help in the absorption, conduction of nutrients from the nucellus to embryo sac.
 - (iii) It also guides the pollen tube into the egg.

22. What is Ornithophily?

Ans. Pollination by birds is called Ornithophily. **Example:** *Erythrina*, *Bombax*, *Syzygium*, *Bignonia*, Sterlitzia etc., Humming birds, sun birds, and honey eaters are some of the birds which regularly visit flowers and brings pollination.

23. Mention some adaptations of ornithophilous flowers.

- Ans. (i) The flowers are usually large in size.
 - The flowers are tubular, cup shaped or (ii) urn-shaped.
 - The flowers are brightly coloured, red, scarlet, (iii) pink, orange, blue and yellow which attracts the birds.