Concern Teacher
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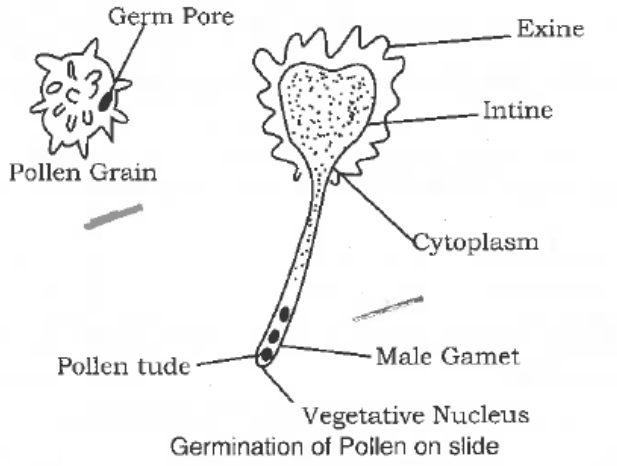
MAJOR EXPERIMENT

EXERCISES – 1

(1) Aim: To study Pollen germination and growth of Pollen tube.



Germination of Pollen on slide

(2) Materials required: Flower, needles, Safranine stain, glycerine, coverslips, microscope.

(3) Procedure:

(1) Take out the pistil from a Portulaca flower.

(2) Stain the isolated pistil and mount in glycerine, Press gently, observe under dissecting microscope.

(3) Take out carefully each germinated pollen and count.

(4) Mount a pollen in glycerine and observe under compound microscope.

(4) Observations:

(1) Observe many pollen grains germinating over stigma. The growth of the pollen tube is stimulated by sugary substances secreted by the stigma.

(2) Pollen tube carrying with it tube nucleus and the generative nucleus.

(3) The generative nucleus divides forming two male gametes.

(4) Count the number of germinated pollen grains.

(5) Precautions:

(i) Mounting should be free from air bubbles.

(ii) Material should be moderately stained.

(iii) Use the clean slide.

Exercise 2

(1) Aim: To determine the population density of plants at a place by the quadrate method.

(2) Materials required: Meter scale, string, nails" hammer, measuring, tape, paper.

(3) Principle: Average number of particular plant species present per unit area is called as population density.

(4) Method:

(1) Choose a nearly area of square field of size 2m and fix the iron Nails at the comers of this square field. Now tie a string and ready the square field.

(2) Now divide this square field into 10 small squares by tying strings at the distance of 10- 10 ems. This square is called as quadrate.

(3) Record the name and number of all species present in the squares.

(4) Population density of the plants in this quadrats can be identified by following formulae-

$$\text{Density} = \frac{\text{Total no. plant speices}}{\text{Observation table:}}$$

Observation table

Observation table

S.No.	Name of Plants species	No.of plants in quadrate of 1x1 m			Total no. of plants in a quadirate	Average
1	Plant A	Quadrate I	Quadrate II	Quadrate III		
2	Plant B					
3	Plant C					
4	Plant D					

Result:

(1) No. of plant species studied in a quadrate are '

(2) Plant species with high density in the quadrate are and species with less density are _.

Precautions :

(1) Only the individuals of one plant species should be considered at one time.

(2) Square field should be taken from single place only.

Experiment No. - 3

(1) Aim: To determine the population frequency of any field by quadrate method.

(2) Materials required: Meter scale, string, nails" hammer, measuring, tape, paper.

(3) Principle: Total no. of quadrate having species in them among the total no. of quadrate gives the percentile of population frequency. .

(4) Method:

(1) Make an area of 1m 2 of a square field. Fix 4 nails at the comers of field and tie a string/thread on the nails.

(2) Now make 10 small squares of area 10 em' by fixing the nails at the corners and tying the thread around them.

(3) In this way 10 quadrate are formed.

(4) By counting the no. of plants in each 1-8 or 1-10 quadrate, population frequency can be determined by following formulae.

$$\text{frequency \% of species} = \frac{\text{No. of quadrates in which species are present} \times 100}{\text{Total no. of quadrates taken for sample}}$$

(5) Observation Table:

S.no.	Name of the plant species	No. of Sp. Present in quadrate of 1 x 1 m^2 size										Frequency
		1	2	3	4	5	6	7	8	9	10	
1	A											
2	B											
3	C											
4	D											
5	E											

(6) Precautions:

(1) Square field should be taken from one place only.
(2) Measurement should be done carefully.
(3) One quadrate should not be overlapped with another quadrate.

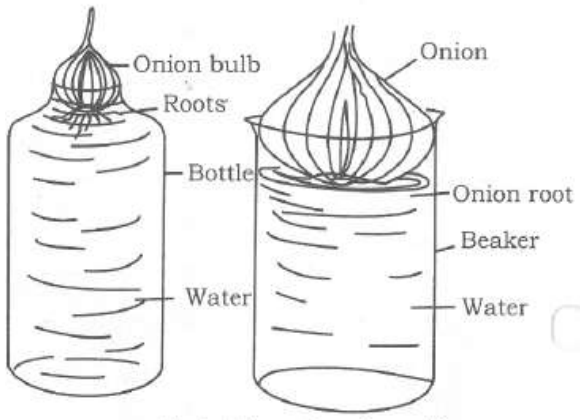
Exercise - 4

1. Aim: To make a temporary mount of the onion root tip to study various stages of mitosis.

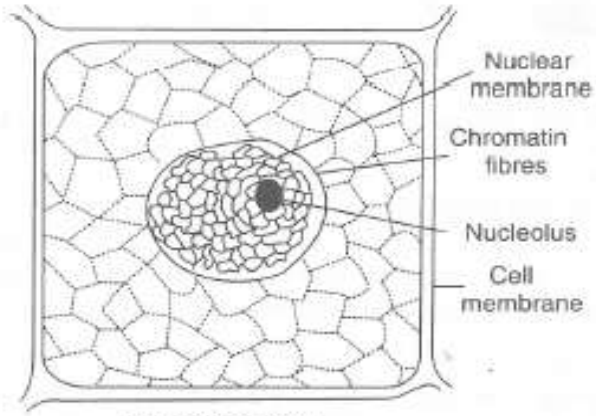
2. Materials required: Onion root tips, needles, brush, slide, coverslip, burner, microscope, acetocarmine stain.

3. Procedure:

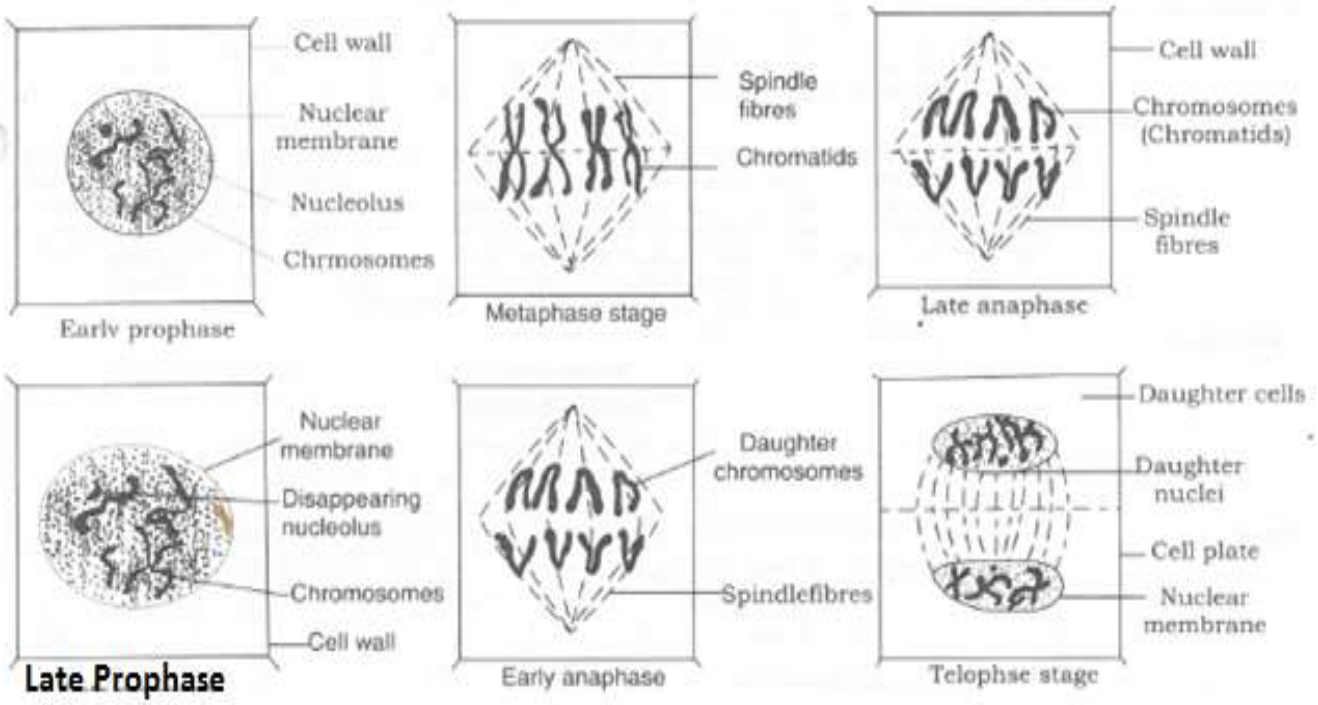
(1) Take a root tip on clean slide and put a drop of acetocarmine stain on it.
(2) This makes the stain specific for nuclear materials. Gently warm it a little over a burner. On warming the stain evaporates. Before it is dried add.more stain on it.
(3) Squash the root tip with the help of a needle or a force put the coverslip. Tap it a bit more from above.
(4) Now take the slide in the folds of a blotting paper and apply gentle pressure with hands.
(5) Observe the slide under the microscope first in the low power and then after locating a specific area in the high power. Examine and identify various stages of mitosis.



: Method of growing onion root tips



Interphase stage



4. Precautions:

(1) The slide should be warmed gently much above the flame of the spirit lamp.
(2) The acetocarmine stain should be filtered before use.
(3) There should be no air bubble in the slide.

5. Observation:
Various stages of mitosis could be seen –

(1) Interphase:
(i) Chromatin fibres appear in the form of a network within the nucleus.
(ii) Nuclear envelope and nucleolus are distinct.

(2) Prophase:
(1) Chromatin material shortens and condenses into thread like structures called chromosomes. .
(2) Each chromosome consists of two chromatids that are joined at a point called centromere.
(3) Nuclear membrane and nucleolus disappear.

3) Metaphase:
(1) Chromosomes become arranged at the equator of the spindle.
(2) Each chromosome get attached to the spindle fibres at its centromere.

(4) Anaphase:
(1) The two sister chromatids of each chromosome separate from the centromere and move towards the opposite poles.
(2) The daughter chromosomes appear V,J,L and I shaped depending upon the position of centromere.

(5) Telophase:
(1) Nuclear membrane and nucleolus reappears and two daughter nuclei appear at opposite poles.
(2) Cytokines is occurs by cell plate formation between the two daughter nuclei.

Exercise - 5

Isolation of DNA from available plant material such as spinach, green pea seeds, papaya etc.

Spinach leaves/Pea seeds/Papaya, Sand ,test tube, 50 ml beakers, Cheesecloth, Mortar and pestle, 1Omlgraduated cylinder.

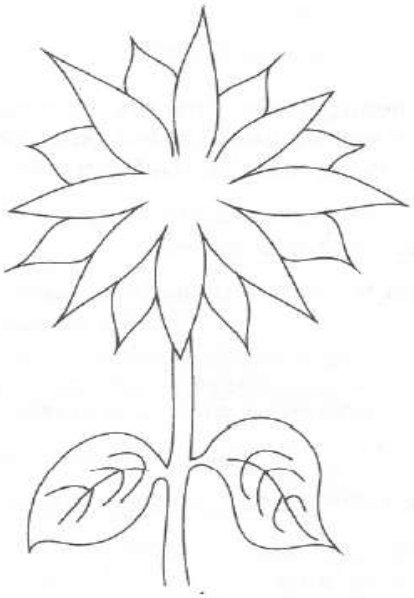
95% Ethanol solution (keep ice cold in plastic bottle in freezer),12% Salt solution,29.2 g deionized salt,250 ml distilled water,50% Detergent solution,50 ml Wisk Free,50 ml distilled water, Contact Lens Cleaning Solution, Use 1 tablet per 3ml of distilled water.

1. Choose 2-3 spinach leaves. Remove any stems if present.
2. Place 1 ml of distilled water in a mortar and pestle along with leaves. Add a small pinch of sand and grind until spinach looks like creamed spinach. Add the contents of the mortar and pestle to a 50 ml beaker.
3. Add 1 ml of 50% detergent solution and 9 ml salt solution to spinach. Mix well with a glass stir rod.
4. Place on a hot plate and heat until boiling. Remove from heat and let sit for minutes.
5. Put on ice for 5 minutes so that it cools down.
6. Pour spinach mixture (supernatant) through cheesecloth into a clean beaker.
7. Pour the supernatant into a test tube then add 1 ml of freshly prepared contact lens cleaning solution.
8. Carefully layer 6 ml chilled 95% ethanol solution onto the green supernatant using a 10 ml graduated cylinder. Slowly pour ethanol down the side of the test tube. Try not to let the two layers mix together.
9. Using the wire loop, spool the DNA by gently swirling the loop at the interface between the green supernatant and the clear ethanol. The DNA will congeal at the point where the two layers meet.

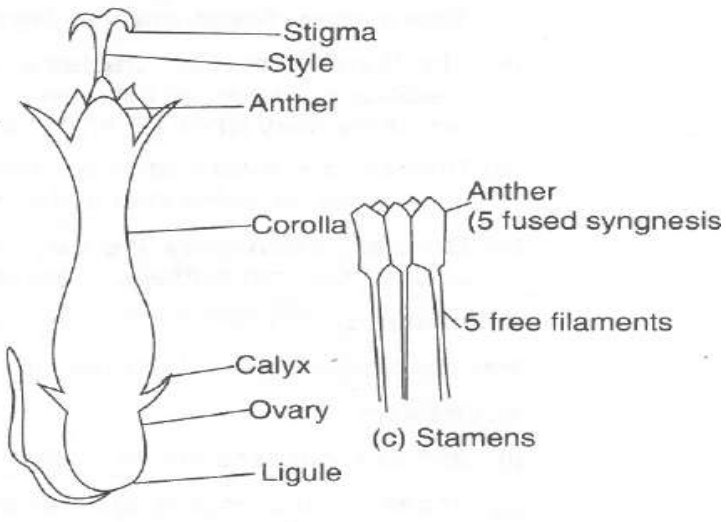
Spotting 1

Aim: To Study the flowers adapted to pollination by different agencies (wind, Insect).

(1) Maize flowers (Anemophilous or wind pollinated flowers)



(A) Sunflower Twig



(B) Single disc floret

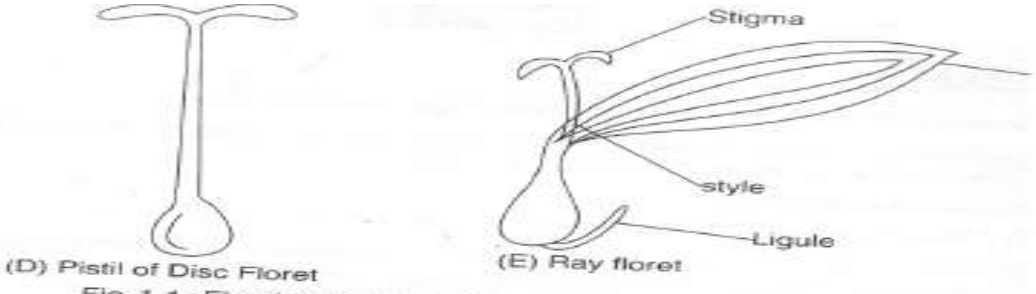


Fig. 1.1 : Floral parts of sunflower (Helianthus annuus)

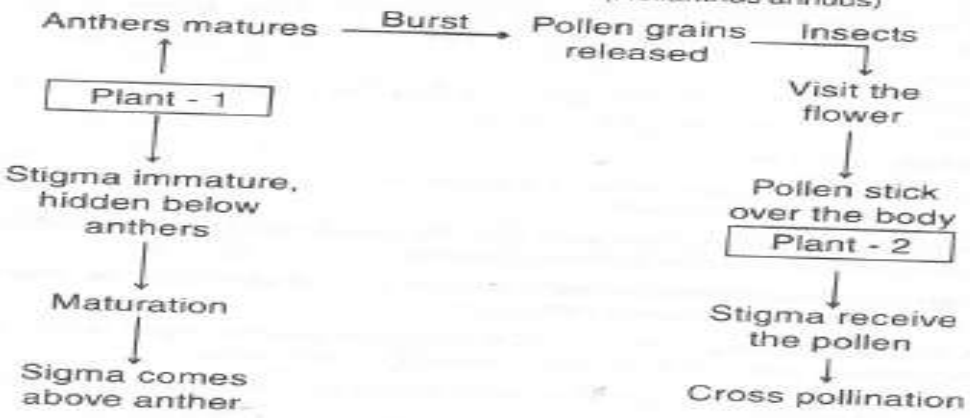


Fig. 1.2 : Diagrammatic representation of pollination in sunflower

A) The maize plant is monoecious and bears unisexual flowers. The male flowers are born in terminal inflorescence while the female flowers are born in axillary inflorescence.
(B) The flowers are colourless, odourless and nectarless.
(C) Flowers are small and inconscipicous.
(D) Both the stigmas and anthers are exerted.
(E) Anthers are versatile, and pollen grains are light, small and dusty.
(F) Stigma is hairy, feathery or branched to catch wind born pollen grains.
(G) The pollen grains are produced in very large numbers.

(2) Salvia flowers (Entomophilous or Insect pollinated flowers.)

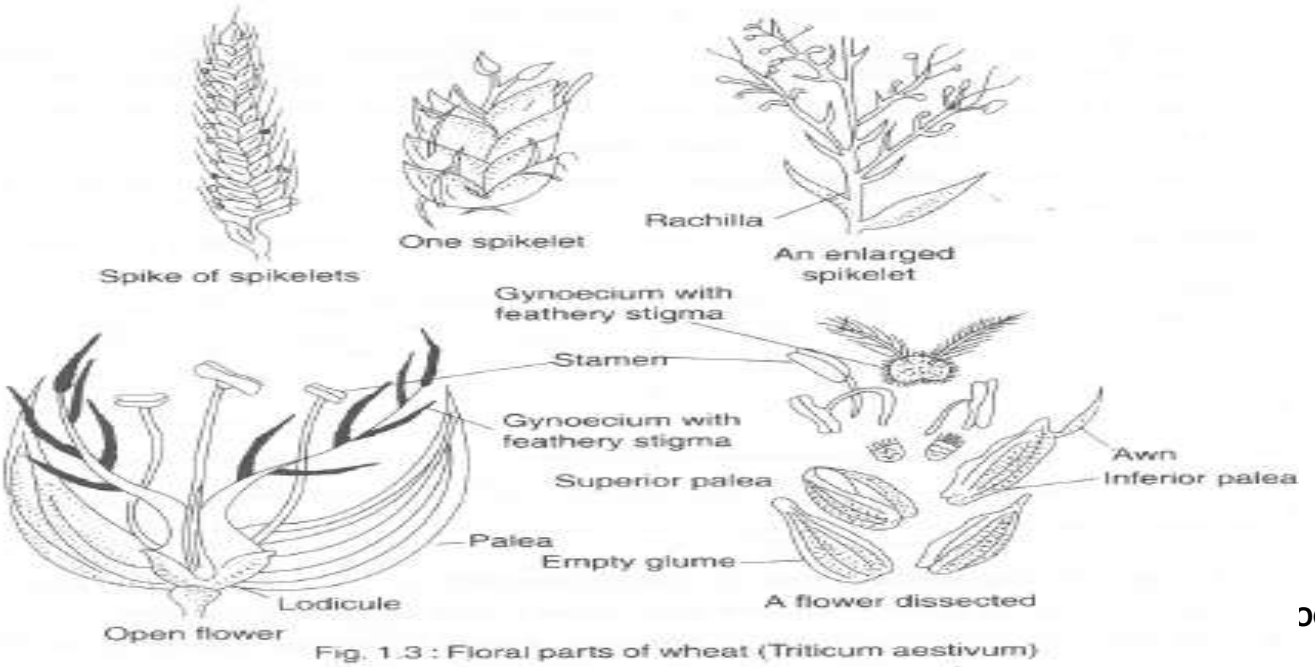
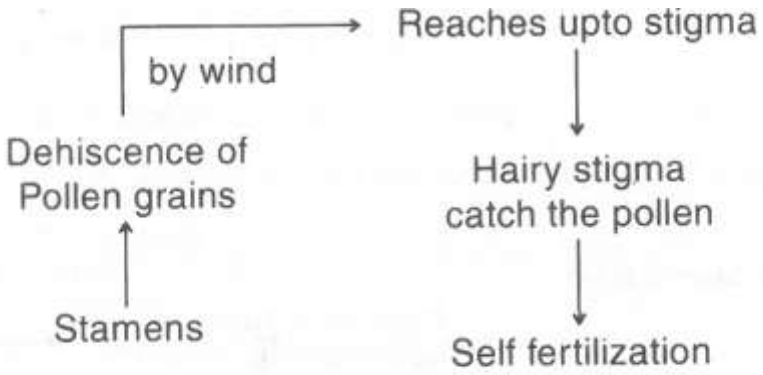


Fig. 1.3 : Floral parts of wheat (Triticum aestivum)

OGY)



. 1.4 : Diagrammatic representation to show wind pollination in wheat.

(A) The flowers are showy or brightly coloured for attracting pollinating Insects.

(B) Flowers secrete nectar to feed visiting insects. Nectar glands are placed in such a position that an insect must touch both the anthers and stigmas.

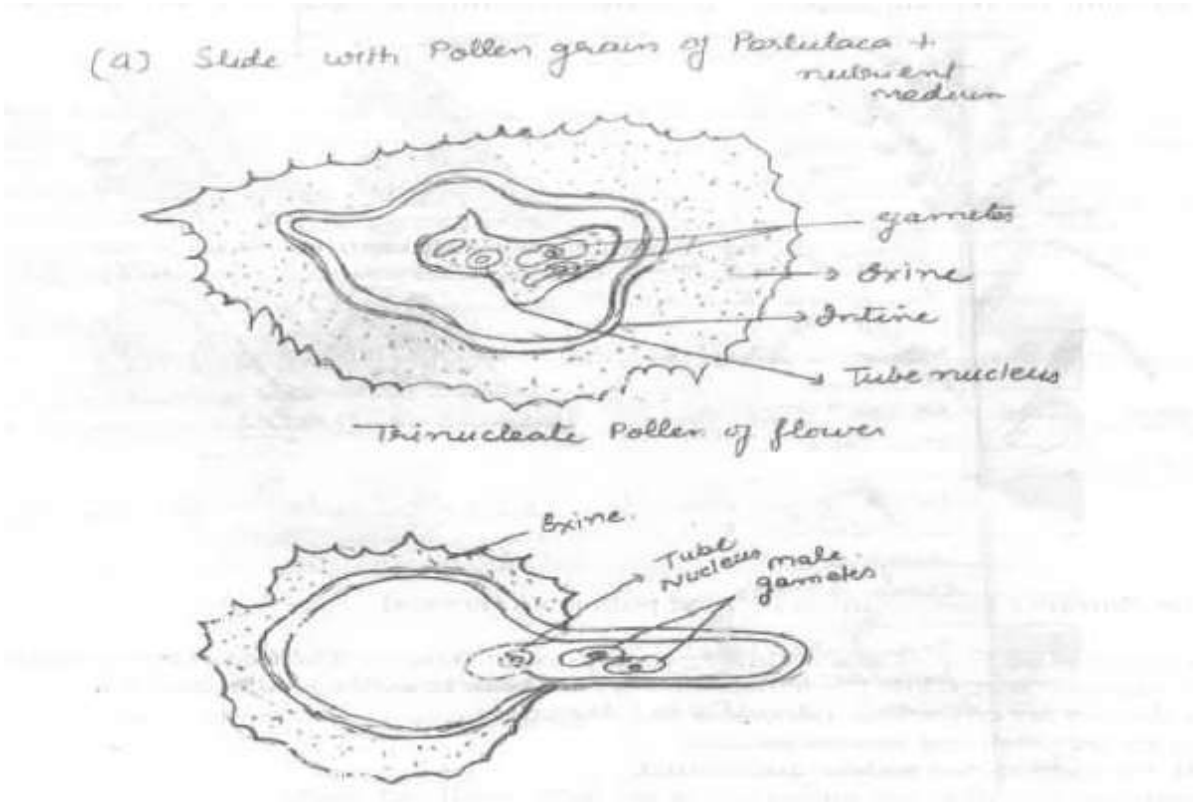
(C) The flowers have landing platform for the insects.

(D) The flowers are protandrous with bilipped corolla and have turn pipe or lever mechanism.

(E) Each stamen has long connective which bears a fertile anther lobe at the upper end and sterile plate like anther lobe at the lower end.

Spotting 2

Identification: Pollen germination on a slide.



Comments:

(1) Pollen grain or microspore is the first cell of male gametophyte.

(2) Each pollen grain of a flowering plant (angiosperm) possesses two cells.

(i) Vegetative cell (2) Generative cell

(3) On the stigma, the pollen grain absorbs water and nutrients from the stigmatic secretion through its germ pores.

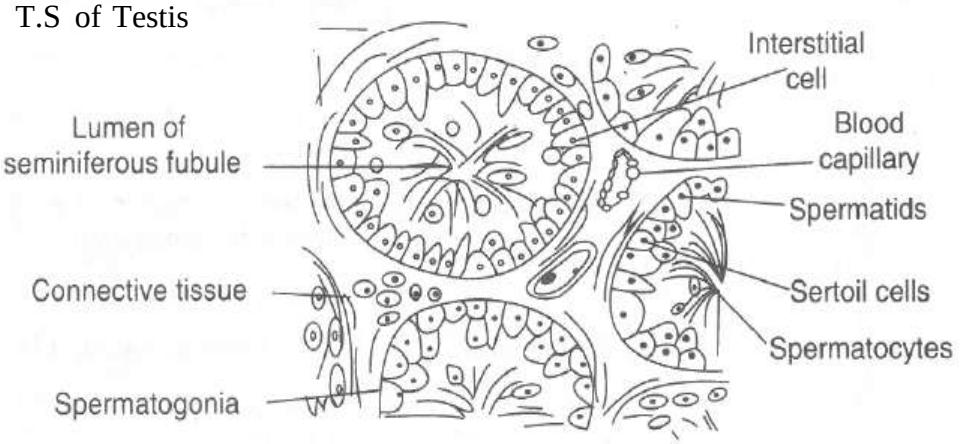
(4) The tube cell gives rise to a pollen tube, the generative cell also descends into the pollen tube and divides in to two male gametes.

(5) There is only one pollen tube from one pollen.

(6) Certain pollen grain do not germinate and are referred as sterile pollens.

Spotting 3 (a)

Identification: T.S of Testis



T.S. of a mammalian testis.

Comments:

(1) The mammalian testis is covered by a thick fibrous tissue called tunica albuginea.

(2) The testis consists of numerous seminiferous tubules embedded in the interstitial tissue.

(3) Various types of germinal cells are present from outside towards lumen in the following sequence. Spermatogonia Spermatocytes Spermatids Spermatozoa Sperms.

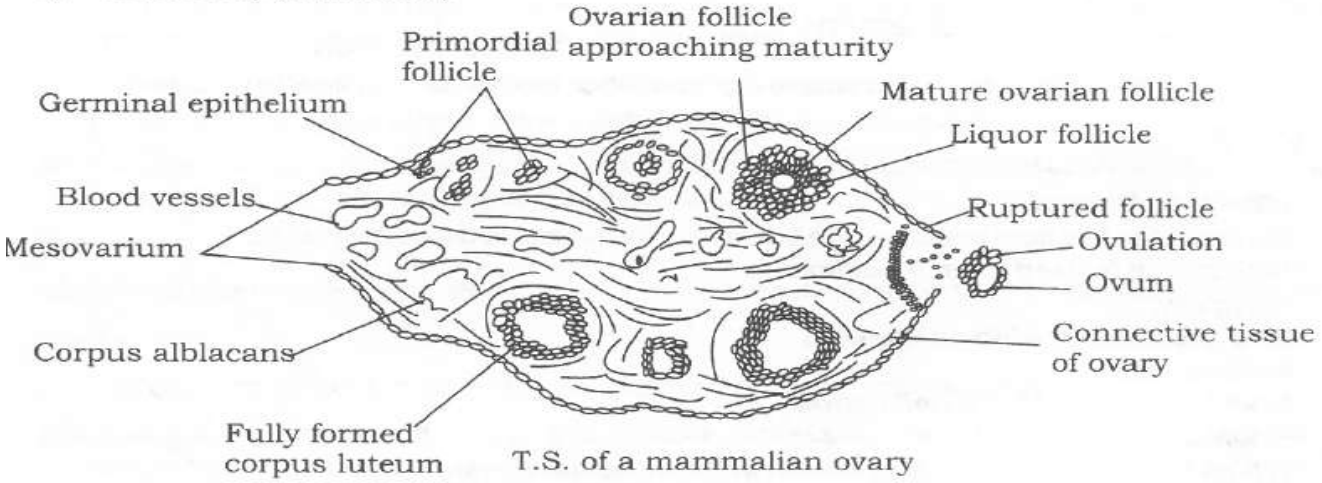
(4) Between the germinal cells, pyramid shaped cells called sertoli cells are present.

(5) The interstitial cells or leydig cells are present in between the tubules they secrete the male sex hormone, testosterone.

Spotting 3 (b)

Identification: T.S of ovary.

a) T.S. of Ovary (Mammalian)



T.S. of a mammalian ovary

Fig. 3.1 : T.S. of a mammalian ovary

Comments:

(1) A mammalian ovary is a solid structure bounded by germinal epithelium followed by a thick layer of fibrous tissue, the tunica albuginia.

(2) The ovary consists of outer cortex and inner medulla.

(3) In the stroma, graffian follicles in various stages of development like primary oocytes and secondary oocytes are found.

(4) A graffian follicle consists of an ovum, surrounded by a group of follicular cells.

(5) A Mature follicle ruptures and releases the ovum out of the ovary. At the point of rupture corpus luteum is formed which secretes the hormone progesterone.

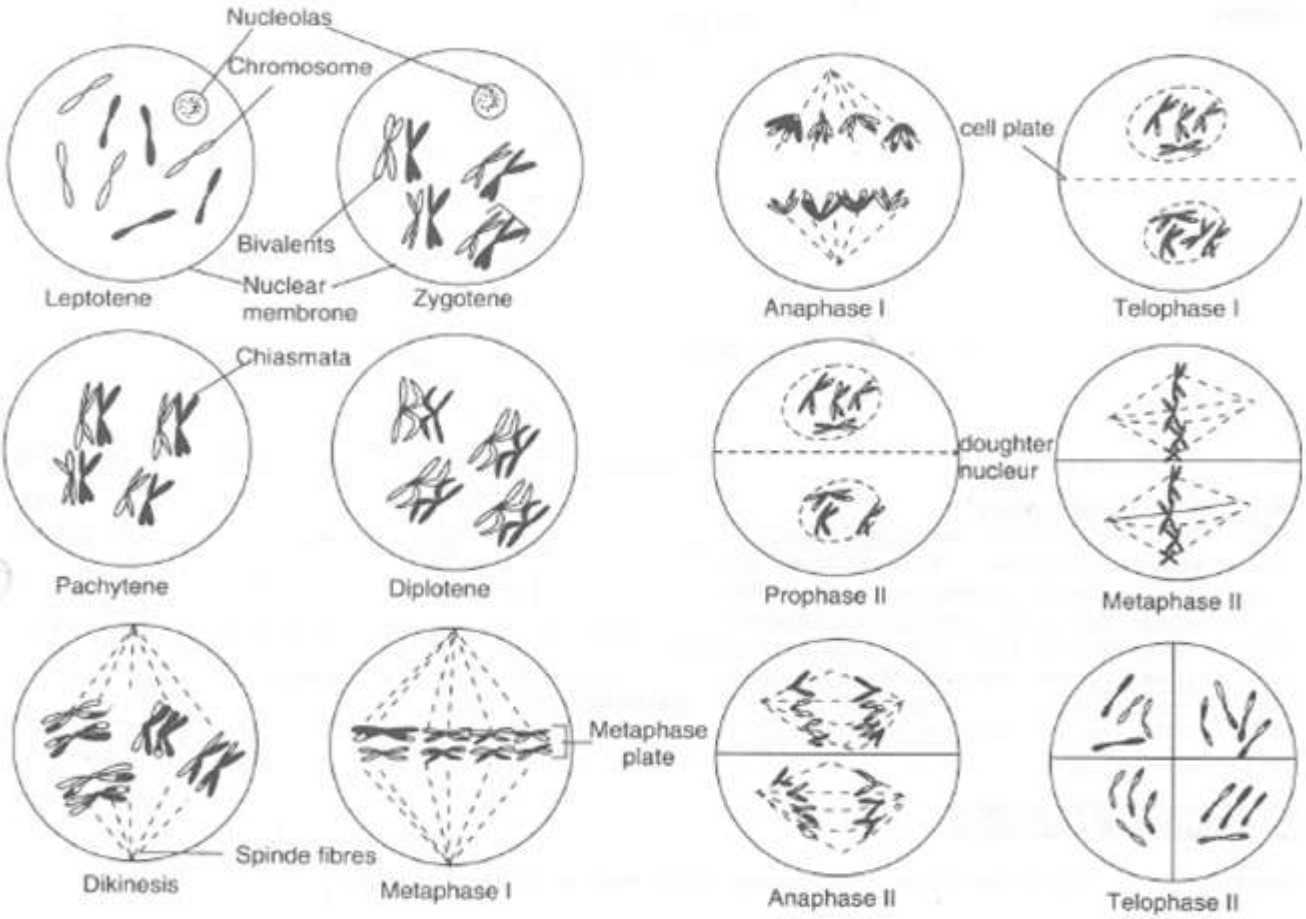
(6) The cortex may also contain a large mass of yellow cells termed corpus luteum, formed in an empty graffian follicle after the release of its ovum.

Spotting 4

Identification: Meiosis in onion bud cells.

Comments:

(A) Meiosis –I



Stages of mitosis in animal cells.

(1) Prophase 1 : It is slightly of longer duration and is different from prophase of mitosis. **It** can further be subdivided into the following five substages-

(a) Leptotene:

(i) Chromatin fibres condense and form thick thread like structures called chromosomes.

(ii) Nuclear envelope and nucleolus are distinct.

(iii) The nucleus increases in size and volume by absorbing water.

(b) Zygotene :

(i) The two homologous chromosomes lie side by side. This is known as pairing or synapsis.

(ii) Each pair of chromosome is known as bivalent.

(c) Pachytene:

(i) Each chromosome of a bivalent splits - longitudinally into two sister chromatids so that the bivalent becomes a tetrad.

(ii)Crossing over occur in a homologs pair.

(iii)The points of crossing over are known as chiasmata.

(d) Diplotene:

(i) As the chromosomes are showing gradual condensation. So there is a tendency that chiasmata tend to slip out of the chromosomes. This is known as terminalisation of chiasmata.

(ii)Chromosomes start separating out but the separation is not complete.

(iii)Nuc1ear Membrane and nucleolus start degenerating.

(e) Diakinesis :

(i) Homologous chromosomes appear thick and ring shaped.

(ii) Nucleolus and nuclear envelope disappear and spindle begins to be formed.

(2) Metaphase - I

(i) The bivalent arrange themselves at the equator of the spindle. (ii)The spindle get attached to the centromere of the chromosome.

(3) Anapbase - I

(i) The two chromosomes of each bivalent move to the opposite pole.

(ii)Each pole has half the number of chromosomes with two chromatids each.

(4) Telopbase - I

(i) The Chromosome at each pole uncoil, and nucleolus and nuclear envelope reappear.

(ii) Cytokinesis occurs to form two haploid daughter cells.

(B) Meiosis II : It includes following four stages.

(a) Prophase II

(i) The chromosomes of daughter cell begin to condense and become thick.

(ii) Nuclear envelope and nucleolus begin to disappear.

b) Metaphase II

(i) The chromosomes are arranged on the equator of the spindle.

(ii) Nucleolus and nuclear membrane disappear.

(c) Anaphase II

(i) The sister chromatids of each chromosomes separate and migrate towards the opposite ph
(ii)Each pole thus receives haploid number of chromosomes.

(d) Telophase II

(i) The chromosomes begin to uncoil and become thin.

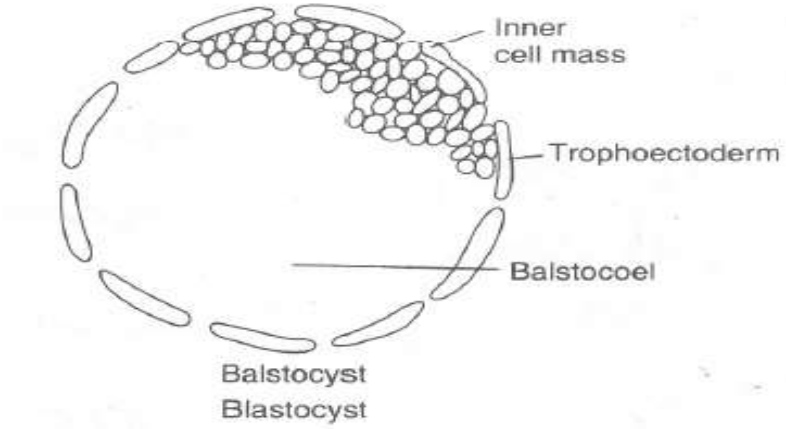
(ii) The nuclear envelope and nucleolus are reconstituted.

Spotting 5

Identification: T.S of Blastula.

Comments:

(1) **It** is a spherical mass of about 32 or 64 cells.
(2) **It** is composed of an outer envelope of cells, the trophoblast or trophoectoderm and inner cell mass (embryoblast).
(3) Within the envelope there is a fluid filled cavity called blastocoel.
(4) The side of the blastocyst to which the inner cell mass is attached is called the embryonic or animal pole, while the opposite side is the abembryonic pole.
(5) The inner cell mass is the precursor of the embryo.
(6) **In** this state it forms the connection with mother's uterus wall which is called implantation.

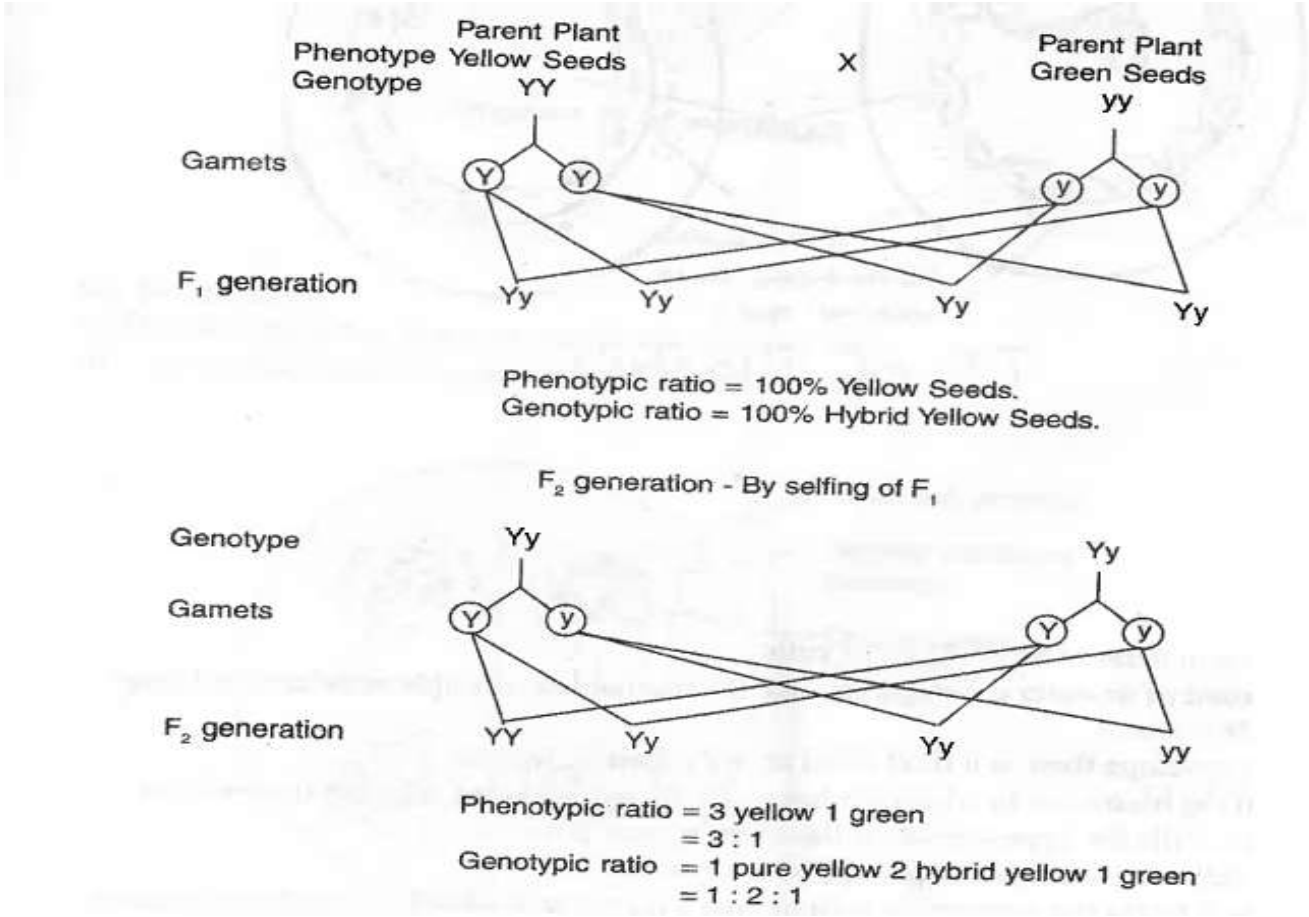


Spotting 6

Identification- Mendelian inheritance.

Object : Study of Mendelian inheritance using seeds of different color f.size of any plant.
Requirements : Seeds of any plant (like pea), pencil, eraser, note book.
Observation .

(i) Collect the seeds of any plant (pea).
(ii) Now count the number of seeds which are yellow and green in colour.
(iii) The ratio were analysed on the basis of law of probability.
(iv) Monohybrid cross can be shown by following cross.



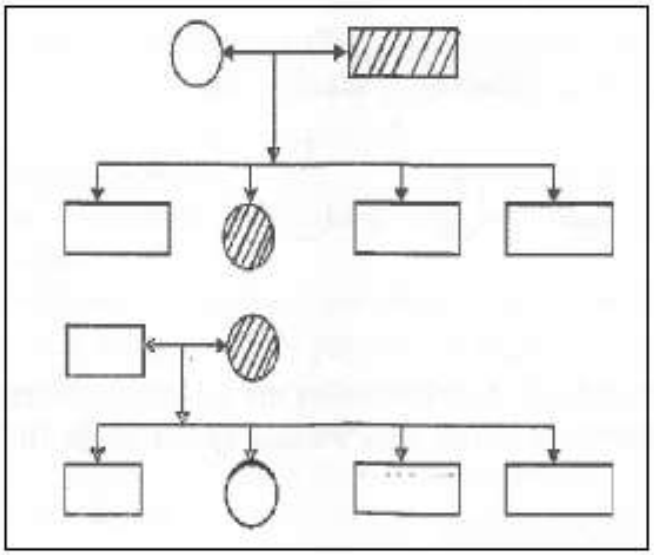
Observation : Ratio of seed colour in plant in Fl generation is ----------
Ratio of seed colour in plant in F2 generation is ----------

Result : **Above ratio matches with Mendelian ratio.**

Spotting 7 (a)

Symbol	Explanation
	Male
	Female
	Mating
	Parents and children (1 boy, 1 girl in order of birth)
	Dizygotic twins
	Death
	Monozygotic twins
	Sex unspecified
	Number of children of sex indication
	Effected individuals
	Consangineous marriage

Aim- Study and analyse the given pedigree chart for genetic trait of blood group.



1. Pedigree Chart is a record of occurrence of a trait in several generations of a human family. In this case the blood group is a given genetic trait.

2, In this pedigree chart male members of the family are shown by squares and females by circles. Parents are joined by horizontal lines and their off springs through a vertical line below the parents in order of their birth.

3. The given pedigree chart shows that a male parent with blood group A' marries a female without blood group 'A' they have four children of which only one female is with blood group 'A'.

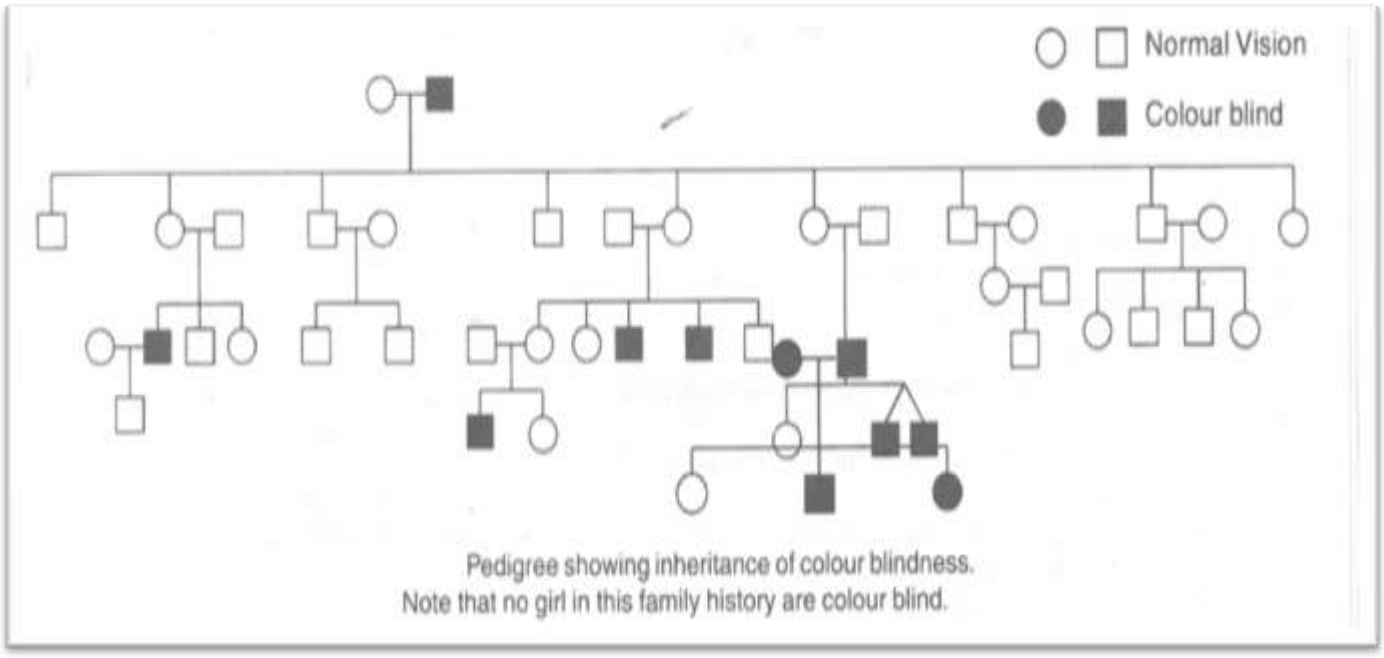
4. Marriage between blood group 'A' female with male without blood group 'A' produces three sons and one daughter. None of the off spring have blood group' A'.

5. Following conclusions can be drawn from the pedigree analysis. (a) Inheritance of blood group is not related to sex~

(b) Male parent with blood group 'A' is - heterozygous (I_AI_o)

(c) Daughter with blood group 'A' is also heterozygous (I_AI_o)

Spotting 7 (b)



Pedigree showing inheritance of colour blindness.
Note that no girl in this family history are colour blind.

Aim -Study and analyse the given pedigree chart for genetic trait of colour blindness.

(1) Pedigree chart is a record of occurrence of a trait in several generations of a human fami colour blindness is a given genetic trait in this cases.

(2) Male members of the family are shown by squares and female members by circles. Pare and their off springs are joined by vertical lines in order of their birth.

(3) The given pedigree chart shows that phenotypically normal parents for colour blindne produces four children, of which three are daughters and one is son. Only son is colour blin~

(4) Marriage between colour blind male and phenotypically normal female produces - f(l children, two sons and two daughters. None of the offsprings exhibits the trait of colo blindness.

Following conclusions can be drawn from the pedigree analysis-

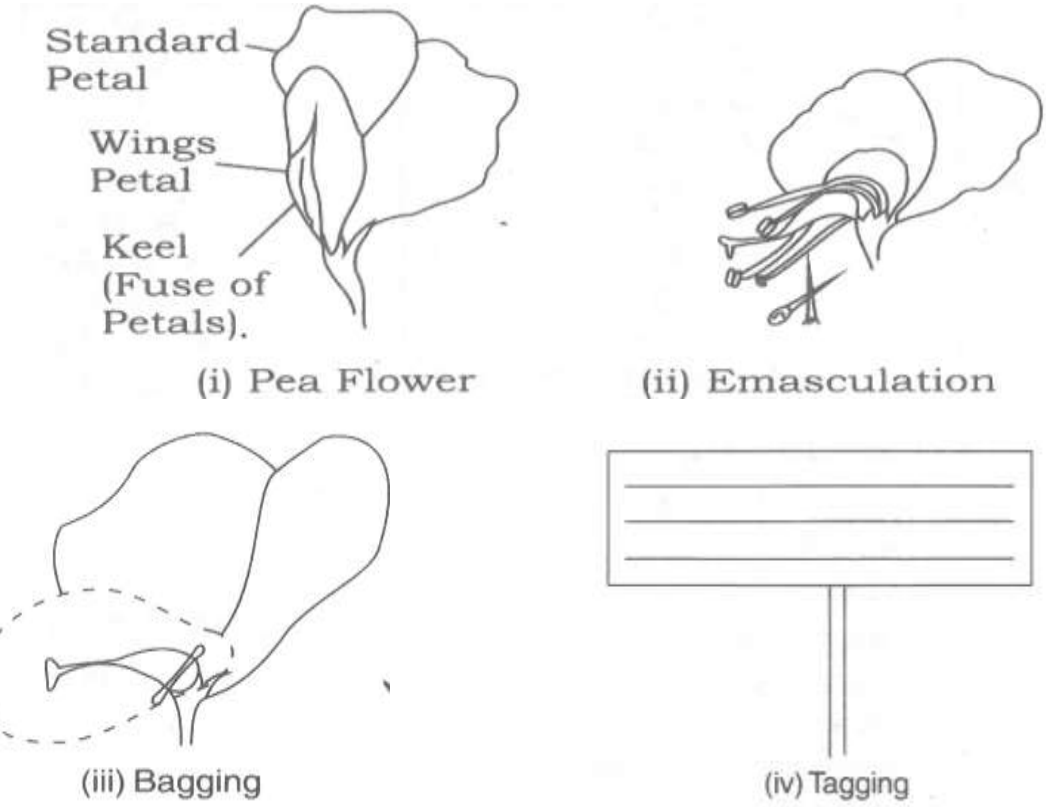
(a) Colour blindness is related to sex.

(a) Colour blindness is related with X chromosomes and is homozygous recessive trait. Hen female is either normal carrier or colour blind whereas male is either sufferer or normal b never a earner.

(b) Female parent in this chart is a carrier trait.

Spotting 8

Identification: Controlled pollination.



(1) A. Emasculation:

(i) In this process anthers are removed from the flowers before their maturation .

(ii) The anthers are cut with the help of sterilized forceps or scissors.

(iii) The Instrument used in this method - Include Pocket lens, forceps, needle, scissors, scalpel etc.

(iv) Method of emasculation is employed to the crops having small flowers like paddy.

(2) Bagging and tagging:

(i) After emasculation, the flowers are covered with small bags to prevent pollination with undesired pollen grains.

(ii) These bags are made up ofpolythene, paper, muslin cloth or parchment paper.

(iii)The flowers of male parents are also protected in bags to prevent mixing of their pollen grain with foreign pollens. .

(iv) After dusting of the desired pollen grains on the emasculated flowers. The bags are retagged.

(v) A label of paper is tagged on the plant which displays the date of emasculation, crossing and brief account of the parents

Common disease causing organisms

Spotting 9 (a)

Identification: Entamoeba

Comments:

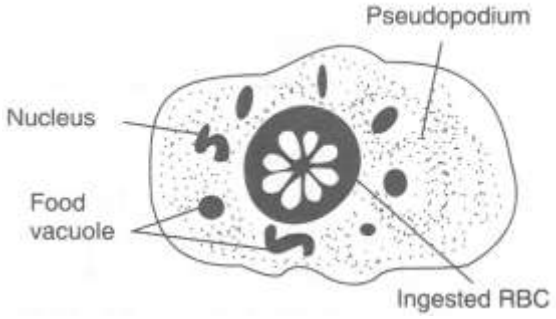
(l) It is a human parasite that resides in the upper part of the large Intestine.

(2) It causes the disease called amoebic dysentery or amoebias is.

(3) The symptoms of the diseases Include abdominal pain, repeated motions with blood and mucus.

(4) The parasite is unicellular and has a blunt pseudopodium.

(5) There is a single nucleus and a number of food vacuoles.
(6) It feeds on red blood corpuscles by damaging the wall of large intestine and reaching the blood capillaries.
(7) It produces ulcers and can also reach other body organs.



Spotting 9 (b)

Identification : Plasmodium vivex (Malarial parasite)

Comments:

(I) It is a protozoan digenic endoparasite of man.
(2) Its primary host is man and female anopheles is its secondary host.
(3) Plasmodium enters human body in sporozoite stage by the bites of female anopheles.
(4) The sporozoite is spindle shaped and uninucleate organism capable of wriggling movement.
(5) The sporozoites infect liver cell and produce meta-cryptomerozoites.
(6) The metacryptomerozoites enter RBCs, and passes trophozoite signet ring stage and amoeboid stage and produce schizont and merozoites.
(7) The merozoites enter fresh RBCs and produce gametocytes.

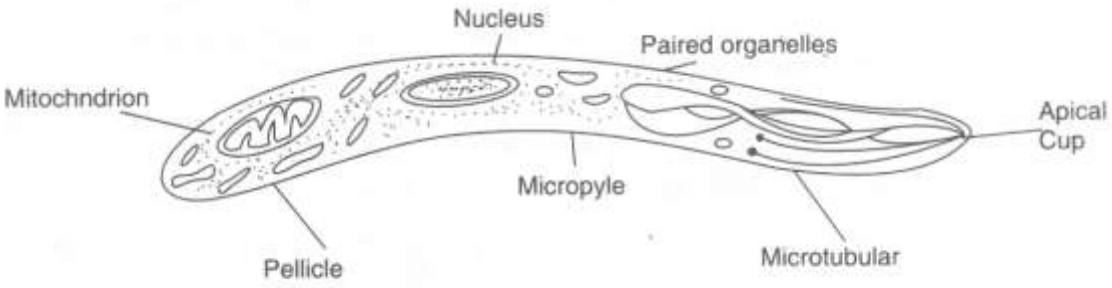


Fig. 9.2 : Plasmodium – Ultrastructure of sprozoite

Spotting 9 (c)

Identification: Ascaris

Comments:

(1) It is an endoparasite of the small Intestine of human beings and is more common in childre
(2) The animal shows sexual dimorphism with separate male and female individuals.
(3) The life history is simple and without any intermediate host. The infection occurs through contaminated food and water.
(4) Ascaris causes abdoininal discomfort and colic pain.
(5) The patient may also suffer from impaired digestion, diarrhoea and vomiting. (6) In children mental efficiency is affected and body growth is retarded.
(7) It causes ascariasis.

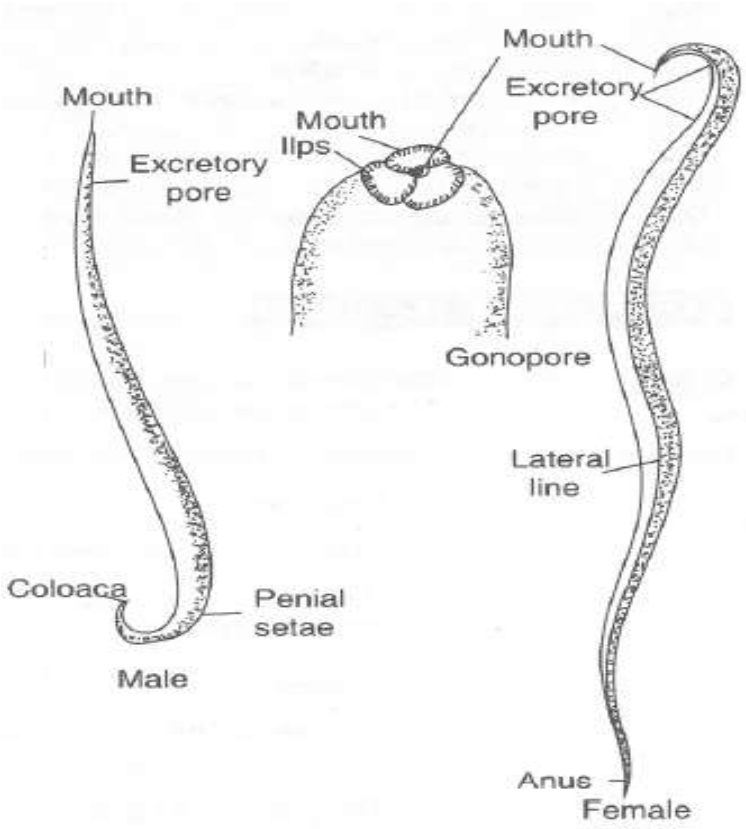


Fig. 9.3

Spotting 9 (d)

Identification- Ringworm
Pathogen - Trichophyton sp.
Disease - Athelete foot

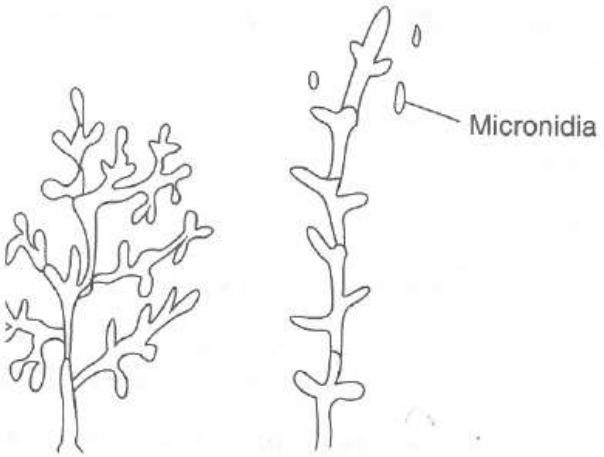


Fig. 9.4 : Trichophyton

Various species of Trichophyton and Disease caused by them.

	Species of Fungi	Diseases
1.	Trichophyton rubrum.	Athlete's foot, foot ringworm.
2.	T-rubrumn, T-mentogrophytes	Ringworm of the nails.
3.	T.tonsurans, T-violaceum, T.scholnleinii	Ringworm of scalp.

Symptoms:

1. **It** forms lesions on hairy parts of smooth skin.
2. **It** also infects the nails of the hands and feet.
3. Some species of these fungi cause ringworm of the scalp found chiefly in children.
4. Mostly they infect the skin so this fungi and disease are called dermatomycoses.
5. Skin becomes dry and whitish in colour with keratin substances.

Spotting 10

Objective:-

To study symbiotic association in root nodules of leguminous plant,cuscuta on host and Lichens through model / specimen/ chart

Requirements:-

Model / specimen / chart showing symbiotic association in root nodules of leguminous plant (pea plant), cuscuta on host and a lichen.

Theory

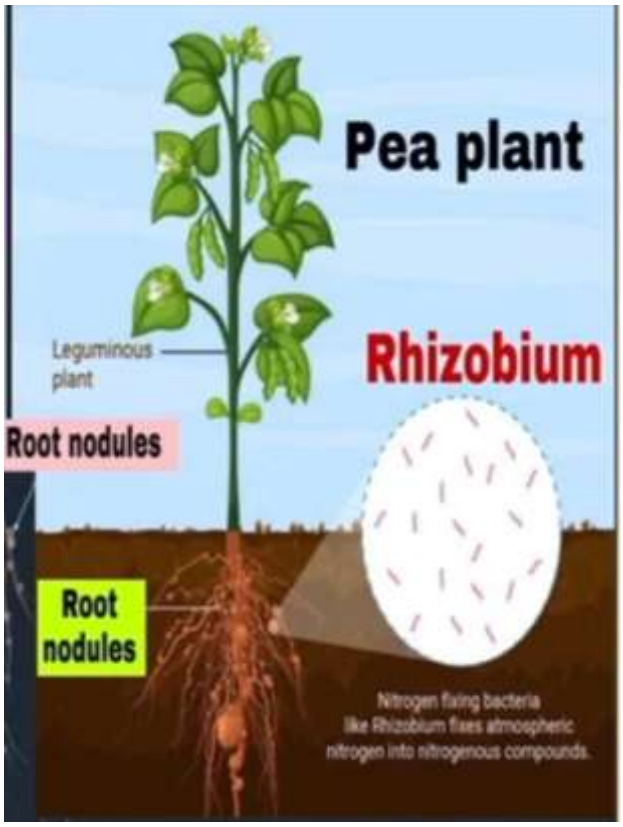
In nature animals, plants and microbes do not and cannot live in isolation but interact in various ways.

1. When two different species interact with each other (Interspecific interaction) and are in close association. With each other in such a way that at least one species is benefited while for other species the relationship may be positive, negative or neutral such association is called symbiotic relationship

2. There are three basic types of symbiotic relationship
   Mutualism (both are benefited)
   Commensalism (one species is benefited while other is neither benefited nor harmed)
   Parasitism (one species is benefited and other is harmed)

Observations

1.Rhizobium in root nodules of leguminous plant (pea plant)

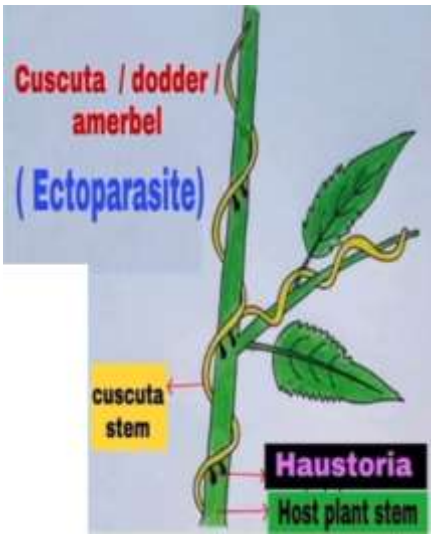


i. Rhizobium bacteria are present in root nodules of leguminous plant and form a symbiotic relationship,mutualism, where both are benefited from each other.Nitrogen fixing bacteria Ike Rhizobium fixes atmospheric nitrogen into nitrogenous compounds

ii. Rhizobium can convert atmospheric nitrogen to ammonia that can be used by pea plant for growth and development

iii. Bacteria receive nutrients and suitable place to grow from plant.

2.Cuscuta with Host



i. Cuscuta commonly called dodder or amerbel and live as stem ectoparasite on other plants

ii. Cuscuta has no fully expanded form of leaves (scale like leaves are present) and has no chlorophyll

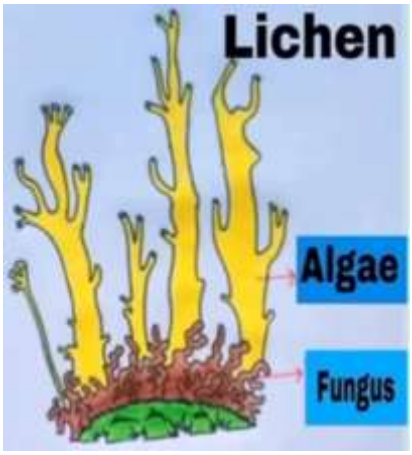
iii. Stem of cuscuta is thin and slender shaped And It winds around the stem of host plant.Stem of cuscuta fixes itself to the stem of host plant with special structures called

iv. Haustoria forms direct connection to the vascular bundles of the host and withdraw water,carbohydrates and other solutes.

v. Roots of cuscuta are temporary and die as soon as it makes connection with host plant

vi. Cuscuta can weaken or kill plant and reduce crop yield

3. Lichens



i) Lichens are composite organisms representing a symbiotic association (mutualism) between fungus and algae

ii) The algal component is known as phycobiont and fungal component is known as mycobiont.

iii) .Algae prepare food for fungi and fungi provide shelter and absorb mineral,nutrients and water for its partner.

iv) They grow on lands,rocks,tree trunks and walls of houses,like dry vegetation.

Spotting - 11

Objective

Study of homologous and analogous organs in plants and animals through models/ flashcards

Requirements




Flashcards / Models of various plants showing thorns ,tendrils,scale leaves of onion ,spines of opuntia, **Rhizome of ginger** Roots of carrot ,phylloclade, **Leaves of mango**,forelimbs of mammals, **wings of butterfly, Bat and bird**


Principle

In plants and animals there are several organs or parts thereof ,apparently alike in their function and appearance,but markedly different from each other in their origin and anatomical structure. These organs are called

ANALOGOUS ORGANS

Analogous structures are a result of CONVERGENT EVOLUTION

It is due to adaptation to similar habitat and identical ecological niche





Observations

1. Tendrils of Passion flower and thorns of pomegranate

i. Tendrils of Passion flower & thorns of pomegranate are **Homologous organs**

ii. They are structurally and functionally different but have same origin

iii. They both arise from **axillary bud**

iv. Tendrils help in climbing while thorns help in protection

(Passiflora incarnata) (Punica granatum)

2 Tendrils of Vitis and thorns of Carissa

i. Tendrils of Vitis and thorns of Carissa are **Homologous organs**

ii. Both arise from the **terminal bud** ,but are functionally different

iii. Tendrils of Vitis provide support while thorns give protection to Carissa .

iv. They differ in their structure but their origin is same

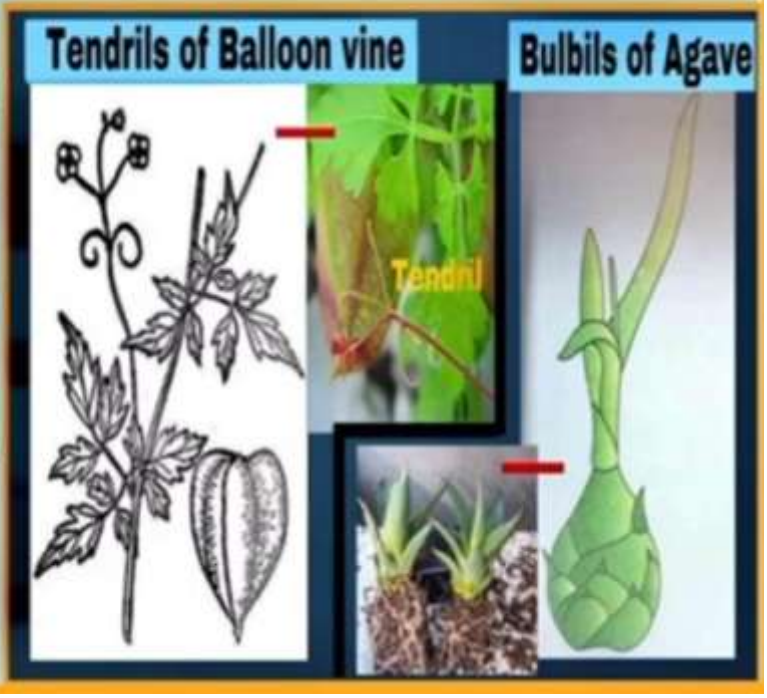
3. Tendrils of Cardiospermum and bulbils of Agave

i. Tendrils of balloon vine (Cardiospermum halicacabum) and bulbils of Agave are **Homologous organs**

ii. Both are modifications of **floral buds**

iii. They perform different functions.

iv. Tendrils help in climbing while bulbils help in reproduction



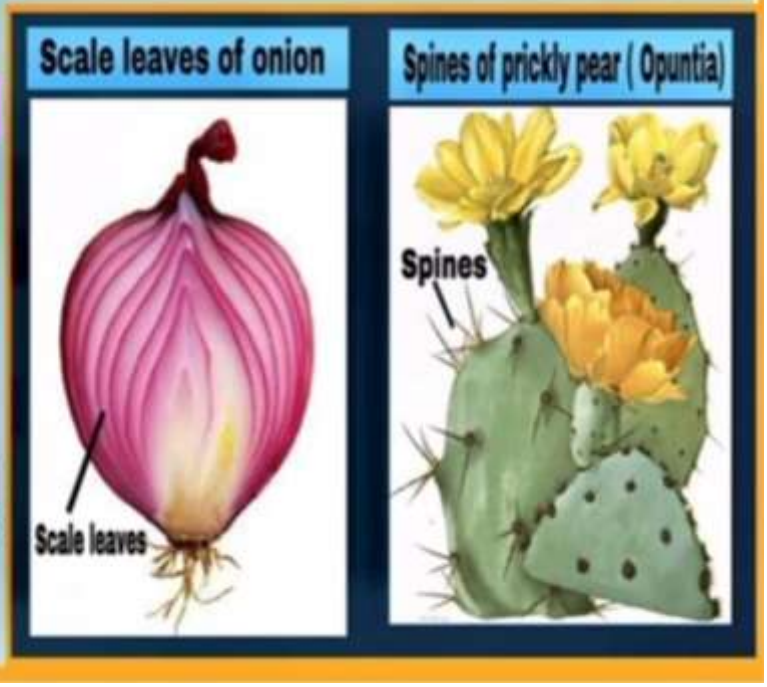
4. Scale leaves of onion and spines of prickly pear (opuntia)

i. Scale leaves of onion anf spines of opuntia are **Homologous organs**

ii. Both are modifications of **leaves (modified leaves)**

iii. But structurally and functionally different

iv. Scale leaves of onion are thick and fleshy and store food. While spines of cactus are defensive organs

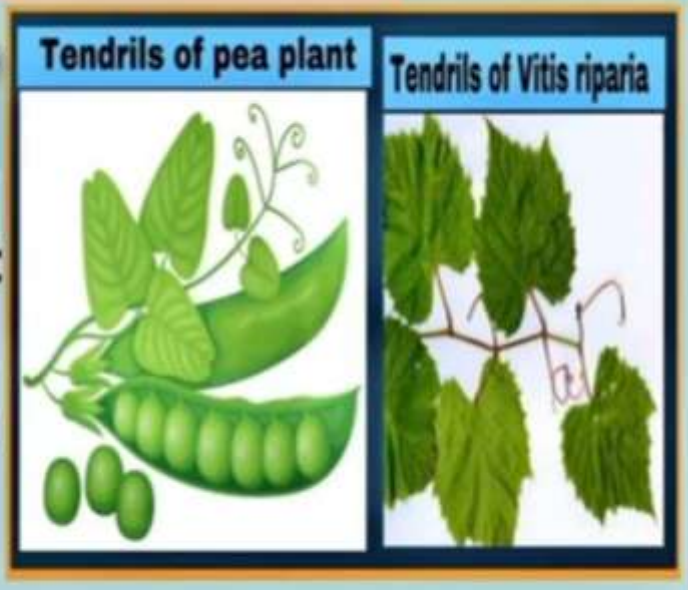


5. Tendrils of Pea and tendrils of Vitis

i. Tendrils of pea and Vitis are **analogous** with one another

ii. Both are structurally and functionally same but have different origin .They both help in climbing.

iii. Tendrils of pea are modification of leaf and in Vitis it is the modification of terminal bud

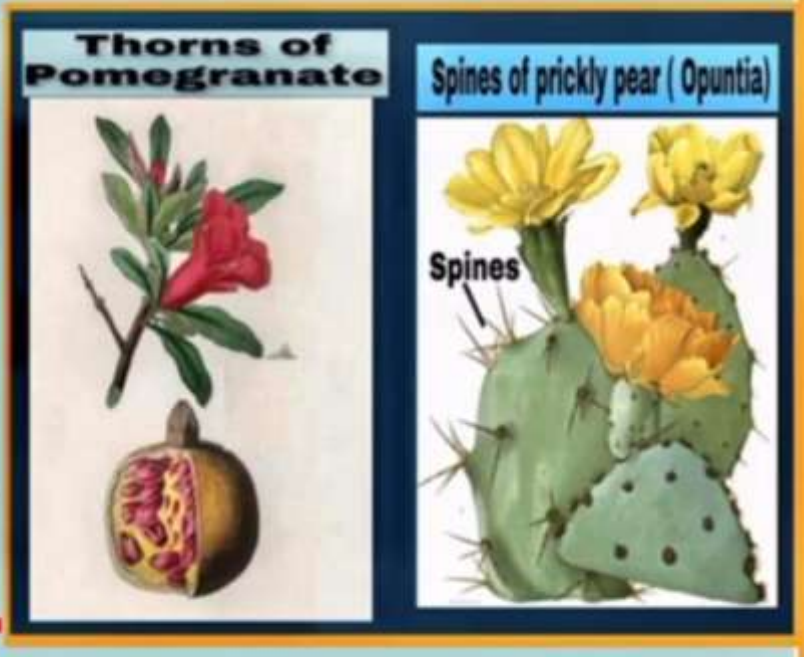


6. Thorns of pomegranate and spines of prickly pear

i. Thorns of pomegranate and spines of prickly pear are **Analogous organs**

ii. Both are defensive in function

iii. Thorns are modification of axillary bud while spines are modification of leaves



7. Modified root (Carrot) and Modified stem (Rhizome of ginger)

i. Modified stem...Rhizome of ginger is **Analogous to** Modified root ...carrot

ii. Both perform the function of storage of food. But their origin is different

iii. Rhizome of ginger and potato tuber are modified stems . While radish and carrot are modified roots

8. Phylloclade of opuntia and leaves of mango

i. Phylloclade of opuntia and mango leaves are **Analogous organs**

ii. They perform same function i.e. they do photosynthesis

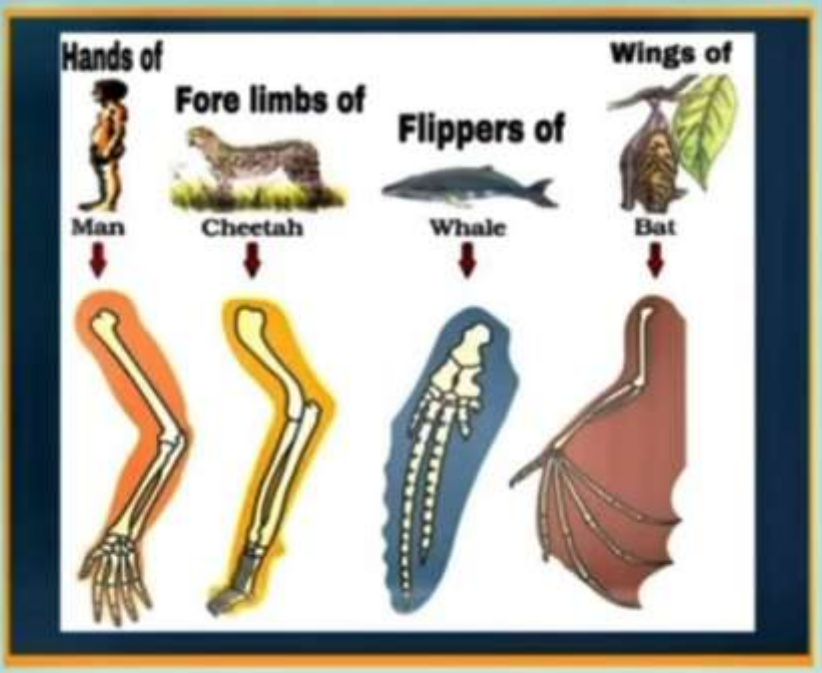
iii. **Phylloclade is a modification of stem.**

9 Hands of man,forelimbs of cheetah,flippers of whale and wings of bat

i. Hands of man,forelimbs of cheetah,flippers of whale and wings of bat are **Homologous organs**

ii. They have same internal structure / same bony elements (humerus,radio-ulna,carpals,metacarpals and phalanges)

iii. Hands of man help in holding,forelimbs of Cheetah help in running ,flippers of whale help in swimming & wings of bat help in flying.



10. Wings of bat,wings of birds and wings of butterfly

i. Wings of bat,bird and butterfly are **Analogous organs**

ii. They perform same function i.e. help in flying

iii. Their internal structures are different from each other

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