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Botany

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UNIT-1

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BOTANY - SYLLABUS

UNIT-I

i) Viruses - A general account of viruses-Their nature origin purification symptematology methods, transmission and control measures of viruses - Vector relationships, multiplication, Bacterial viruses, algal viruses and mycoviruses.

ii) Bacteria - A general account of bacteria with reference to cell morphology, appendages, envelops and nutrition, growth and reproduction, structure and replication of nucleic acids in Bacteria plasmids and gene manipulation, classification as per Bergey Manual (1973) economic importance of bacteria.

iii) Thallophytes –

a) Algae: A comparative study of the range of structure, organisation, reproduction, life history and classification of algae (Bold and Wynne, 1978). Ecology of Algae-Productivity in the sex, algae as indicators meant of pollutions, algicides, economic importance of algae.

b) Fungi -Classification (Alexopoules and Mims 1979). A systematic study of the range of structure, reproduction, life cycles phylogeny and affinities of the main classes of fungi; Economic importance of fungi.

c) Lichens - A general account of lichens - Structure, nutrition; reproduction, classification and economic importance of lichens.

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UNIT – I

VIRUSES

General Concepts

Virus history

- The history of virology goes back to the late 19th century, when German anatomist Dr Jacob Henle (discoverer of Henle's loop) hypothesized the existence of infectious agent that were too small to be observed under light microscope. This idea fails to be accepted by the present scientific community in the absence of any direct evidence.
- At the same time three landmark discoveries came together that formed the founding stone of what we call today as medical science. The first discovery came from Louis Pasture (1822-1895) who gave the spontaneous generation theory from his famous swan-neck flask experiment. The second discovery came from Robert Koch (1843-1910), a student of Jacob Henle, who showed for first time that the anthrax and tuberculosis is caused by a bacillus, and finally Joseph Lister (1827-1912) gave the concept of sterility during the surgery and isolation of new organism.
- The history of viruses and the field of virology are broadly divided into three phases, namely discovery, early and modern. The discovery phase (1886-1913) In 1879, Adolf Mayer, a German scientist first observed the dark and light spot on infected leaves of tobacco plant and named it tobacco mosaic disease.
- Although he failed to describe the disease, he showed the infectious nature of the disease after inoculating the juice extract of diseased plant to a healthy one. The next step was taken by a Russian scientist Dimitri Ivanovsky in 1890, who demonstrated that sap of the leaves infected with tobacco mosaic disease retains its infectious property even after its filtration through a Chamberland filter.

- The third scientist who plays an important role in the development of the concept of viruses was Martinus Beijerinck (1851-1931), he extended the study done by Adolf Mayer and Dimitri Ivanofsky and showed that filterable agent form the infectious sap could be diluted and further regains its strength after replicating in the living host; he called it as "contagium vivum fluidum". Loeffler and Frosch discovered the first animal virus, the foot and mouth disease virus in 1898 and subsequently Walter Reed and his team discovered the yellow fever virus, the first human virus from Cuba in1901.
- Poliovirus was discovered by Landsteiner and Popper in 1909 and two years later Rous discovered the solid tumor virus which he called Rous sarcoma virus. The early phase (1915-1955) In 1915, Frederick W. Twort discovered the phenomenon of transformation while working with the variants of vaccinia viruses, simultaneously Felix d'Herelle discovered bacteriophage and developed the assay to titrate the viruses by plaques. WendellStanley (1935) first crystallized the TMV and the first electron micrograph of the tobacco mosaic virus (TMV) was taken in 1939.
- In 1933 Shope described the first papillomavirus in rabbits. The vaccine against yellow fever was made in 1938 by Thieler and after 45 years of its discovery, polio virus vaccine was made by Salk in 1954. The modern phase (1960-present) During this phase scientists began to use viruses to understand the basic question of biology. The superhelical nature of polyoma virus DNA was first described by Weil and Vinograd while Dulbecco and Vogt showed its closed circular nature in 1963.
- In the same year Blumberg discovered the hepatitis B virus. Temin and Baltimore discovered the retroviral reverse transcriptase in 1970 while the first human immunodeficiency virus (HIV) was reported in 1983 by Gallo and Montagnier. The phenomenon of RNA splicing was discovered in Adenoviruses by Roberts, Sharp, Chow and Broker. In the year 2005 the complete genome sequence of 1918 influenza virus was done and in the same year hepatitis C virus was successfully propagated into the tissue culture. Many discoveries are done using viruses as a model.
- The transcription factor that binds to the promoter during the transcription was first discovered in SV40. The phenomenon of polyadenylation during the mRNA synthesis was first described in poxviruses while its presence was first reported in SV40. Many of our current understanding regarding the translational regulation has been studied in poliovirus. The oncogenes were first reported in Rous sarcoma virus. The p53, a tumor suppressor gene was first reported in SV40.
- Discovery and Detection

- Viruses were first discovered after the development of a porcelain filter, called the Chamberland-Pasteur filter, which could remove all bacteria visible in the microscope from any liquid sample.
- In 1886, Adolph Meyer demonstrated that a disease of tobacco plants, tobacco mosaic disease, could be transferred from a diseased plant to a healthy one via liquid plant extracts.
- In 1892, Dmitri Ivanowski showed that this disease could be transmitted in this way even after the Chamberland-Pasteur filter had removed all viable bacteria from the extract.
- Virions, single virus particles, are very small, about 20–250 nanometers in diameter. These individual virus particles are the infectious form of a virus outside the host cell.
- Unlike bacteria (which are about 100 times larger), we cannot see viruses with a light microscope, with the exception of some large virions of the poxvirus family.
- The surface structure of virions can be observed by both scanning and transmission electron microscopy, whereas the internal structures of the virus can only be observed in images from a transmission electron microscope.

Important discoveries

Date	Discovery
1796	Cowpox virus used to vaccinate against smallpox by Jenner.
1892	Description of filterable infectious agent (TMV) by Ivanovsky.
1898	Concept of the virus as a contagious living form by Beijerinck.
1901	First description of a yellow fever virus by Dr Reed and his team.
1909	Identification of poliovirus by Landsteiner and Popper.
1911	Discovery of Rous sarcoma virus.
1931	Virus propagation in embryonated chicken eggs by Woodruff and Goodpasture.
1933	Identification of rabbit papillomavirus.
1936	Induction of carcinomas in other species by rabbit papillomavirus by Rous and Beard.
1948	Poliovirus replication in cell culture by Enders, Weller, and Robbins.
1952	Transduction by Zinder and Lederberg.
1954	Polio vaccine development by Salk.
1958	Bacteriophage lambda regulation paradigm by Pardee, Jacob, and Monod.
1963	Discovery of hepatitis B virus by Blumberg.
1970	Discovery of reverse transcriptase by Temin and Baltimore.
1976	Retroviral oncogenes discovered by Bishop and Varmus.
1977	RNA splicing discovered in adenovirus.
1983	Description of human immunodeficiency virus (HIV) as causative agent of acquired immunodeficiency syndrome (AIDS) by Montagnier, Gallo)
1997	HAART treatment for AIDS.
2003	Severe acute respiratory syndrome (SARS) is caused by a novel coronavirus.
2005	Hepatitis C virus propagation in tissue culture by Chisari, Rice, and Wakita.
2005	1918 influenza virus genome sequencing.

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1. The symbiotic association between algae and fungi is calledlichen

A) mychorrhizha

B) lichen

C) VAM

D) mutualism

2. Many scientists consider algal-fungal relationship in lichen as 'helotism'. Helotism is a

A) a kind of symbiotic association

B) a kind of mutualism

C) master-slave relationship

D) master-master relationship

3. The fungal partner in lichen is called mycobiont whereas algal partner is called

A) glycobiont

B) algobiont

C) phycobiont

D) often referred as algal partner

4. The study of lichens is called

A) phycology

B) mycology

C) lichology

D) lichenology

5. More than 95% of the lichens, the fungal partner belongs to the class

A) ascomycetes

B) basidiomycetes

C) zygomycetes

D) mastigomycetes

6. The benefit of algae in this association is

A) food

B) vitamins

C) growth substances

D) protection

7. In lichens, sexual reproduction is carried out by

A) algae

B) fungi

C) both algae and fungi

D) fungi only

8. The major group of algae involved in lichen formation is

A) red algae

B) brown algae

C) blue green algae

D) all

9. Usnea is a

A) foliose lichen

B) fruticose lichen

C) crustose lichen

D) filamentous lichen

10. Lichens are the major pollution indicators of

A) SO_2

B) NO_2

C) mercury

D) CO

11. If the fungal partner belongs to Ascomycetes, then called

A) ascomycetes

B) ascomycetes lichen

C) lichen

D) ascolichen

12. Lichens that are rock dwellers with xerophytic adaptations are called

A) lignicolous

B) terricolous

C) saxicolous

D) corticolous

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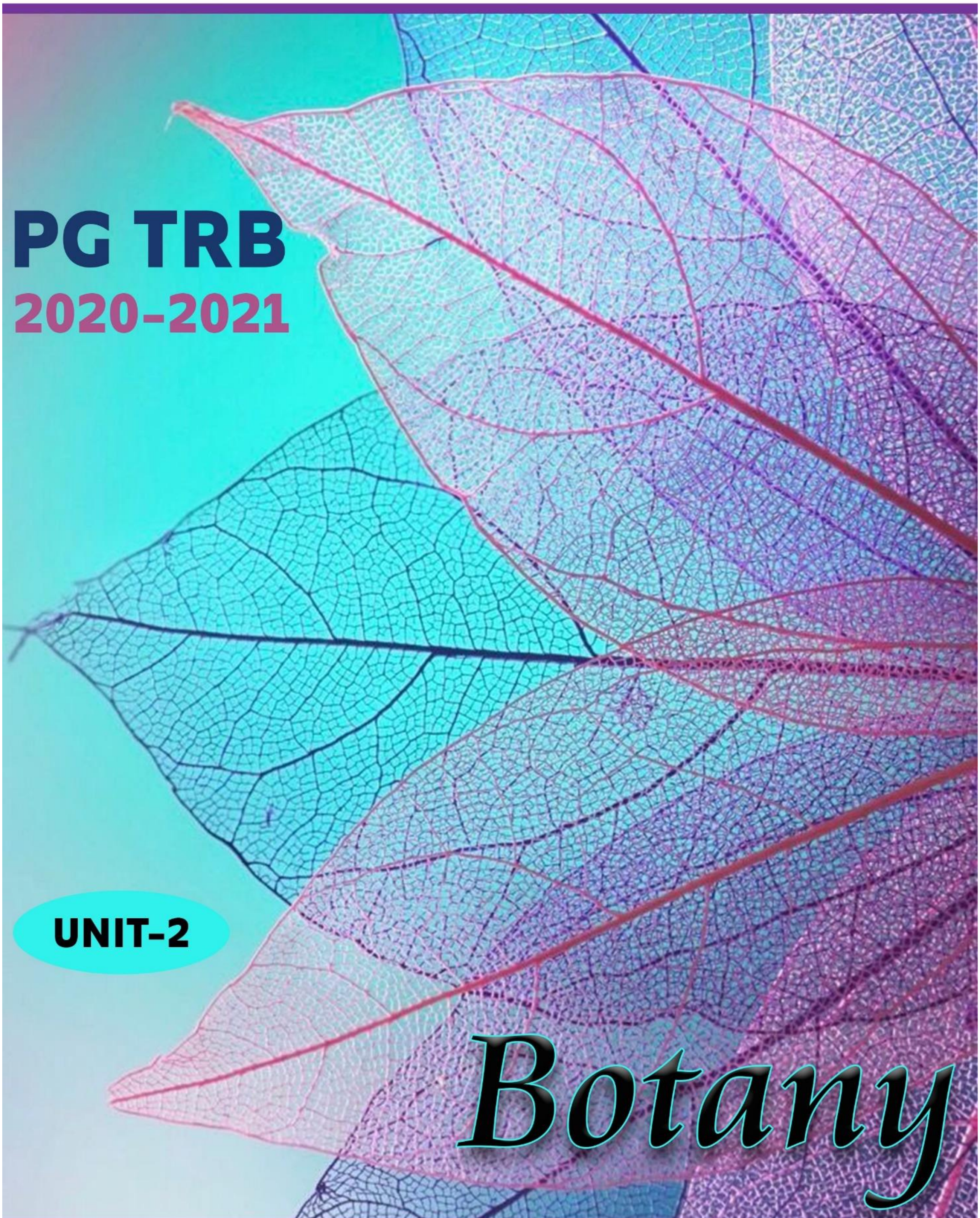

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UNIT-2

Botany

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BOTANY SYLLABUS

UNIT-II

a) Plant Pathology - A general account of plant disease due to fungi, bacteria and viruses with special reference to India Hostmicrobe interaction, principles of disease control, (physical, chemical and biological methods).

b) Microbiology-Soil microbiology-Soil microbes N2 fixation and Bio-geochemical cycles-Food and Water microbiology-Microbial flora of fresh and spoiled foods-Industrial microbiology-Industrial applications of microbes for the manufacture of Alcohols S.C.P. organic acids.

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UNIT – II

PLANT PATHOLOGY

STAGES IN DISEASE DEVELOPMENT : DISEASE CYCLE

In an infectious disease there is a series of more or less distinct events which occur in sequence and lead to development and perpetuation of the disease and the pathogen. This chain of events is called a disease cycle. The disease cycle involves the changes in the plant and the plant symptoms as well as those in the pathogens, and spans periods within a growing season and from one growing season to the next. The main events of a disease cycle include:

(i) Inoculation, (ii) Prepenctration, (iii) Penetration, (iv) Infection (also includes invasion), (v) growth and reproduction of the pathogen, (vi) dissemination of the pathogen, and (vii) seasonal carry-over of the pathogen.

1. Inoculation

Inoculation is the contact of a pathogen with a plant. This is the inoculum that lands on or otherwise brought into contact with plant. Inoculum is any part of the pathogen that can cause infection.

In fungi inoculum may be spores sclerotia or myceltal fragments. In bacteria, mycoplasmas, viruses and viroids, inoculum is always whole individuals. In nematodes, inoculum may be adults larvae or eggs, whereas in parasitic higher plants it is plant fragment or seed.

Inoculum that surrives the off season periods (winter or summer) and causes the original infection in the growing season is called primary inoculum, and the infections as primary infections. Inoculum produced from these primary infections that actually spreads the disease in the field under favourable conditions, is called secondary inoculum, that brings about secondary infections. Inoculum in the absence of its host from the field survives in plant debris, field soil, seed, tubers, transplants or other plant parts, perennial weeds, alternate hosts.

The inoculum is carried to host plants and this landing or arrival of inoculum is passive by wind, water, insects etc or in some cases also by active growth as in some root-infecting fungi like Armillaria mellea.

2. Prepenetration

This phase includes all the events prior to actual entry of the pathogen. Such events include (i) germination of spores and seeds, (ii) hatching of eggs (nematodes), (iii) attachment ofpahtogen to host, and (iv) recognition between host and pathogen (early event-not still understood clearly). Lack of specific recognition factors in plant surface may not allow the attachment of pathogen to it. Such factors in plant include lectins (proteins or glycoproteins) and some oligo-and polysaccharides. In viral pathogen lack of recognition of its nucleic and by host ribosomes may lead to failure in disease. **3. Penetration**

This is the actual entry of the pathogen into their host plants. Pathogens penetrate plant surfaces in different ways :

(i) Direct penetration through intact plant surfaces.

(ii) Through natural openings, and (iii)Through wounds.

4. Infection

This is the process by which a pathogen establishes contact with host cells or tissues and procure nutrients from them. This stage also includes invasion and to some extend growth and reproduction of the pathogen. During invasion, he pathogens colonise the host tissues in different ways and to different extents.

The time elapsing between penetration or more accurately spore germination and established infection is called infection period. We shall describe this stages in detail later.

5. Growth and reproduction of pathogen

Pathogens invade and infect tissues by growing and multiplying into them. In this way they colonise and infect more areas or parts of attacked plant. The period between infection, or more accurately spore germination and the appearance of visible symptoms is called incubation period. Thus incubation period includes the full life cycle of the pathogen. It may thus be seen that between spore germination and complete expression of the disease (symptoms), a series of events happens in the host. This chain of events between the time of infection, or more accurately spore germination and the complete expresson of disease is called disease cycle or disease development. For spread of secondary inoculato perpetuate the disease in the field during growing season of plant, dissemination is also sometimes included as a stage in disease development. Seasonal carry-over of the inoculum to next season is also similarly included by some under disease development.

6. Dissemination of pathogen

After pathogen has grown and multiplied in or on the infected host, it spreads to new, healthy plants. Dissemination is the transfer of inoculum from the site of its production to the susceptible host surface. Some pathogens disperse in active manner, whereas most passively with the help of an agent of dispersal. The chief agents of dissemination are :

(i) Air, (ii) Water, (iii) Vectors i.e., insects, mites, nematodes etc. (iv) Man.

7. Seasonal carry – over of pathogen

In the absence of their hosts, the pathogens undergo over-summering or over-wintering. Pathogens have evolved great variety of means of this seasonal carry – over.

At the on – set of suitable conditions in the next growing season, these resting structures become active andproduce inoculum. This inoculum then is taken to host surface.

Pathogens

A pathogens is a living entity that can cause a disease. Some authors use this term in wider sense to include also non-living causes as mineral deficiencies or excesses in soil and other physical factors etc. that bring about physiological disorders rather than diseases in plants. They define a pathogen, therefore, as an entity that incites disease. However, if diseases are caused, the pathogen should include only living entities. The pathogens that attack plants belong to different taxonomic groups of microorganisms and there is wide range in their size (Fig.4). Following are the different types of pathogen that cause disease in plants.

(i) Fungi, (ii) Bacteria, (iii) Mycoplasmas, (iv) Viruses and Viroids, (v) Nematodes, (Vi) Protozoa and (vii) Parasitic higher plants.

There pathogens cause infectious diseases in plants. Such diseases are characerised by the ability of the pathogen to grow and multiply rapidly on diseasedplants and also by its ability to spread from diseased to healthy plants and, thereby, to cause new infections.

Parasite versus Pathogen

An organism that lives on or in some other organism and obtains its food from the latter is called a parasite. The relationship between a parasite and its host is called parasitism. A plant parasite is an organism that becomes intimately associated with a plant and multiplies or grows at the expense of the plant. The removal of nutrients and water from the host by the parasite usually leads to reduced efficiency in the normal growth of the plant and may become detrimental to its further development and reproduction. Thus in many situations, parasitism is intimately associated with pathogenicity (ability to cause disease), since a pathogen must first be able to invade and become established in the host tissue.

Does this mere removal of nutrients from the host by a pathogen cause damage reaching at levels responsible for a disease? In most plant diseases, however, the amount of damage caused to plants is often much greater than would be expected from the mere removal of nutrients by the parasite. This additional damage results from the substances secreted by the pathogen or produced by the host in response to stimuli originating in the pathogen. Such substances have adverse effects on plant physiology. These substances include enzymes, toxins, and growth-regulators. This pathogens interfere with essential functions of the plant, a parasite mormally does not. A pathogen is thus a parasite plus something more all pathogens are parasites but not all parasites are pathogens. Thus pathogen’s ability to cause disease resides in its ability to cause damage to plants

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1. Which of the following microorganism produces dextran?

(A) Bacillus polymyxa

(B) Bacillus thuringiensis

(C) Leuconostoc mesenteroides

(D) Streptomyces olivaceus

2. Which of the following carbohydrates are mainly present in whey?

(A) glucose

(B) lactose

(C) fructose

(D) sucrose

3. Lactobacillus bulgaricus is a homofermentative organism.

(A) True

(B) False

4. What temperature is necessary for the production of vinegar?

(A) 43 degree C

(B) 60 degree C

(C) 10-13 degree C

(D) 15-34 degree C

5. Which of the following product is used for the treatment of pernicious anemia?

(A) Insulin

(B) Streptokinase-streptodornase

(C) Cobalamin

(D) Sorbose

6. Microbial fermentation produces D optical isomers of the amino acids.

(A) True

(B) False

7. Diaminopimelic acid (DAP) is produced by which of the following microorganism?

(A) E.coli

(B) Enterobacter aerogenes

(C) Bacillus subtilis

(D) Streptococcus equisimilis

8. Which of the following raw materials are important for the production of glutamic acid?

(A) glycerol

(B) corn-steep liquor

(C) tryptone

(D) biotin

9. Insulin was isolated from which of the following organs of animals?

(A) small intestine

(B) tongue

(C) pancreas

(D) stomach

10. Which of the following yeast is used for the production of riboflavin?

(A) Saccharomyces cerevisiae

(B) Eremothecium ashbyi

(C) Saccharomyces rouxii

(D) Candida utilis

11. Which of the following product utilizes whey as its raw material?

(A) lactic acid

(B) acetic acid

(C) glutamic acid

(D) lysine

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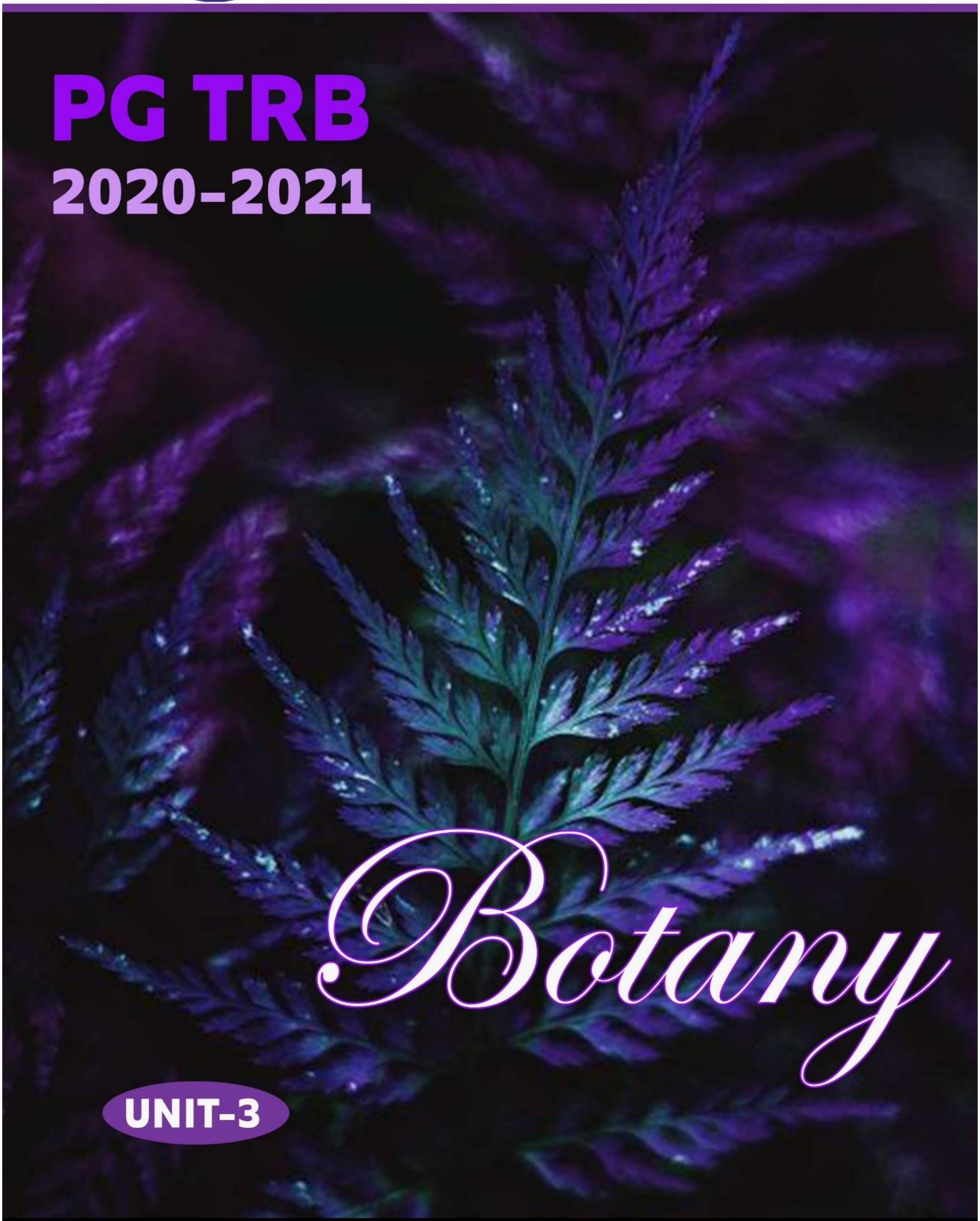

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Botany

UNIT-3

BOTANY SYLLABUS

UNIT-III

i) Bryophytes: Classification (Watson 1963)-Ecology and distribution-Range of structure in gametophyte and sporophyte and their evolutionary trends - Reproduction and Economic importance of Bryophvtes.

ii) Pteridophytes: Classification (Sporne 1976) - Distribution of extinct and extant forms - comparative study of morphology anatomy of sporophytes-Structure and development of gametophytes of the major groups (Psilopsida Lycopsida Sphenopsida and peteropsida).

iii) Gymnosperms: Classification (Sporne 1977) - Distribution of extinct and extant forms - Comparative study of morphology, anatomy and reproductions of major groups - Cycadopsida coniferopsida and Gnetopsida evolution of male and female gametophytes and Economic importance.

HEAD OFFICE: NO. 38/23, VAIGUNDA PERUMAL KOIL, SANNATHI STREET, KANCHIPURAM – 1. CELL: 9566535080

B.Off 2: 65C, Thillai Ngr(West), 4th Cross St, Trichy – 620018

B.Off 3: Vijiyaraghavachariar Memorial Hall(Opp to Sundar Lodge), Salem

Trichy : 76399 67359 Salem : 93602 68118

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UNIT – III

BRYOPHYTES

GENERAL CHARACTERS OF BRYOPHYTES

1. Mostly amphibious, few aquatic; grown in bog's (wet and soft ground); in xeric conditions (Polytrichum); epophyllus;saprophytes; grow on rocks and barks.

2. The plants show two morphologically distinct heteromorphic generations i.e. gametophyte and sporophytic generations.

3. The plants body is gametophyte and it is the dominant phase of life cycle.

4. The gametophyte (plant body) is well developed, green and autotrophic.

5. The sporophyte is entirely dependent on the gametophyte.

6. The plant body is thalloid (Riccia & Marchantia) or differentiated into rhizoids, stem (axis) and leaves.

7. Unicellular, multi cellular rhizoids and multicellular scales are present.

8. The plant body consists of simple parenchy matous cells,xylem,phloem and lignified cells are completely absent.

9. Vegetative reproduction largely takes place by means of tubers and gemmae.

10. The sexual reproduction is oogamous type.

11. The male reproduction organ is called antheridium. The consist of a central mass of androcytes enclosed by a single layer sterile jacket cells. Each androcyte produces a single biflagellate spermatozoid.

12. The female reproductive organ is called archgonium. It is a multicellular flask-shaped structure. The basal swollen portion is called Venter and the elongated narrow portion is called neck.

13. Fertilization takes place in presence of water.

14. The zygote does not undergo any resting period.

15. Embrogeny is exoscopic (The division of zygote is transverse and the embryo proper develops from the outer cell).

16. The embryo is retained within the archegonium where it develops into a sporophyte.

17. Except in a few cases, the sporopytes consist of foot, seta and capsule.

18. Spores are formed after meiosis in the capsule, they are homosporus.

19. The spores germinate directly into the new gametophytic plants. In mosses, the spores germinate into filamentous protonema from which are produced that give rise to a new plant.

- Bryophytes are "Avascular Archegoniate Cryptogams" which constitute a large group of highly diversified plants.
- Braun (1864) for the first time introduced the name 'Bryophyta' but at that time Algae, Fungi, Lichen and mosses were also included in this group. Schimper (1879) placed Bryophyta at the level of division and since then it occupies the same rank till date.
- Bryophytes are a group of plants that include mosses, liverworts and hornworts.
- Bryophytes are plants that are found growing in moist and shady places.
- Something unique about these plants is that they can survive on bare rocks and soil.
- They play an important role in plant succession on bare rocks.
- They show alternation of generations and have a unique nickname. So they are called the amphibians of the plant kingdom.
- Though they grow in a terrestrial environment, they are dependent on water for the reproduction process.

Mosses:

- Mosses may be small, but they may also be as complex as flowering plants.
- They have stems with leaves, and there is just about as much variation in the form and size of these plants as there is in the flowering plants.
- The 20,000 species range from being microscopic to over a metre; they may be upright, or creeping and much branched.

- They may grow in streams or deserts, on mountain tops or in sea spray, from the antarctic through tropical rain forests to the arctic, and in fact just about anywhere except in the sea itself.

Liverworts

- It may be leafy and very similar to mosses (although the fruit looks quite different). Or they may form flat plates of apparently leafless tissue, in which case they are called thallose.

Hornworts

- It looks like thallose liverworts, but have fruit that is unlike that of either mosses or liverworts.
- It is probable that mosses, liverworts and hornworts are not at all closely related, being united only by sharing their peculiar life-cycle.
- Mosses and Liverworts have been called up-side-down or role-reversal plants.
- The green and often leafy part underneath that we would think of as the moss or liverwort itself, is equivalent to tiny parts within a flower, or to a small, rarely seen part of the fern.
- The part that is equivalent to all of the flowering plant or fern that we normally see is the fruit of the moss or liverwort.
- As in all plants, and indeed animals, these two parts, or generations, alternate with each other in the life-cycle. The spores produced by the moss fruit will germinate into green leafy plants.
- These plants produce gametes, or eggs and sperm, and the resulting embryos grow up into new fruits. But what makes bryophytes different from all other plants, is that the fruit or spore-bearing generation remains semi-parasitically attached to the green gamete-bearing generation, and never becomes independent.
- The truth about this strange life cycle was not finally established until 1851
- The gamete-bearing generation is the green plant that most people think of as the main plant. This is the part that traps light energy and converts it into food for both generations.
- One of the most attractive and flower-like structures of mosses is found on the fruit. The fruit consists of a fruit stalk whose foot remains embedded in the moss plant, and a spore-producing capsule. When the spores are ripe, the lid falls off, but the release of spores is usually controlled by a fringe of flexible teeth round the capsule mouth.
- These are the peristome teeth (meaning ‘around the mouth’) and they are as varied and beautiful as any flowers, but very much smaller
- Moreover, they move as they are watched, since small currents of air cause changes in humidity, making the teeth flex in and out. These movements assist in the most effective distribution of spores, flicking out small quantities when air conditions are right, and stopping the process when they are not. Look at a ripe moss capsule with a hand lens, and your breathing will make the teeth flex.

PG TRB 2020 – 21 BOTANY UNIT - 3 - QUESTIONS

1. Algae are useful as they

(A) Are used in study of photosynthesis

(B) Purify air

(C) Cause alcoholic fermentation

(D) Occur in larger number

2. Which one is found on fern leaves

(A) Indusium

(B) Spathe

(C) Ramenta

(D) Frond

3. Endodermis is a component of

(A) Extrastelar tissue system

(B) Intrastelar tissue system

(C) Epidermal tissue system

(D) Vascular tissue system

4. Sago palm is

(A) Cycas

(B) Cedrus

(C) Pinus

(D) Taxus

5. In Dryopteris

(A) Sporophyte is parasitic over gametophyte

(B) Sporophyte is independent

(C) Gametophyte is independent

(D) Both (B) and (C)

6. Pigments present in Ulothrix are

(A) Chl a, Chl b and phycocyanin

(B) Chl a, Chl c, phycocyanin and fucoxanthin

(C) Chl a, Chl b, carotenes and xanthophylls

(D) Chl a and fucoxanthin

7. Lower plants having green pigments similar to those of higher plants are

(A) Rhodophyceae

(B) Chlorophyceae

(C) Phaeophyceae

(D) Schizomycetes

8. Mosses grow in moist places because they

(A) Lack vascular tissue

(B) Have gametes which require water for transport

(C) Lack root and stomata

(D) Cannot grow on land

9. Chlamydomonas is found in

(A) Snow

(B) Ponds and lakes

(C) Oceans

(D) All of these

10. Protostele occurs in

(A) Bryophytes

(B) Pteridophytes

(C) Gymnosperms

(D) Angiosperms

11. A plant producing seeds but lacking flowers is

(A) Gymnosperm

(B) Pteridophyte

(C) Angiosperm

(D) Bryophyte

12. Which one produces carrageenin

(A) Brown algae

(B) Red algae

(C) Green algae

(D) Blue green algae

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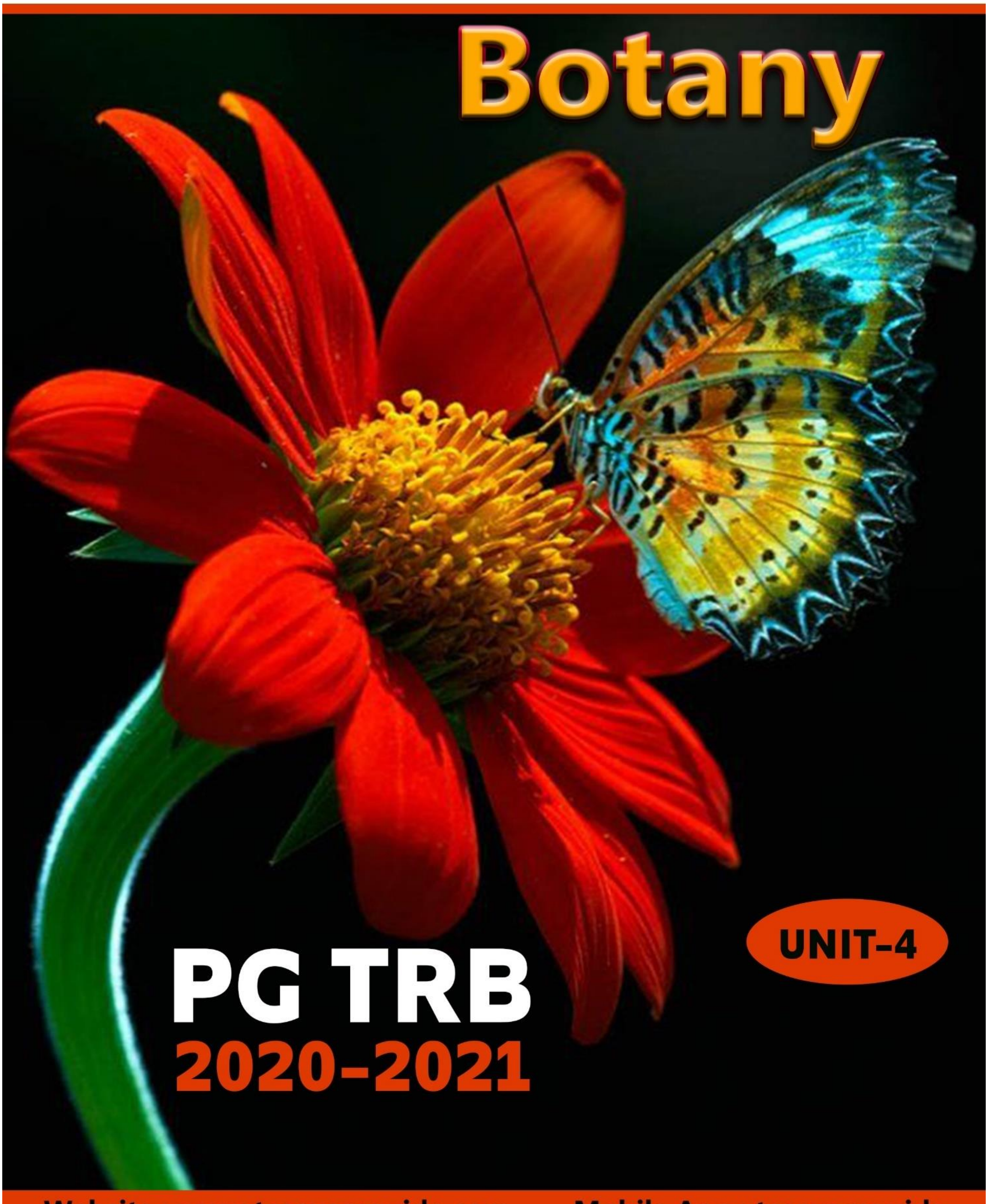

UNIT-4

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2020-2021

BOTANY SYLLABUS

UNIT-IV

i) Morphology: The plant body, the root system, the stem the leaf, the inflorescence, the flower, pollination and fertilization, the fruit and the seed, dispersal of fruits and seeds, vegetative reproduction and Germination.

ii) Taxonomy: History and classification-Artificial system-Linnaeus, Natural system-Jessieu De candolle, Bentham and Hooker, Phylogenetic system-Engler and PrantD. Bessey Hutchinson Recent Trends in systematics-Cyto-taxonomy, Chemotaxonomy, numerical taxonomy. International code of Botanical nomenclature, Herbarium techniques, A critical study of the following families: Ranunculiaceae Magnoliaceae, Polygalacea, Caryophyllaceae, Rubiaceae, Meliaceae, Lythraceae, Cactaceae, Rhizophoraceae, Oleaceae, Aristalochaceae, Casuarinaceae, Dioscoriaceae, Bignoniaceae, Solanaceae, Lauraceae, Loranthaceae, Euphorbiaceae, Arecaceae, Typhaceae and Poaceae.

iii) Economic Botany: Food crops, Cereals, millets, legumes nuts and tropical fruits, sugar yielding crops – spices –Beverage plants – Timbers and pulp yielding plants – Minor forest products – Resins, gums, tannin and rubber yielding plants – oil yielding plants – medicinal plants – fiber yielding plants.

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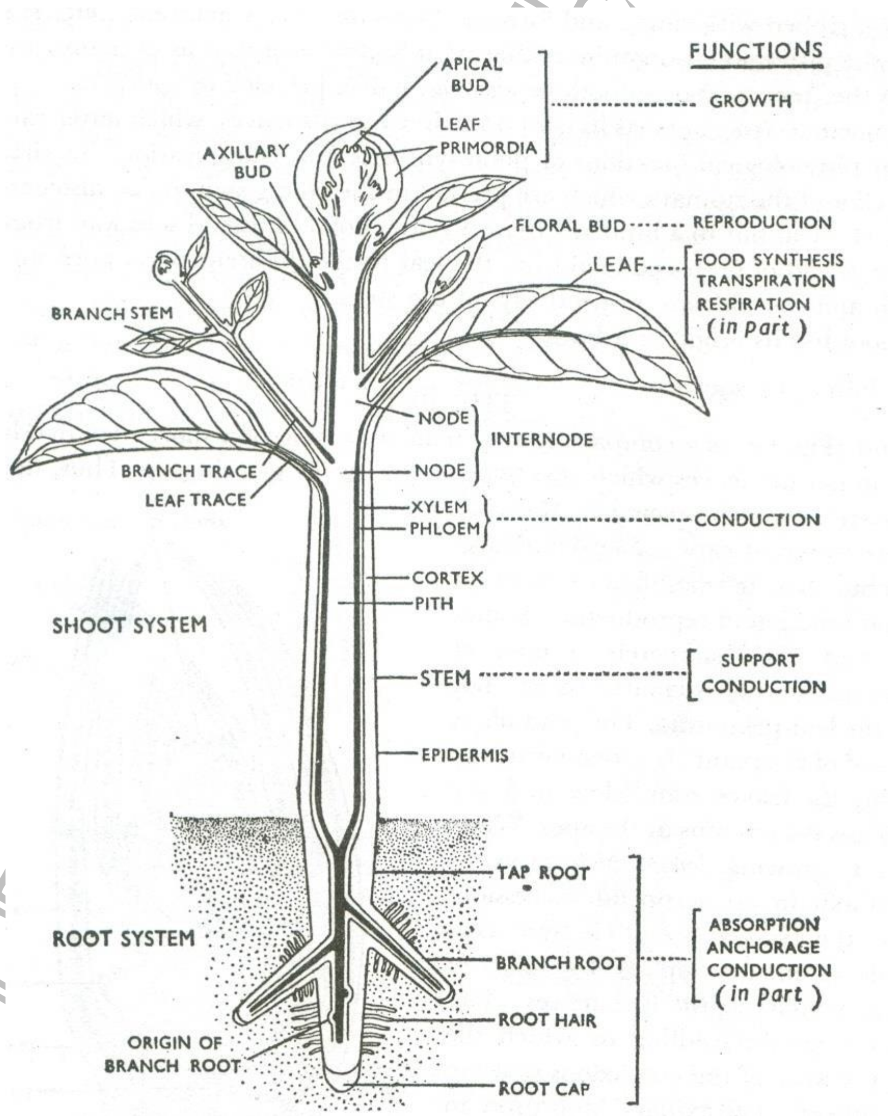
UNIT – IV

PLANT MORPHOLOGY

THE PLANT BODY-THE SHOOT

Given the requisite conditions, the seedling soon develops a luxuriant plant. What one sees above is the shoot system. or the ascending axis developed out of the plumule while below, covered by the soil, is an equally important portion-the root system.



The shoot is the emblem of greenness because of the green leaves while the root, growing in darkness is never green. Fig. 1 shows the ground plan of a plant.

The skeleton of the shoot is formed by the stem. The main stem is developed as a direct pmlongation of the tigellum of the embryo and grows vertically up while its branches grow horizontally or may be wmcvyhat inclined. On the stem are borne the similar braneh stems, the leafy appendages that are dissimilar to the Stem ana the reproductive modifications of shoot which a.re commonly called flowers. The young stem is green but later on it may change its appearance because of secondary growth and the formation of bark. A stem may bear multicelluiar hairs and branches on it develop exogenously. As opposed to the root, the nodes divide the stem into internodes; the internodal regions being bare while leaves and branches come out only from the nodal regions. If the nodes are very prominently developed, as in some grasses, the stem has ajointed or articulated appearrance. A stem is usually cylindrical but it may be triangular (Cyperus rotundas), square (Labiatae), ribbed with ridges and furrows (Cucurbita), flat (Cactaceae), etc. It is usually solid but the pith may disorganise rendering it hollow or fistular as in many grasses. The surface of the stem may be smooth or glabrous, hairy, prickled or spiny, etc.

The normal stem supports its own branches and the leaves, which latter carryon the important physiological functions of photosynthesis and transpiratioll. By virtue of the chlorophyll and the stomata which are present in the young stem it can also carry NI the functions ofa leaf but to a limited extent. Conduction of mineral solutions from the loot to the leaves and of prepared food from the leaf to the different part~ goes on through the xylem and the phloem, respectively, of the stem.

FORMS OF STEMS

The stem form of plallts is either erected (strong) when the plant can stand erect or weak when the plant is not strong enough to stand up by itself. In the latter ca'le the plant has to trail along the ground or to climb up some support.

ERECT FORMS : A majority of plants have the erect habit. These again may be subdivided into herbs, shrubs and trees according to the strength of the stem.

HERBS : The herbaceous stem is extremely succulent. The phmt is necessarily very small and may not even rise above the surface of the soil. Very often (spe.eially among Monoocots) it is subterranean giving rise to some leaves at soil level.' At the reproductive season the scape (Fig. 2) or the flowering shoot, which is a short stem bearing the inflorescence, springs forth. Such a plant may

be called acauiescent (caulis = stem) as it is apparently stemless. Because of its special nature the stem is often modified. Grasses and some other herbs have special methods of vegetative reproduction which enable them to creep and cover a large surface of soil. They may, therefore, be called ereeper plants of the grass type are sometimes stronger when they give rise to erect stems called culm. Which are more or less hollow at the internodes but solid anhe nodes? A culminatiol) of, this sort of development is met with in bamboo (Fig. 3) which is really a tall grass but can no longer be called a herb.

According to the duration of its life herbs may be : (1) Ephemerals-when the plants live only for a few weeks. This happens when the growing season is very short as near deserts or in very cold countries. The plant has to complete its life cycle .within that short time. (2) Annuals-They last for one season every year after which they flower and die. There are a large number of annuals in our country represented by the seasonal flowers, vegetables and crops. (3) Biannuals or biennials require two years to complete their life cycle. Many annuals of our country like the cabbage and the radish are biannnuals in cold countries as the temperature t here does not allow sufilcient growth in one year. (4) Perennials grow for a longer time. This perennation may not be in one stage but in annual stages as in plants growing by rhizomes, etc. In these, the aerial shoot dies every year but the underground parts (rhizome, etc.) form the link year after year. Bananas are true perennials as are all the shrubs and trees.

Some plants are stronger than herbs but still not strong enough to attain the level of shrubs. Vegetables like brinjals and chillies come under these. These have got slightly woody stems. They may be called woody herbs or undershrubs.

SIIRUBS : Shrubs are lager than herbs and .usually give rise to woody branches from the level of the soil forming a bushy plant without any main trunk The woody branches are never as strong as the trunk of a tree and the plants are much smaller than trees. Shrubs are very common among flowering plants as rose, china-rose, etc.

TRHES : Trees are the biggest plants with prominent woody Li unks which usually give rise to bl anches above. Among them (1) tht caudex (Fig. 4) usually dues But branch at all. The lateral buds on the .tall columnar drunk are dormant or dead. On the top there is a crown of leaves. This is the habit of palms. They may branch only abnormally. An unbranched stem like this may also be ealled columnar. (2) In the excurrent (Fig. 5) trees the main stem grows indefinitely and the side branches develop in a strict acropetal order as in the Mast tree (Polyalthia longifolia), Casuarina and Pine. (3) The apical bud of a deliquescent (Fig. 6) tree is weaker than the strong lateral buds and very often, it is destroyed-at some phase of its life so that the tree has a spreading habit as in banyans and many common trees

WEAK FORMS

Weak plant forms are not capable of growing erect without some help. These may be creepers, trailers or climbers.

PG TRB 2020 – 21 BOTANY UNIT - 4 - QUESTIONS

1. The waxy substance associated with the wall of the cork cell is

A) Lignin
B) Hemicellulose
C) Cutin
D) Suberin

2. A tissue that does not contain lignin

A) Sclerenchyma
B) Parenchyma
C) Collenchyma
D) Chlorenchyma

3. Lateral roots originate in

A) Cortex
B) Endodermal cells
C) Pericycle
D) Cork cambium

4. Which gives rise to the cork tissue?

A) Periblem
B) Phellogen
C) Phelloderm
D) Periderm

5. Which are the external protective tissues of the plant?

A) Cortex and epidermis
B) Cork and cortex
C) Pericycle and cortex
D) Epidermis and cork

6. Following is the characteristic of collenchyma

A) Elongated cells with thickened corners
B) Isodiametric cells with thickened walls
C) Elongated cells with deposits of cellulose and pectin
D) Isodiametric cells with deposits of cellulose and pectin

7. Casparian strips are found in

A) Epidermis
B) Endodermis
C) Exodermis
D) Pericycle

8. The apical meristem of the root is found in

A) Taproots
B) Radicals
C) Adventitious roots
D) All the roots

9. Bordered pits are found in

A) Vessel wall
B) Sieve cells
C) Sieve tube
D) Companion cells

10. Where in epiphytes are velamen cells located?

A) Below the endodermis
B) Below the epidermis
C) Just outside the cortex
D) Just outside the exodermis

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BOTANY SYLLABUS

UNIT-V

i) Cell Biology: Cytological methods-auto radio graphy – Isolation of cellular components – Fixation – staining – prokaryotes and Eukaryotes. Ultra structure and molecular organization of cell-cell wall, plasma membrane, Endoplasmic reticulam, Mitrochondria, Lysosomes and other cell organelle. Plastids – Classication, morphology, structure – functions Cytoplasm – Physical and Chemical properties. Nucleus – morphology, structure and chemistry – Cell division – Mitosis, meiosis, meiosis and their significance chromosome – morphology, fine structure, Types – giant chromosome, Isochromosome.

ii) Genetics: Mendelian and non-mendelian inheritance – linkage and crossing over. Mutation – Mutagenic agents – structural and chemical basis of mutations in plants cytoplasmic inheritance, Male steribity in plants – Sex determination in plants – sex linked inheritance. Chromosomal aberrations. Molecular genetics – Nucleic acids as genetic material – Types of Nucleic acids – Replication of DNA – Methods and models in DNA repair mechanism – Enzymes – split genes – Jumping and mobilic genes – concepts of gene – Cistron, Muton and recon.

PG TRB 2020 -21 BOTANY

UNIT – V

CYTOLOGICAL METHODS

MICROSCOPES

Microscopy comprises of the tools that are used to see/image the microscopic objects and even macromolecules. There exists a wide variety of microscopic tools for studying the biomolecules and biological processes. Light microscopy is the simplest form of microscopy. It includes all forms of microscopic methods that use electromagnetic radiation to achieve magnification. In this lecture, we shall be discussing the principles of microscopy.

Resolution of microscope Resolution of a microscope

$d_{min} = 1.22\ \lambda\ 2n\ sin\alpha = 1.22\ \lambda\ 2\ N.A. = 0.61\ \lambda\ N.A.$ ·········· (1)

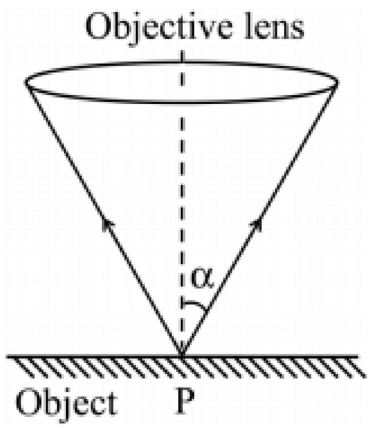
dmin = minimum distance between point objects that can be resolved

λ = wavelength of the light source used

n = refrective index of the medium between the objective lens and the specimen

α = half of the objective angular aperture

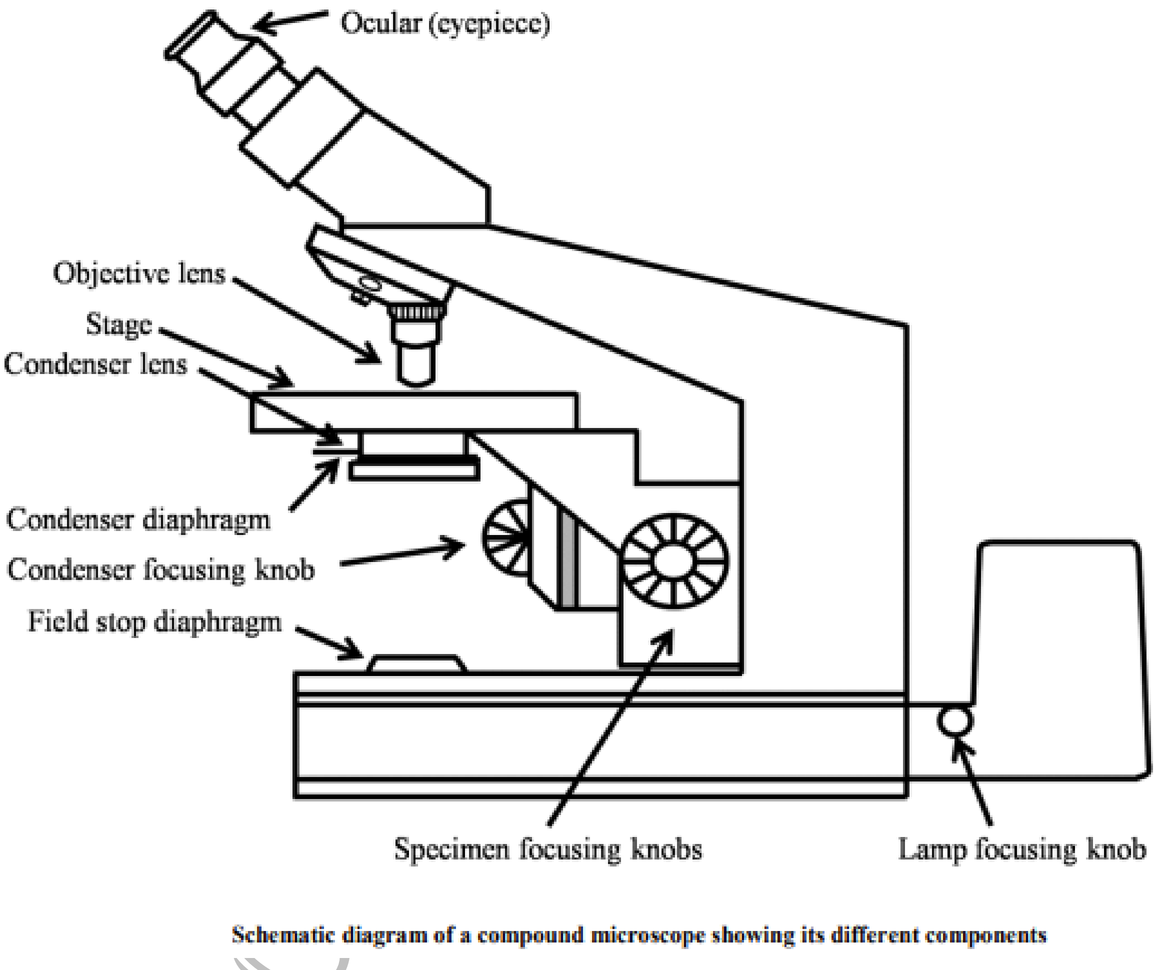
N. A. = numerical aperture = n sinα



Resolution of a microscope

As is clear from the definition of resolution, lower dmin implies higher resolution. Resolution of a light microscope operating at the blue end of the visible spectrum will therefore be higher than that operating at the red end, assuming all other parameters remain same. The theoretical limit for dmin for a light microscope operating in high refractive index (typically, nmax = 1.4 for the oil used in microscopy) is ~ 0.17 μm (Assuming λ = 400 nm and sinα = 1). It is therefore an intrinsic limitation of a light microscope to resolve the particles closer than ~0.17 μm. It is evident that the resolution can be increased if the wavelength of the source radiation is reduced.

The light is produced by a lamp source and focused on the specimen by the condenser. The light diffracted by the sample is then collected by the objective lens that generates a real magnified image. This image is further magnified by the eyepiece.



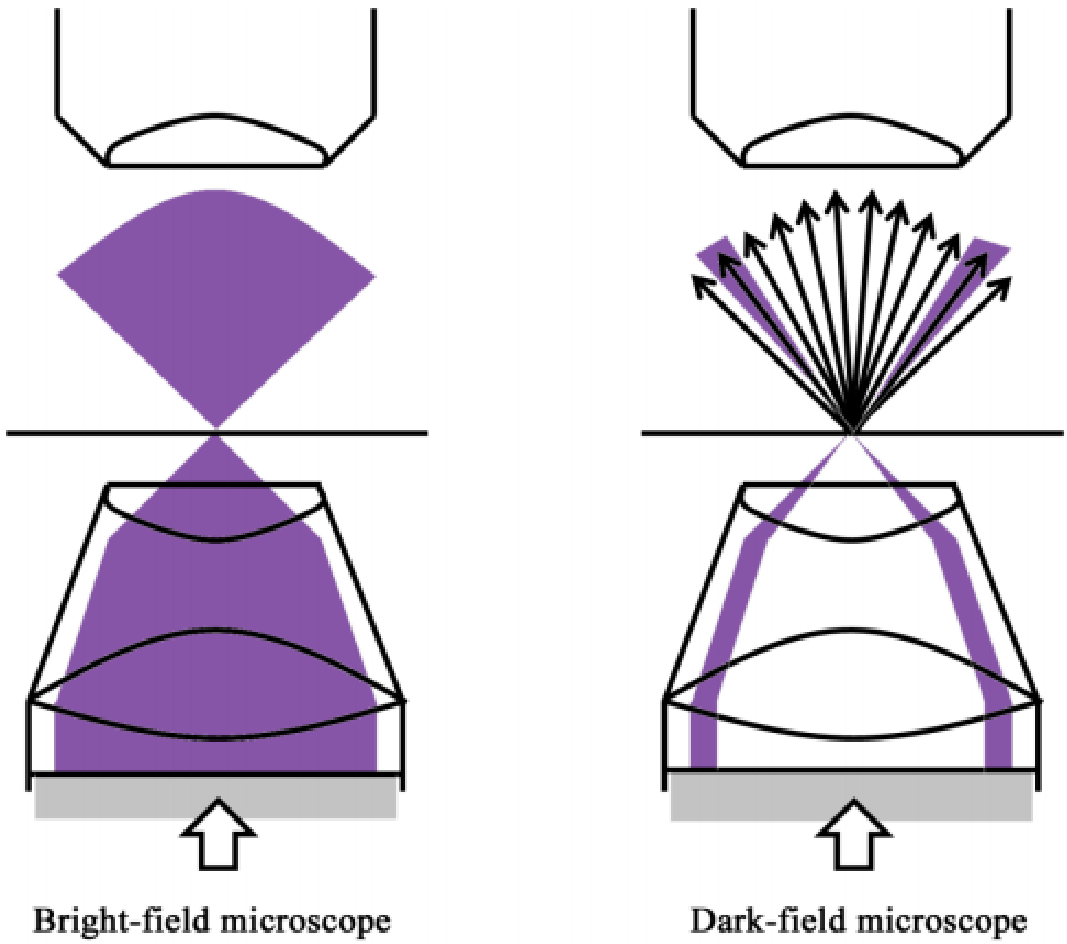
Schematic diagram of a compound microscope showing its different components

Bright-field microscopy

In a bright-field microscope, both diffracted (diffracted by the specimen) and undiffracted (light that transmits through the sample undeviated) lights are collected by the objective lens (Figure 14.6). The image of the specimen is therefore generated against a bright background, hence the name bright-field microscopy. Most biological samples are intrinsically transparent to the light resulting in poor contrast. To increase the contrast of the image, the specimens are therefore generally stained with the dyes. However, intrinsically colored samples such as erythrocytes can directly be observed using bright-field microscopy

Dark-field microscopy

Dark-field microscopy increases the contrast of the image by eliminating the undiffracted light. The specimen is illuminated by the light coming from a ring at an oblique angle (Figure 14.6). If there is no specimen in the optics path, no light is collected by the objective lens. Presence of specimen results in the diffraction of light; the objective lens collects the diffracted light generating a bright image against a dark background.



Phase contrast microscopy

4. Phase Contrast Microscopy:

The phase contrast principle was discovered by Fritz Zernike who was awarded Nobel prize in physics in 1953. According to this principle, light waves have variable character for frequency and amplitude. Human eyes cannot perceive a phenomenon when two light rays have similar amplitude and frequency but different phases (Fig. 35.4).

PG TRB 2020 – 21 BOTANY UNIT - 5 - QUESTIONS

1. Mendel used ____________ for his experiments.

A) Pisum sativum

B) Pisum album

C) Oryza sativa

D) Oryza Orientalis

2. Which of the following relationship was not studies by Mendel?

A) Flower colour and seed colour

B) Height and seed colour

C) Flower colour and shape of pollen grain

D) Height and seed coat colour

3. Choose the odd one out – Green pod, Yellow seed, Purple flower, Terminal flower.

A) Green pod

B) Yellow seed

C) Purple flower

D) Terminal flower

4. Which of the following two traits is characteristic of a single gene?

A) Seed colour and shape

B) Flower colour and position

C) Colour of flower and seed coat

D) Height and colour of seed

5. Which of Mendel's laws will be violated by linkage?

A) Panspermia

B) Diminance

C) Segregation

D) Independent assortment

6. Which of Mendel’s law is against the theory of Blending inheritance?

A) Law of segregation

B) Law of dominance

C) Law of recessive

D) Law of independent assortment

7. Considering the concept of Multiple alleles, one organism can have _____ alleles.

A) One

B) Two

C) Three

D) Four

8. It is confirmed that phenotype of short pea plant height will be expressed only when ______________

A) Both the parents are tall

B) One parent is tall and other short

C) The seeds are generated by selling

D) Both parents are short

9. Which of the following was not a cause for Mendel’s lack of instant popularity?

A) Darwin’s theory of Natural selection

B) His experimental model being rare

C) His ideas of using statistics being beyond his time

D) His article was published in less known journal

10. Mendel did not give ______________

A) Concept of genes

B) Concept of inheritance

C) Concept of dominance

D) Concept of chromosomes

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Botany

UNIT-6

BOTANY SYLLABUS

UNIT-VI

i) Anatomy: Meristems – General account, classification, various concepts of apical organization of shoots and root apices. Procambium, Cambium and their relationship. Development of Secondary vascular tissues. Simple tissues, conductive tissues – Xylem & Phloem. Wood anatomy – variations in wood structure – tyloses – Heartwood and sapwood – growthrings. Microtomy: Use of Rotary and Sledge microtomes – whole mounts – Paraffin method – clearing and macerations. Fixation and fixatives: Staining and stains – Histo – chemistry – cellulose, lignin, enzymes, proteins and nucleic acids.

ii) Embryology : Microsporogenesis and structure of micro-sporangium – Male gametophte. Mega sporogenesis and structure of megasporangium – Female gaetophyte. Present concept of fertlization, endosperm types – Endosperm haustoria.

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PG TRB BOTANY 2020 - 21

UNITS - VI

ANATOMY, MICROTOMY AND EMBRYOLOGY

i) ANATOMY

Introduction

- The study of internal structure and organization of plant is called "**plant anatomy"** (*Gk* = *Ana* - as under; *temnein* - to cut).
- In plants cells are the **basic unit**.
- Father of Plant Anatomy - **Nehemiah Grew.**
- Cells organized into **tissues** and tissues organized into **organs**.

MERISTEMS - GENERAL ACCOUNT, CLASSIFICATION,

1:0 INTRODUCTION:

The study of internal structure of plant organs is called plant anatomy (ana = as under; temnein = to cut)".

The plant body consists of a number of organs i.e., Root, stem, leaf and flower.Each organ is made up of a number of tissues. Each tissue consists of many cells of one kind. The tissue units are called tissue systems. The plant body of a vascular plant is basically composed of three systems namely.

1. The dermal system
2. Vascular system
3. The fundamental system

The tissue systems of primary body are derived from the apical meristems. The partly differentiated tissues can be classified as Protoderm, Procambium and ground meristem.

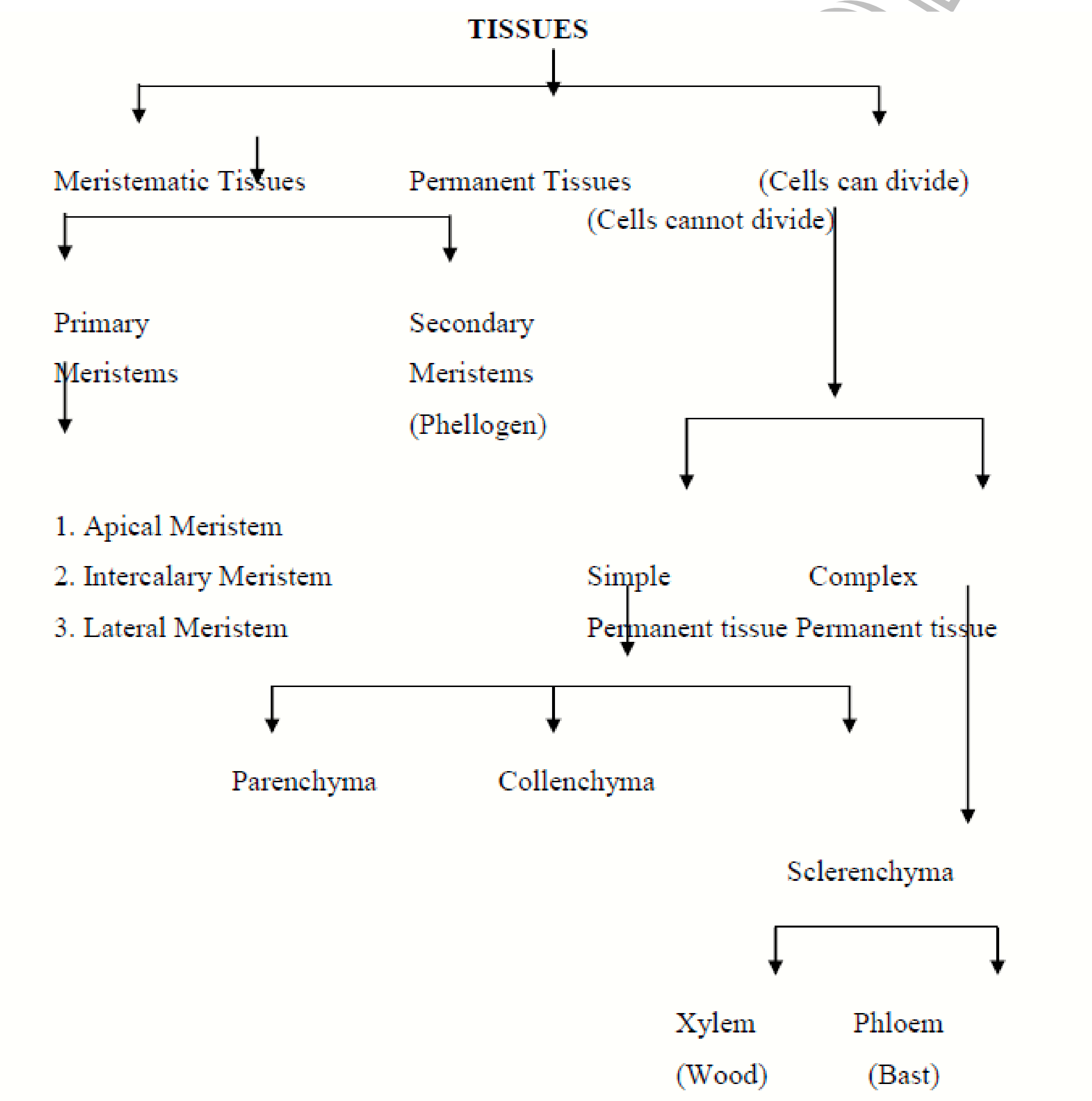
1:1 TYPES OF TISSUE:

Plant tissues are classified on the basis of the ability or inability to divide in to meristematic tissues and permanent tissue respeatively.

The different types of tissues can be categorised as follows.

MERISTEMATIC TISSUES:

The term meristematic is derived from the Greek word Meristos which means divisible.



Meristems are a group of cells with the potential to divide. The term meristem was introduced by Nageli in 1858 to designate dividing cells. The term meristem is applied to regions of more or less continuous cell and tissue initiation. The cells of meristem differ from those of mature tissues in that commonly they have abundant cytoplasm with vacuoles, nuclei and no intercellular spaces.

In plants continuous nature of growth is due to the ability of meristematic tissues present in permanently embryonic state in different parts like stem tips, root tips and other zones.

1:2 CYTOLOGICAL FEATURES OF MERISTEMS:

1. The cells have no inter cellular spaces.
2. The cells have dense cytoplasm.
3. The cell walls are very thin and flexible.
4. Plastids are absent, however proplastids may present.
5. Ergastic substances are absent.
6. The neighbouring cells of meristem are interconnected by cytoplasmic strands (Plasmodesmata).

1:3 CLASSIFICATION:

Meristems are variously classified on the basis of the following criteria.

1. Classification on the basis of origin.
2. Classification on the basis of location in the plant body.
3. Classification on the basis of planes of cell division.
4. Meristem based on function.

1. **CLASSIFICATION ON THE BASIS OF ORIGIN**:

Based upon this criteria meristems are classified into

(a) Primary meristems.

(b) Secondary meristems.

Perimary meristems are present as such from the time of embryo formation till the death of the plant. These meristems are responsible for the primary growth of the plant body. Some of these meristems like intrafascicular cambium also contributes to secondary growth as in dicot stems. The primary meristems develop from embryonic meristems called promeristem.

Secondary meristems develop from permanent tissues by the process of dedifferentiation. During this process cells which usually do not divide develop the ability to divide. These meristems are exemplified by interfascicular cambium and cork cambium. It is formed from mature cells like cortical, epidermal or phloem cells.

2. **CLASSIFICATION ON THE BASIS OF LOCATION IN THE PLANT BODY**:

On the basis of location in the plant body the following types of meristems are recognized.

(a) Apical meristems.

(b) Intercalary meristems.

(c) Lateral meristems.

Apical meristems which are located at the growing apices of the main stem, main roots and their branches. The apical meristems are responsible for growth in length of the plant organs. Initiation of growth is maintained by **apical cells**.

PG TRB 2020 – 21 BOTANY - UNIT - 6 - QUESTIONS

1.Haploid microspores are produced within

A) stamens

B) carpels

C) filament

D) pollen sac

2.The haploid microspores produced in pollen sacs are called

A) ovary

B) anther

C) stamen

D) carpel

3.The process which undergoes into the microspore nucleus is known as

A) binary fission

B) mitosis

C) meiosis

D) calluses

4.A germinated microspore has

A) tube nucleus only

B) two sperms only

C) three sperms

D) tube nucleus and two sperms

5.A germinated microspore contains a tube nucleus and

A) three sperms

B) one sperms

C) four sperms

D) two sperms

6.Flowers with both androecium and gynoecium are called

A) Bisexual flowers

B) Anther

C) Stamens

D) Unisexual flowers

7.The transfer of pollen from the anther to stigma is called

A) Pollination

B) Fertilization

C) Adoption

D) Diffusion

8. The fusion of female reproductive nucleus with the male reproductive nucleus is known as

A) Adoption

B) Excretion

C) Fertilization

D) Regeneration

9. The two nuclei at the end of the pollen tube are called

A) Tube nucleus and a generative nucleus

B) Sperm and ovum

C) Generative nucleus and stigma

D) Tube nucleus and sperm

10. Generative nucleus divides forming

A) 2 male nuclei

B) 3 male nuclei

C) 2 female nuclei

D) 3 female nuclei

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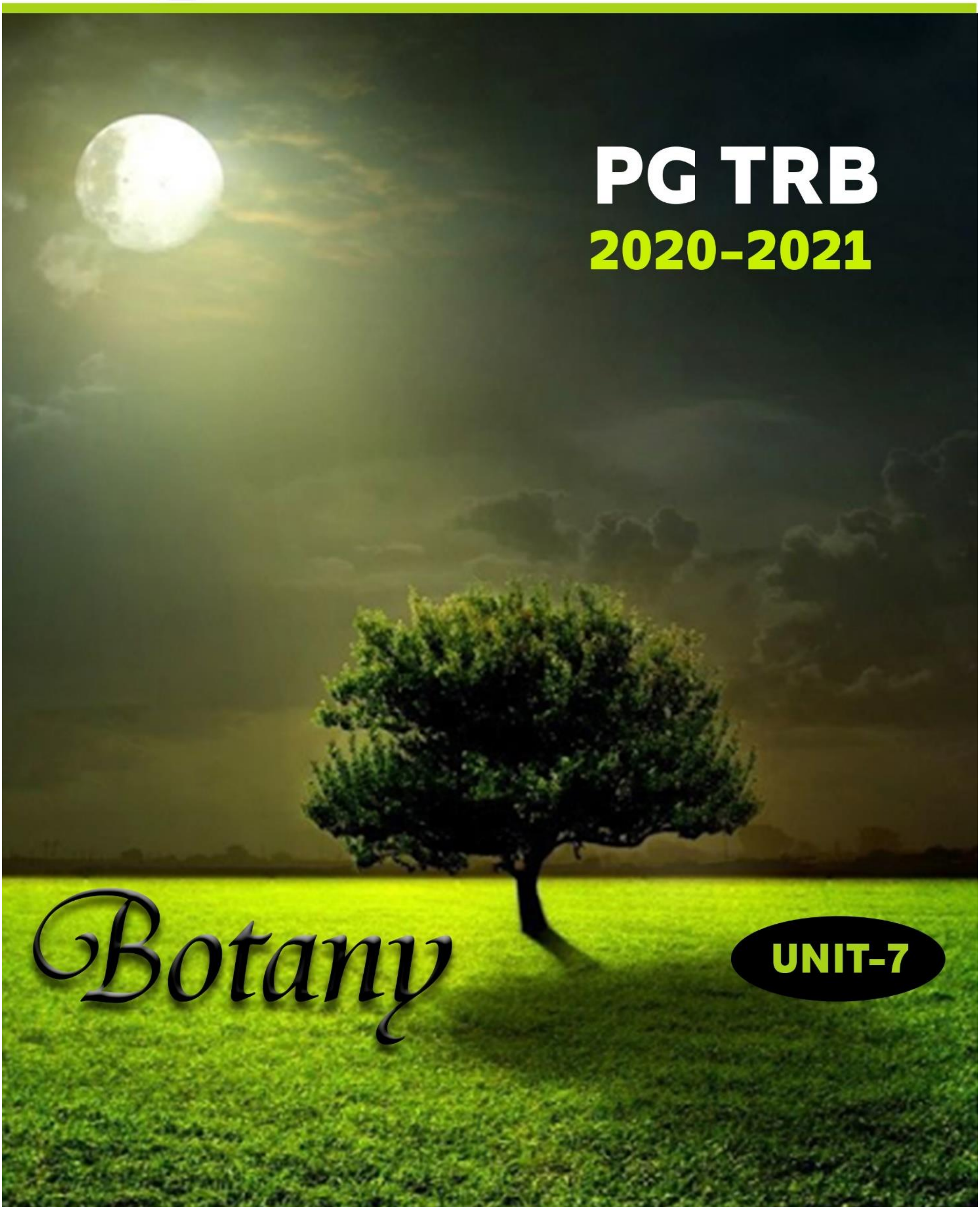

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BOTANY SYLLABUS

UNIT-VII

i) Plant Physiology: Water relations of plants – Mechanisms; of absorption of water – passive and active – apoplast symplast concept. Stomatal mechanism and Transpiration – Ascent of Sap. Mineral nutrition – Methods of studying plant nutrition. Essential elements – macro and micro nutrients. Asorption of solutes translocation of solutes – pathway and mechanism.

Photosynthesis – Properties of light – interaction between radiant energy and matter. Photosynthetic pigments and pigments and pigment systems. Hill Reaction – Photochemical reaction, Photophosphorylation – Cyclic and non-cyclic and calvincycle.

Respiration – Glycolysis, Krebs cycle, Electron Transport Nitrogen metabolism – Sources of soil nitrogen, Nitrogen fixation. Legume-Rhizobium symbiosis – biochemistry and physiology. Growth and Development – auxins, cytokinins. Gibberellins, phytochromes – role and mode of action.

ii) Bio-chemistry: Chemistry of carbohydrates – classification – structure and function, lipids – classification, occurrence, structure and importance of lipids and phosphates. Proteins – structure, properties and classification of aminoacids – peptides – structural organization and classification of proteins Nucleic acids – chemistry of Nucleic acids – structure and properties, location and biological significance of DNA – different types of RNA, their origin, properties and fuctions. Enzymes – Properties, mode of action, nomenclature and classification – factors affecting enzyme activity.

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UNIT – VII

PLANT PHYSIOLOGY:

- **WATER RELATED PLANTS - MECHANISM OF ABSORPTION OF WATER:**
- **Water absorption**
- The successively smaller branches of the root system of any plant terminate ultimately in the root tips, of which there may be thousands and often millions on a single plant. Most absorption of water occurs in the root tip regions, and especially in the root hair zone. Older portions of most roots become covered with cutinized or suberized layers through which only very limited quantities of water can pass.
- Whenever the water potential in the peripheral root cells is less than that of the soil water, movement of water from the soil into the root cells occurs. There is some evidence that, under conditions of marked internal water stress, the tension generated in the xylem ducts will be propagated across the root to the peripheral cells. If this occurs, water potentials of greater negativity could develop in peripheral root cells than would otherwise be possible. The absorption mechanism would operate in fundamentally the same way whether or not the water in the root cells passed into a state of tension. The process just described, often called passive absorption, accounts for most of the absorption of water by terrestrial plants.
- The phenomenon of root pressure represents another mechanism of the absorption of water. This mechanism is localized in the roots and is often called active absorption. Water absorption of this type only occurs when the rate of transpiration is low and the soil is relatively moist. Although the xylem sap is a relatively dilute solution, its osmotic pressure is usually great enough to engender a more negative water potential than usually exists in the soil water when

the soil is relatively moist. A gradient of water potentials can thus be established, increasing in negativity across the epidermis, cortex, and other root tissues, along which the water can move laterally from the soil to the xylem. *See also* Plant mineral nutrition.

- **ABSORPTION OF WATER BY PLANTS**

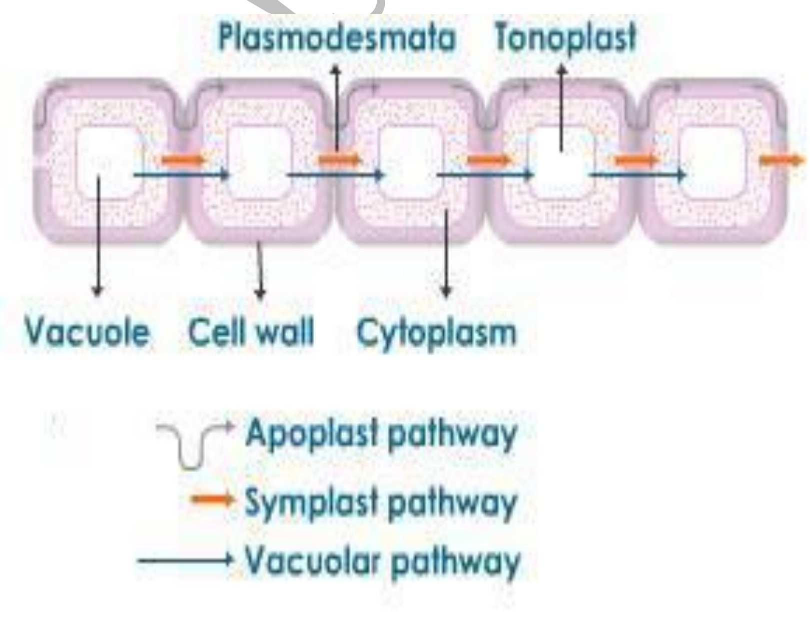
Plants absorb water through the entire surface - roots, stems and leaves. However, mainly the water is absorbed by roots. The area of young roots where most absorption takes place is the root hair zone. The root hairs are delicate structures which get continuously replaced by new ones at an average rate of 100 millions per day. The root hairs lack cuticle and provide a large surfacearea. They are extensions of the epidermal cells. They have sticky walls by which they adhere tightly to soil particles. As the root hairs are extremely thin and large in number, they provide enormous surface area for absorption. They take in water from the intervening spaces mainly by osmosis. Water to in the roots moving by two pathways. They can be classified as

1) Apoplast pathway

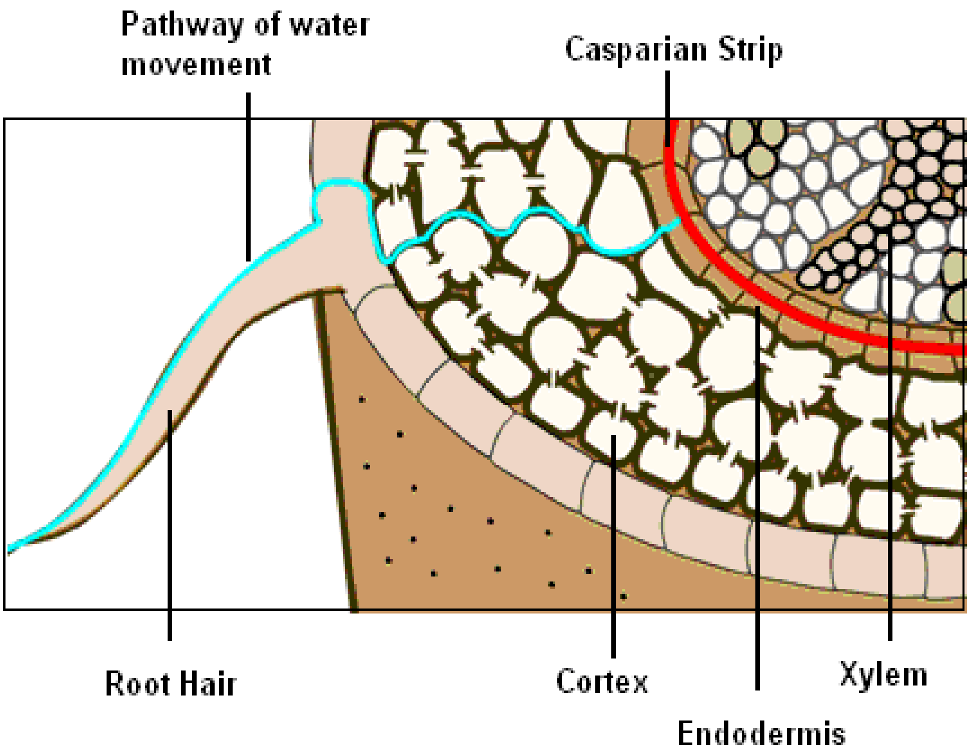
- 2) Symplast pathway

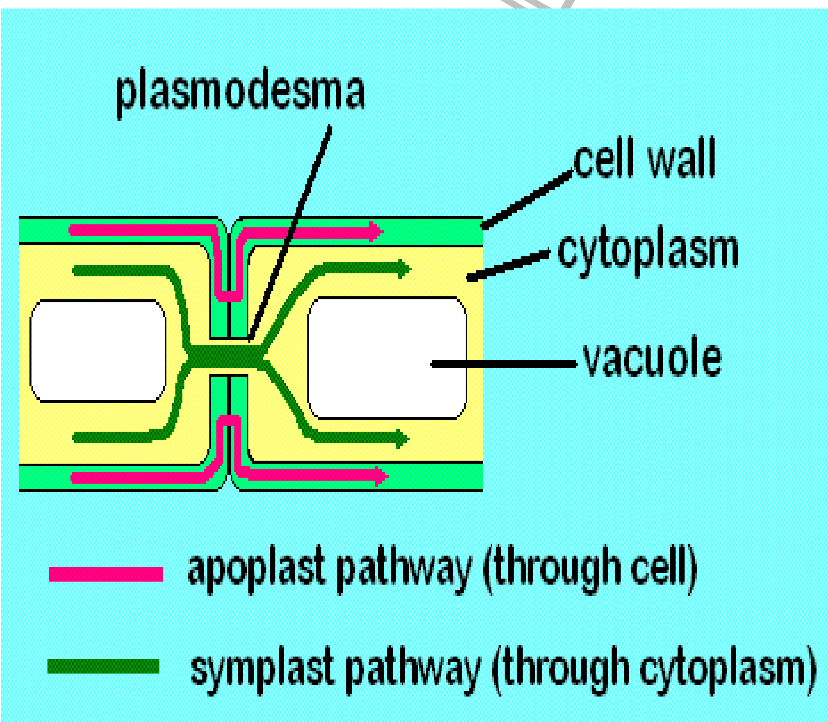
APOPLAST PATHWAY

- In this pathway the movement of water occurs exclusively through cell wall without the involvement of any membranes. Majority of the amount of water goes through the apoplast pathway. The cortex of the root does not oppose such movement of the water.



Three Pathways of Water Movement





Within a plant, the **apoplast** is the free diffusional space outside the plasma membrane. It is interrupted by the Casparian strip in roots, air spaces between plant cells and the cuticula of the plant.

Structurally, the apoplast is formed by the continuum of cell walls of adjacent cells as well as the extracellular spaces, forming a tissue level compartment comparable to the symplast. The apoplastic route facilitates the transport of water and solutes across a tissue or organ. This process is known as **apoplastic transport**.

PG TRB 2020 – 21 BOTANY UNIT - 7 - QUESTIONS

1. 3-phosphoglycerate is not the metabolic precursor for ____________

A) Serine

B) Glycine

C) Cysteine

D) Arginine

2. Pyruvate is the precursor for ____________

A) Alanine

B) Glutamate

C) Serine

D) Proline

3. The cyclized derivative of glutamate is ____________

A) Proline

B) Arginine

C) Glutamine

D) Serine

4. Precursor of glycine is ____________

A) Proline

B) Glutamine

C) Serine

5. Which of the following is a non-essential amino acid?

A) Methionine

B) Threonine

C) Lysine

D) Cysteine

6. Which of the following gives rise to methionine, threonine, and lysine?

A) Pyruvate

B) Glutamate

C) Aspartate

D) Serine

7. Which of the following gives rise to valine and isoleucine?

A) Pyruvate

B) Glutamate

C) Aspartate

D) Serine

8. Which of the following is not an aromatic amino acid?

A) Phenylalanine

B) Tyrosine

C) Tryptophan

D) Leucine

9. Which of the following can be formed by hydroxylation of phenylalanine?

A) Serine

B) Tyrosine

C) Tryptophan

D) Leucine

10. Phosphoribosyl pyrophosphate is a precursor of tryptophan and ____________

A) Tyrosine

B) Histidine

C) Phenylalanine

D) Isoleucine

11. Tyrosine gives rise to a family of catecholamines that does not include ____________

A) Dopamine

B) Norepinephrine

C) Epinephrine

D) Cortisol

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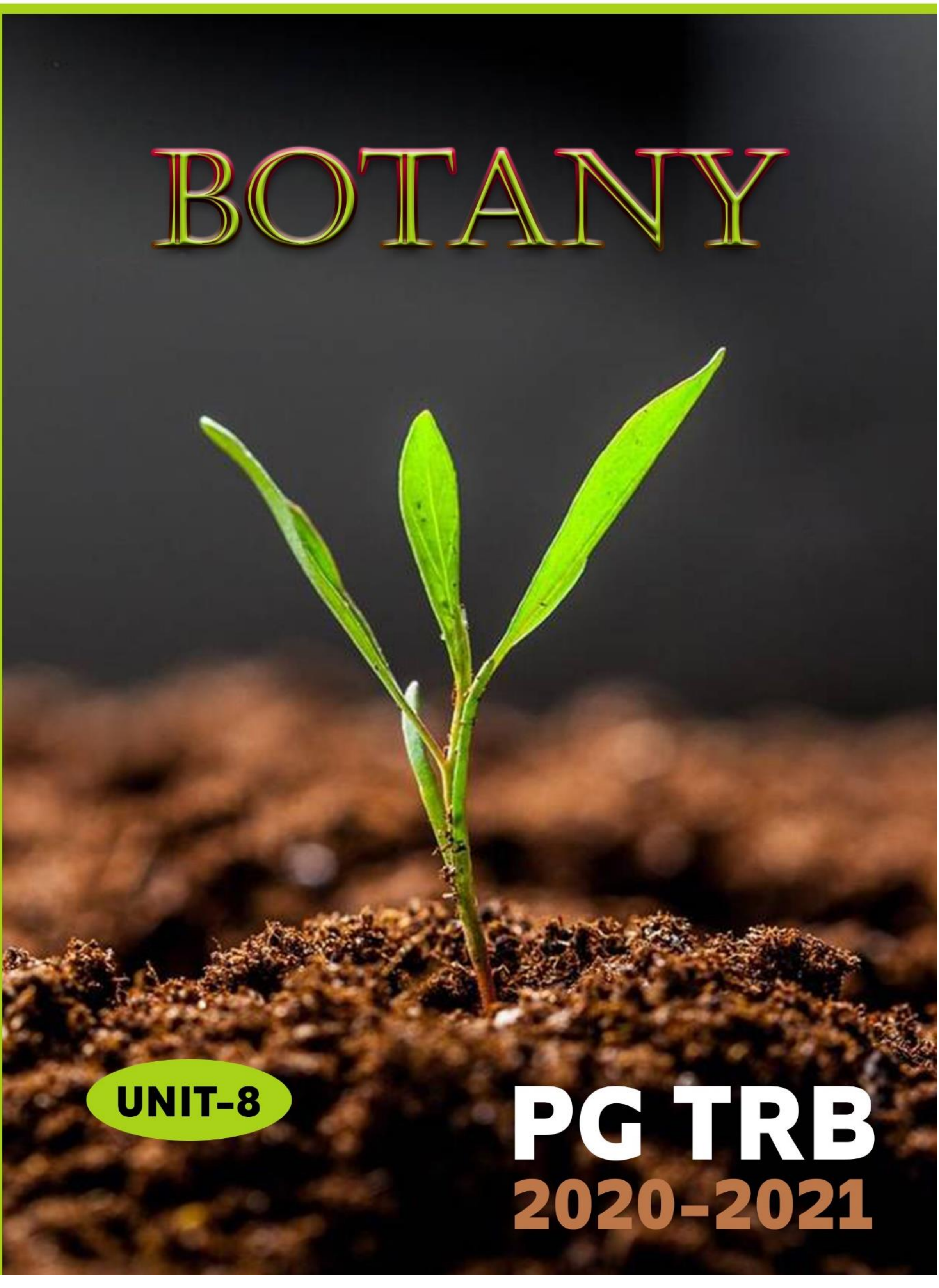

UNIT-8

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BOTANY SYLLABUS

UNIT-VIII

i) Plant Breeding: Methods of improvement of crops. Plant introduction – Selection – Heterosis Hybridization – Polyploidy – Mutation breeding.

ii) Bio-Technology: Scope and importance of Bio-technology – Basic techniques – Transformation of E.coli cutting and joining DNA molecules – vectors – Plasmids. Cesmids. Application of recombinant DNA technology in Enzyme engineering – industries in prevention, diagnosis fermentation and cure of diseases (medicine) in the production of bio-fertilisers, bio-insecticides, Tissue culture.

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UNIT – VIII

I.PLANT BREEDING

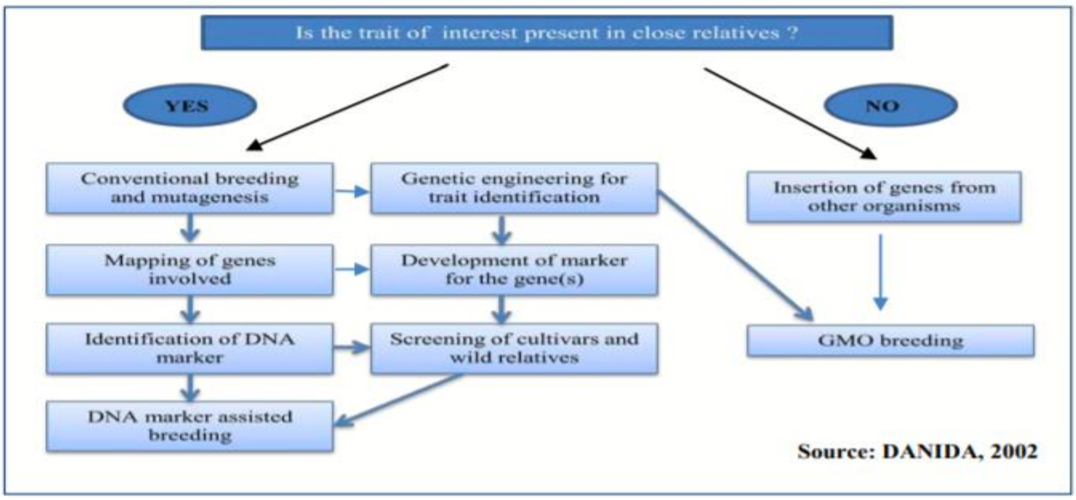
Methods of improvement of crops

Crop Improvement :: Breeding Methods in Crop Plants

Crop improvement refers to the genetic alteration of plants to satisfy human needs. In prehistory, human forebears in various parts of the world brought into cultivation a few hundred species from the hundreds of thousands available. Plant introduction usually means the introduction of the plants from places outside the county, may be of same or another continent. It can be defined as the **"process of introducing plants from their growing locality to a new locality."**

Plant breeding is done for the following objectives –

- Increase the crop yield
- Improve the quality of the crop
- Increase tolerance to environmental conditions like salinity. extreme temperatures and drought
- Develop a resistance to pathogens
- Increase tolerance to the insect pest



Decision making box by using both conventional and modern biotechnology approaches for crop breeding

Table: Some genetic approaches for crop improvement

Method / technique	Benefits	Limitations	When the method is most useful
Conventional breeding	Well established. Accelerated by recent advances including use of genomic information, for example in marker assisted selection.	Slow. Limited to the genetic diversity in current varieties and their relatives. Widespread unintended side-effects from additional genetic changes introduced along with those sought.	For complex multi-gene traits where the genetic basis is poorly understood.
Mutational breeding	Can generate new diversity not readily available in current varieties and their wild relatives.	Untargeted. Widespread unintended side-effects since many mutations are induced at random and these are time consuming to remove.	For single gene traits where there is insufficient diversity available in current germplasm. For traits for which the genetic basis is poorly understood.
GM (transgenic)	Enables introduction of wider range of traits not available through conventional or mutational breeding. Can increasingly make changes directly in elite lines.	Unintended side-effects due to insertion of the transgene into the genome. Many desirable traits are complex and/or there is insufficient knowledge of their genetic basis to introduce them in this way.	For traits that depend on a small number of known genes.
New genetic improvement technologies:			
Site-directed / targeted genome editing	More targeted gene insertion/deletion is possible. Provides a more precise way to increase variation in specific genes. Can increasingly make changes directly in elite lines, allowing rapid and precise swapping of gene variants.	Many desirable traits are complex and/or there is insufficient knowledge of their genetic basis to introduce them in this way. Frequency of unintended side-effects not yet determined.	For traits that depend on a small number of known genes.
Epigenetic modifications	Epigenetic modifications resulting in gene silencing may be targeted to specific sites in the genome without affecting the order of A,C,G and T in the DNA. The gene silencing effect may persist for the lifetime of the plant and even across generations. The epigenetic mechanism can be targeted by RNA that is delivered by a virus or by grafting – plant regeneration from tissue culture may not be required.	More research is needed to identify genetic loci that are susceptible to epigenetic modification and the factors that influence the stability of the epigenetic change either within a plant or between generations.	For traits that can be improved by loss of gene function.

Classification of crop plants based on mode of pollination and mode of reproduction

Modern Plant Breeding

Modern plant breeding uses techniques of molecular biology to select the variations. This approach which combines biotechnology and molecular biology is known as molecular breeding.

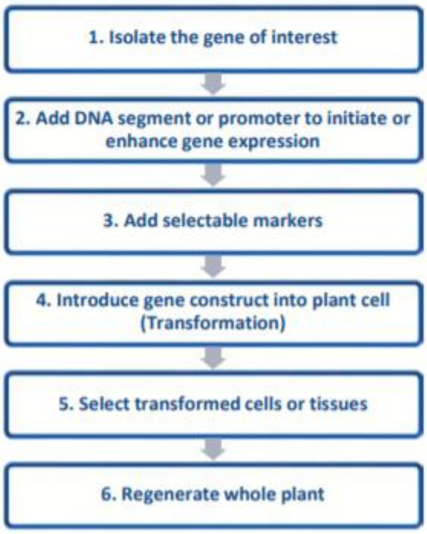
Steps Involved In Plant Breeding

Following steps are involved in both traditional as well as modern plant breeding.

1. **Generation (or identification) of variant** may be done simply by collection of wild type varieties or traditional varieties from farmers or by hybridization (crossing 2 or more plants species) and by induced mutation and induced polyploidy.
2. **Selection for desired characteristics** like grains for large seed size, seed dormancy, and non-shattering seed heads. It is possible now to select variants based on molecular markers.

- These two steps are still followed for plant breeding but biotechnology has changed the breeding techniques. In this chapter we are going to focus more on the new technology of introducing characters to the plant called Transgenic Technology
- Transgenic Technology results into genetic variation across kingdoms, rather than within a species or genus. Gene transfer is more precise than previous methods.

Steps Involved In Production of Transgenic Plants



BREEDING METHODS IN CROP PLANTS

Plant breeding can be broadly defined as alterations caused in plants as a result of their use by humans, ranging from unintentional changes resulting from the advent of agriculture to the application of molecular tools for precision breeding. The vast diversity of breeding methods can be simplified into three categories: (i) plant breeding based on observed variation by selection of plants based on natural variants appearing in nature or within traditional varieties; (ii) plant breeding based on controlled mating by selection of plants presenting recombination of desirable genes from different parents; and (iii) plant breeding based on monitored recombination by selection of specific genes or marker profiles, using molecular tools for tracking within-genome variation. The continuous application of traditional breeding methods in a given species could lead to the narrowing of the gene pool from which cultivars are drawn, rendering crops vulnerable to biotic and abiotic stresses and hampering future progress. Several methods have been devised for introducing exotic variation into elite germplasm without undesirable effects.

PG TRB 2020 – 21 BOTANY UNIT – 8 - QUESTIONS

1.tetr, kanr are example of

(A) Marker genes

(B) Cos Site

(C) Ori site

(D) All of above

2) Cosmids are prepared by inserting______of phage into a ______ .

(A) TDNA, Plasmid

(B) CosSite, Plasmid

(C) Genome, Plasmid

(D) None of these

3) Isolation of B+ gene from B thuringiensis was done by ?

(A) Barton et al (1987)

(B) Venter et al (1998)

(C) Baltimore

(D) Braun

4) Isozymes analysis of hybrid verification employs

(A) Starch gene

(B) Polyacrylamide gene

(C) Starch gene and Polyacrylamide gene both

(D) None of these

5) In Haploid culture, chromosome duplication without nuclear division taker place it is known as?

(A) Eumitosis

(B) Endomitosis

(C) Cloning

(D) All of the above

6) Immobilized cell systems uses ________ for cell immobilization.

(A) Calcium alginate

(B) Agarose Beads

(C) Calcium alginate and Agarose Beads both

(D) None of these

7) Intron are absent in ..?

(A) Zein Storage genes of maize

(B) Soybean Protein Genes

(C) Zein Storage genes of maize and Soybean Protein Genes both

(D) None of these

8) Cryopreservation is the storage of material at ultralow temperatureby.

(A) Very Rapid Cooling

(B) Gradual Cooling

(C) Gradual Cooling & Simultaneous Dehydration at Low Temperature

(D) All of the above

9) Electrophoretic separation of DNA molecules, several megabases in size, achieved by ?

(A) PFGE

(B) FISH

(C) SDSPAGE

(D) None of these

10) Confirmation of DNA transformation in rDNA teachnology can be done with the help of

(A) Western Blotting

(B) Southern Blotting

(C) PFGE

(D) PCR

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UNIT-9

BOTANY SYLLABUS

UNIT-IX

i) Ecology: Importance of ecology, Ecological factors – their classification and interaction Edaphic factors – Water factors – Fire factors – Biotic factor. Synecology – classification of plant communities Raunkiaer's life – forms – Ecological succession – causes and effects climax concept. Eco system – components and inter relationship. Bio-geo-chemical cycles.

ii) Plant Geography: Principles of Plant Geography Dispersal and migration – Types – Age and Area hypothesis – continuous range, cosmopolitan, circum polar, circum boreal and circum austral, pantropical Discontinuous distribution – Wegner's theory of continental drift.

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UNIT – IX

ECOLOGY

IMPORTANCE OF ECOLOGY

Ecology is defined as the scientific study of interactions of organisms (both biotic and abiotic) with one another within the physical and chemical environment. Ecology involves use of scientific methodology via lab experiments to understands how the different organisms grow, populate, how they interact with other organisms either as parasites, predators, how the organisms die out as well as how they evolve or adapt to changing climatic and environmental situations.

Importance of Ecology

The study of ecology is important in ensuring people understand the impact of their actions on the life of the planet as well as on each other. **Here are the reasons why ecology is important**:

1. It helps in environmental conservation

Ecology allows us to understand the effects our actions have on our environment. With this information, it helps guide conservation efforts by first showing the primary means by which the problems we experience within our environment begin and by following this identification process, it shows us where our efforts would have the biggest effect.

Ecology also shows individuals the extent of the damage we cause to the environment and provides predictive models on how bad the damage can get. These indicators instil a sense of urgency among the population, pushing people to actively take part in conservation efforts and ensure the longevity of the planet.

2. Ensures proper resource allocation

Ecology equally allows us to see the purpose of each organism in the web of connectivity that makes up the ecosystem. With this knowledge, we are able to ascertain which resources are essential for the survival of the different organisms. This is very fundamental when it comes to assessing the needs of human beings who have the biggest effect on the ecosystem.

An example is human dependency on fossil fuels that has led to the increase of carbon footprint in the ecosystem. It is ecology that allows humans to see these problems which then calls for the need to make informed decisions on how to adjust our resource demands to ensure that we do not burden the environment with demands that are unsustainable.

3. Enhances energy conservation

Energy conservation and ecology is connected in that, it aids in understanding the demands different energy sources have on the environment. Consequently, it is good for decision making in terms of deciding resources for use as well as how to efficiently convert them into energy.

Without proper understanding of energy facts through ecology, humans can be wasteful in their use of allotted resources such as indiscriminate burning of fuels or the excessive cutting down of trees. Staying informed about the ecological costs allows people to be more frugal with their energy demands and adopt practices that promote conservation such as switching of lights during the day and investing in renewable energy.

4. Promotes eco-friendliness

With all the information and research obtained from ecology, it ultimately promotes eco-friendliness. It makes people aware of their environment and encourages the adoption of a lifestyle that protects the ecology of life owing to the understanding they have about it.

This means that in the long-term, people tend to live less selfishly and make strides towards protecting the interest of all living things with the realization that survival and quality life depends on environment sustainability. Hence, it fosters a harmonious lifestyle and assures longevity for all organisms.

5. Aids in disease and pest control

A great number of diseases are spread by vectors. The study of ecology offers the world novel ways of understanding how pests and vectors behave thereby equipping humans with knowledge and techniques on how to manage pests and diseases.

For example, malaria which is one of the leading killer diseases is spread by the female *Anopheles* mosquito. In a bid to control malaria, humans must first understand how the insect interacts with its environment in terms of competition, sex, and breeding preferences. The same applies to other diseases and pests. By understanding the life cycles and preferred methods of propagation of different organisms in the ecosystem, it has created impressive ways to device controls measures.

ECOLOGICAL FACTORS THEIR CLASSIFICATION AND INTERACTION

Some of the major ecological factors that constitute the environment of an organism are as follows:

1. Climatic Factors
2. Edaphic Factors
3. Topographic Factors
4. Biotic Factors
5. Limiting Factors.

In any eco-system, a living organism is influenced by a number of factors and forces. These environmental factors are known as eco- factors or ecological factors which include light, temperature, soil, water etc.

These factors may be biotic (living) and abiotic (nonliving). The sum total of all these factors constitutes the environment of an organism.

All these ecological factors can be broadly classified into the following divisions:

(i) Climatic or Aerial factors:

(a) Light;
(b) Temperature;
(c) Water
(d) Rainfall,
(e) Humidity,
(f) Atmospheric gases (wind).

(ii) Topographic or Physiographic factors:

(a) Altitude;
(b) Direction of mountain chains and valleys,
(c) Steepness and exposure of slopes.

(iii) Edaphic factors:

These deal with formation of soil, its physical and chemical properties and details of related aspects.

(iv) Biotic factors:

These are all kinds of interactions between different forms of life. These are plants, animals, micro-organisms etc.

(v) Limiting Factors:

1. Climatic Factors:

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1. Consider the following protected areas:

1. Bandipur
2. Bhitarkanika
3. Manas
4. Sunderbans

Which of the above are declared Tiger Reserves?

(A) 1 and 2 only

(B) 1, 3 and 4 only

(C) 2, 3 and 4 only

(D) 1, 2, 3 and 4

2. With reference to the wetland of India, consider the following statements:

1. The country's total geographical area under the category of wetlands is recorded more in Gujarat as compared to other states.
2. In India, the total geographical area of coastal wetlands is larger than that of inland wetlands.

Which of the statements given above is/are correct?

(A) 1 only

(B) 2 only

(C) Both 1 and 2

(D) Neither 1 nor 2

3. Which of the following can be threats to the biodiversity of a geographical area?

1. Global warming
2. Fragmentation of habitat
3. Invasion of alien species
4. Promotion of vegetarianism

Select the correct **Answer** using the codes given below:

(A) 1 and 2 only

(B) 2 and 3 only

(C) 1, 2 and 3 only

(D) 1, 2, 3 and 4 only

4. Consider the following statements:

1. Biodiversity is normally greater in the lower latitudes as compared to the higher latitudes.

2. Along the mountain gradients, biodiversity is normally greater in the lower altitudes as compared to the higher altitudes.

Which of the statements given above is/are correct?

(A) 1 only (B) 2 only

(C) Both 1 and 2 (D) Neither 1 nor 2

5. The Red Data Books published by the International Union for Conservation of Nature and Natural Resources (IUCN) contains lists of

1. Endemic plant and animal species present in the bio-diversity hotspots.

2. Threatened plant and animal species.

3. Protected sites for conservation of nature and natural resources in various countries.

Select the correct **Answer** using the codes given below:

(A) 1 and 3 (B) 2 only

(C) 3 only (D) 2 and 3

6. biodiversity forms the basis for human existence in the following ways:

1. Soil formation

2. Prevention of soil erosion

3. Recycling of waste

4. Pollination of crops

Select the correct **Answer** using the codes given below:

(A) 1, 2 and 3 only (B) 2, 3 and 4 only

(C) 1 and 4 only (D) 1, 2, 3 and 4

7.Which of the following regions of India have been designated as biodiversity hotspots?

Select the correct **Answer** from the codes given below:

1. Eastern Himalaya

2. Eastern Ghat

3. Western Ghat

4. Western Himalaya

Codes:

(A) 1 and 2 only (B) 1 and 3 only

(C) 2 and 4 only (D) 3 and 4 only

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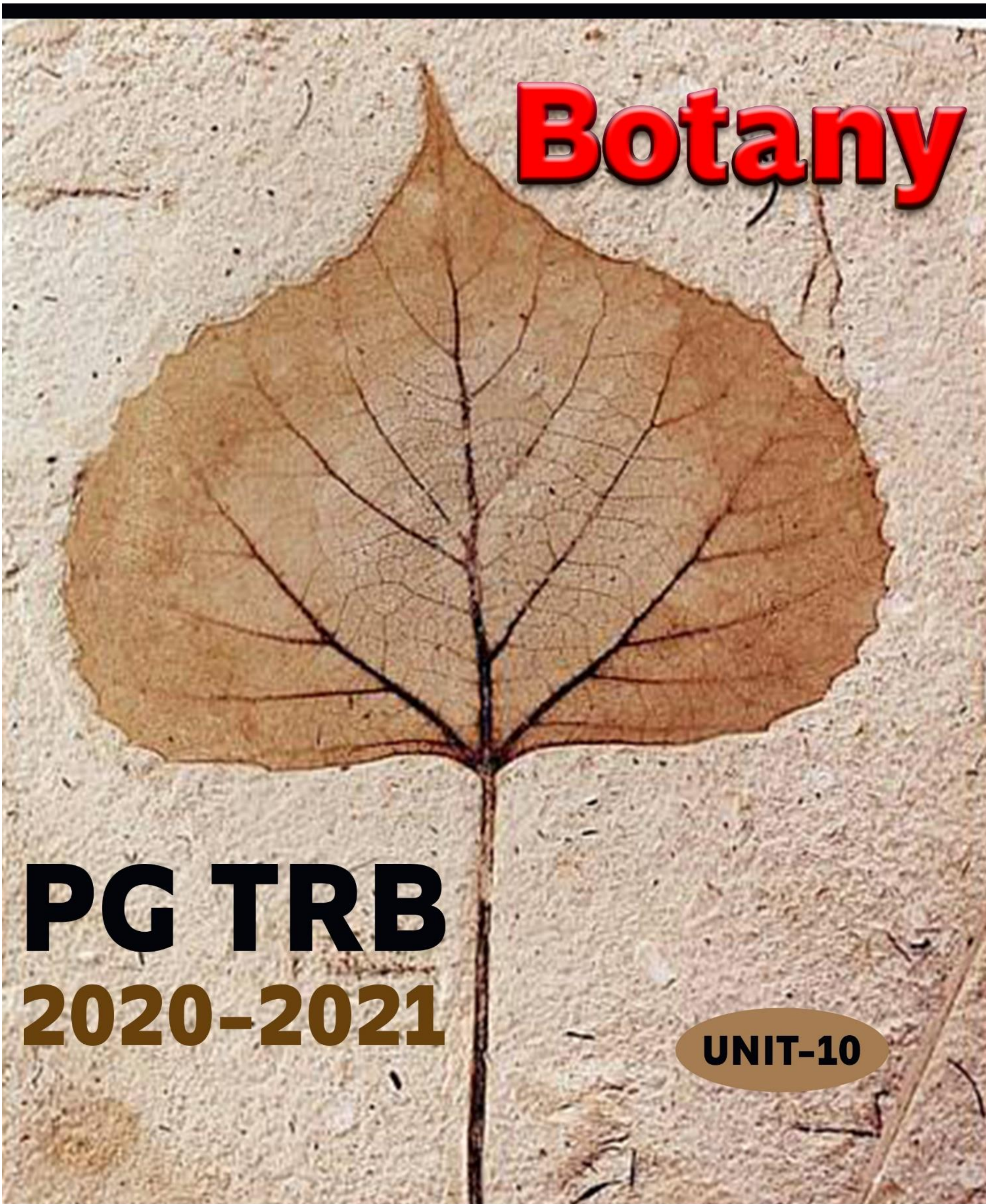

Botany

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2020-2021

UNIT-10

BOTANY SYLLABUS

UNIT-X

i) Paleo Botany: Geological time scale – Techniques of fossil study – Types of fossils and different methods of fossilization – Radio carbon dating – study of fossil forms in algae, bryophytes, pteridophytes and Gymnosperms. Conservation of fossil fuels.

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UNIT - X

Introduction:

Fossil studies in plants are difficult when compared to animals, as the organs of plants are few and very much similar in diversed groups. The leaves are soft and cannot by easily preserved like animal structure. However many types of fossil plants are obtained, but assembling the parts of a single genus is difficult, and hence plant fossils are studied as individual organ (stem, Root, seed etc.) 'form genera'. In this unit you will also be knowing the details of *Lepidodendron* and *Williamsonia*.

Paleobotany

Paleobotany, also spelled as palaeobotany (paleon(Gr.) = old and "botany", study of plants), is the branch of paleontology dealing with the recovery and identification of plant remains from geological contexts, and their use for the biological reconstruction of past environments, and the evolution of both the plant kingdom and life in general.

Paleobotany includes the study of terrestrial plant fossils, as well as the study of prehistoric marine photoautotrophs, such as photosynthetic algae, seaweeds or kelp. A closely-related field is palynology, which is the study of fossilized and extant spores and pollen.

Paleobotany is important

 in the reconstruction of ancient ecological systems and climate, known as paleoecology and paleoclimatology respectively;

 as fundamental to the study of green plant development and evolution.

 has also become important to the field of archaeology, primarily for the use of phytoliths in relative dating and in paleoethnobotany.

Plant fossils

Within the preview of palaeobotany comes the observation of the plant remains called fossils. A plant fossil is any preserved part of a plant that has long since died. In a popular sense fossils may be defined as ‘imprints of nature, in the womb of earth’. So fossils may be prehistoric impressions that are many millions of years old, or bits of charcoal that are only a few hundred years old.

Geological time scale:

- Macroscopic remains of true vascular plants are first found in the fossil record during the Silurian Period of the Paleozoic era. Some dispersed, fragmentary fossils of disputed affinity, primarily spores and cuticles, have been found in rocks from the Ordovician Period in Oman, and are thought to derive from liverwort- or moss-grade fossil plants .
- An important early land plant fossil locality is the Rhynie Chert, an Early Devonian sinter (hot spring) deposit composed primarily of silica found outside the town of Rhynie in Scotland.
- Plant-derived macrofossils become abundant in the Late Devonian and include tree trunks, fronds, and roots. The earliest tree is *Archaeopteris*, which bears simple, fern-like leaves spirally arranged on branches atop a conifer-like trunk.
- Widespread coal swamp deposits across North America and Europe during the Carboniferous Period contain a wealth of fossils containing arborescent lycopods up to 30 meters tall, abundant seed plants, such as conifers and seed ferns, and countless smaller, herbaceous plants.
- Angiosperms (flowering plants) evolved during the Mesozoic, and flowering plant pollen and leaves first appear during the Early Cretaceous, approximately 130 million years ago.
- Fossils arranged in a chronological order clearly reveal the relationship between one group and other which are diverse in the present day. The chronological order of the different eras and periods in the history of earth together with fossils round in the period is called as Geological time scale.

It is as represented in the following section:

Geological time scale			
Era	Period	Age in million years	Type of vegetation
Cenozoic era	Quaternary	1	Modern
	UpperTertiary,Pliocene, Miocene	10 20	Modern
Mesozoic	LowerTertiary,Oligocene Ecocene Upper Cretaceous	35 50 75	Modern, with tropical plants in Europe
	Lower cretaceous Upper Jurrassic	100 130	Gymnosperms dominant (conifers and Bennettitales)
	Lower Jurassic (Liassic) Upper Triassic (Rhaetic)	140 160	Luxuriant forests of Gymno-Sperms and Ferns
	LowerTriassic(Bunter)	180	Sparse desert flora with Gymnosperms (Conifers and
	Upper Permian	190	Bennettitales)
Palaeozoic	Lower Permian Upper Carboniferous (coal measures)	200	Tall swamp forests with Early Gymnosperms, tree Lycopods, *Calamites*, Ferns.
	Lower Carboniferous Upper Devonian	250 260	Early Gymnosperms, large Tree Lycopods and Ferns.
	Middle Devonian	275	*Rhynia* vegetation in marshy localities
	Lower Devonian Upper Silurain	300	Herbaceous marsh plants (*Psilophyton*, *Zosterophyllum*), small shrubs
	Silurian Ordovician	350 425	Marine algae
	Cambrian	500	Marine algae, but some evidence of land plants.
Pre cambian		4500?	Fungi and bacteria reported to have occurred 2,000 million years ago.

PG TRB 2020 – 21 BOTANY UNIT – 10 - QUESTIONS

1.The idea that a dike transecting bedding must be younger than the bedding it crosses is called the _______________

A) Principle of Original Horizontality

B) Principle of Original Continuity

C) Principle of Fossil Succession

D) Principle of Superposition

2.Which of the following could be a fossil?

A) a woman who lived 15,000 years ago found frozen in a glacier

B) a penguin that lived 100,000 years ago found in a dry valley in Antarctica

C) a wasp inside a 30 million year old block of ambe

D) all of the above

3.Approximately how many species of plants, animals, and other living things have been given scientific names and described?

A) 150,000

B) 250,000

C) 1.8 million

D) 54 million

4.Which of the following statements is true about fossilization?

A) It is a common occurrence

B) It is more common for animals from mountains and forests than for those from deserts and oceans.

C) Small animals with light weight, thin bones are more likely to become fossils than are large animals with heavy, dense bones

D)none of the above

5.A paleospecies is most often defined from the fossil record based on:

A) the reproduction of fertile offspring

B) DNA comparisons

C) morphology

D) all of the above

6. **This group consists of non-renewable organic resources**

A) Water, air and minerals

B) natural gas, oil and coal

C) wood, water and natural pastures

D) sand, air and clay

7. A non-renewale source of energy is

A) Wile life

B) Fossils fuels

C) Water

D) Forest

8. **Coal is produced in industry to get**

A) Coke

B) Coal tar

C) Coal gas

D) All of these

9. **Coke is used in the manufacturing of**

A) Lead

B) Iron

C) steel

D) Copper

10. **Which is an almost pure form of carbon?**

A) Coke

B) Coal tar

C) Coal gas

D) None of these

11.The idea that younger beds are deposited on top of older beds is called the

A) Principle of Original Horizontality

B) Principle of Fossil Succession

C) Principle of Cross-Cutting Relationships

D) Principle of Original Continuity

BOTANY