SREE SIDDAGANGA COLLEGE OF ARTS, SCIENCE and COMMERCE
B.H. ROAD, TUMKUR
(AFFILIATED TO TUMKUR UNIVERSITY)

DEPARTMENT OF BOTANY

I B.Sc, II SEMESTER CBCS

PRACTICAL PAPER- II

MANUAL

Plant ecology, Phytogeography and Plant pathology

I BSC II SEMESTER
PAPER-II THEORY SYLLABUS CBCS

PLANT ECOLOGY, PHYTOGEOGRAPHY AND PLANT PATHOLOGY

THEORY: 90 Marks CREDITS:4 60 Hours

UNIT-I: (2 Hr)

Introduction and Scope of Ecology

UNIT-2 (10 Hrs*)*

Ecological factors-**Climatic factors**-light,Temperature, Wind, Precipitation and Atmospheric humidity. **Edaphic factors**-Soil factors- Soil Profile, Types of Soil, soil Humus, Soil water, Soil PH, Soil organisms and Soil temperature. **Biotic factors**- Positive and Negative interrractions.

UNIT:3 (10 Hrs)

Ecosystem- Concepts, Components, Study of Marine ,Grassland and Forest Ecosystem, Food chain, Food web, Ecological pyramids, Prodution and Productivity,(Primary and secondary), **Biologeo chemical cycles**- Carbon, Nitrogen, Phosphorous.

UNIT: 4(14 Hrs)

Ecological Adoptations- Hydrophytes, Xerophytes, Halophytes, Epiphytes and Parasites. **Ecological Succession** - Definition, Process of Succession, Xerosere and Hydrosere. **Polluiton**- A brief account on Air, water and Soil. Global issues- Green house effect, Ozone depletion, nuclear winter, Solid waste management.

UNIT:5 (10 Hrs)

Plant biodiversity- Definition, types, Values of Biodiversity conservation- Soil conservation, Social forestry, Hot spots, Endangered species, Red data book.Phytogeography- Phytgeographical regions of India, Vegetational types of Karnataka.

UNIT6:-(14 Hrs)

Plant Pathology- Introduction and classification of Plant diseases based on pathogens. Symptoms, causal organisms and management of 1) Kole roga 2) Late blight of Potato, 3) Grain smut of Sorghum, 4) Blast disease of Rice. 5) Red rot of Sugar cane. 6) Citrus canker. 7) Coffee rust. 8) Tikka disease.

BOTANY II SEMESTER PAPER—II PRACTICAL SYLLABUS CREDITS-2

1. **Study of morphological character of Hydrophytes** (Eichhornia, Elodea). Xerophytes (Casuarina, Opuntia, Nerium) Epiphytes (Vanda), Halophytes (Rhizophora) Parasites (Cuscuta).
2. **Study of Anatomical characters (Slides Only).** Elodea, Nerium, or Casuarina, Rhizophora, Vanda aerial root, Cuscuta.
3. **Study of Ecological instruments-** Photographs of Hygrometer, Anemometer, Rain gauze, Lux meter.
4. Determination of **PH of soil, Soil porosity.**
5. **Water holding capacity** of different soil samples**.**
6. Determination of **Relative density of plant species by quadrant method** (Demonstration).
7. **Study of plant diseases-**Kole roga, Late blight of Potato, Grain smut of Sorghum, Blast disease of Rice.
8. **Study of Plant diseases-** Red rot of Sugar cane, Citrus canker, Coffee rust, Tikka disease.

Practical Question Paper –II

Time: 3 Hrs **Max. Marks: 50**

1. Write Ecological features of 'A 'and 'B'.	**2x4=8**
2. Identify the Slides 'C' and 'D'.	**2x4=8**
3. Write a note on ecological instrument'E'.	**1x4=4**
4. Estimate Total hardness of the given sample 'F'.	**1x12=12**
5. Identify the Specimens 'G' and 'H'.	**2x4=8**
6. Vivo voice+ Submissions.	**3+ 2= 5**
7. Class records.	**05**

SCHEME OF VALUATION

1. **Specimens from morphological characters of ecological groups (Identification-1, Diagram-1, and Comment-1).**
2. **Slides from Anatomy of Ecological groups. (Identification-1, Diagram-1, Comment-1).**
3. **Ecological instruments (Identification-1, Comment-3).**
4. **Total hardness of given sample. (Procedure and Principle-6, Conducting-5, Result-1).**
5. **Plant Pathology. (Identification-1, Comment-3).**
6. **Vivo voce- From above topics- (3 marks), Submissions-Any 2 plant diseases (2 marks).**
7. **Class Records- (5 marks).**

STUDY OF HYDROPHYTES

Plants which grow in extremes of water supply are called **Hydrophytes.**

STUDY OF ELODEA

Hydrilla is a submerged hydrophyte , grows completely submerged in water, but rooted in the soil with fibrous roots .

It shows the following hydrophytic adaptations:-

1. Root system is poorly developed, root hairs and root caps are absent.
2. Floating stem, branches are long, slender, flexible bears small leaves at nodes with air spaces.
3. The leaves are variously dissected, so that water flows easily without resistance
4. Mechanical tissues are poorly developed.
5. Vascular system is very much reduced.
6. The absorption of nutrients and water takes place through root, stem and leaves.

STUDY OF EICHHORNIA AND PISTIA

Pistia is a free floating hydrophyte. It floats on the surface of water .It is contact with air and water but not with the soil.

It shows the following Hydrophytic adaptations:-

1. Root consists of root hairs; at the tip of the root hairs root pockets are present, which helps to prevent the physical injury.
2. Stem is reduced offset and helps in floating.
3. Leaves are sessile, arising in close spirals on nodal region and appears like a flower.
4. In the region of nodes a cluster of adventitious roots arises and providing stability.
5. Leaves are also thick and covered with waxy coat.

Ex: Elodea Eichhornia Pistia

T.S. OF HYDRILLA STEM

Hydrilla is a submerged hydrophyte. T.S. of hydrilla stem shows the following features:-

1. **Epidermis: -** Epidermis is single layered, thin-walled cells without cuticle.

2. **Cortex: -** The outer layers of the cortex are parenchymatous without inter-cellular air spaces, inner cortex is aerenchymatous and possesses large air spaces. It helps in floating(buoyancy) of the plant and facilitates during respiration and photosynthesis.There is no distinction of endodermis and pericycle.

3. **Stele:-S**tele **is** much reduced; it is composed of central portion of xylem cavity surrounded by broad zone of phloem. Xylem tissue is very poorly developed. Phloem is composed of sieve tube elements.
4. **Pith** is absent.

HYDROPHYTIC FEATURES

1. Presence of air cavities and thin walled parenchyma.
2. Absence of Mechanical tissues, stomata, and cuticle in the epidermal layer.
3. Reduced vascular system.
4. Extremely reduced xylem and comparatively well developed phloem.
5. Absence of vessels and presence of sieve tubes.

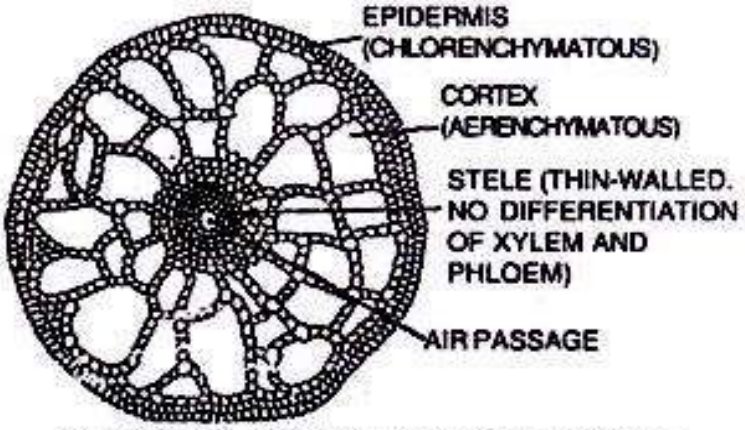


Fig. 2.4. T.S., of *Elodea* stem. (Note undifferentiated vascular tissue in the stelar region)

SYUDY OF XEROPHYTES

Plants which grow in dry habitats are called xerophytes. They develop large, deep penetrating root system and capable of efficient absorption. They posses sacculent, small leaves with mucilage which tends to reduce transpiration.

EX:-NERIUM

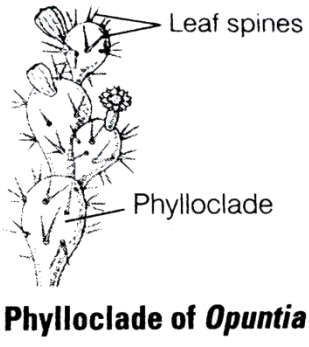
1. Nerium is a non- sacculent xerophytic shrub. Leaves are leathery with glazed surfaces.
2. It has multiple Epidermis with thick cuticle.
3. Lower epidermis bears stomata in pits lined with hairs.
4. Mechanical tissues and vascular bundles are well developed.
5. Mesophyll is differentiated into palisade and spongy parenchyma.

EX:-CASURINA

1. Casurina is a perennial, non-sacculent Xerophytic tree.
2. Stem branches are modified into green, long cylindrical, needle like structures called **'Phyllode'**.
3. Leaves are modified into small, membranous whorl of scales.
4. Stem has epidermis with thick cuticle, sunken stomata lined with hairs in furrows.
5. Sclerenchymatous hypodermis and vascular tissues are well developed.

EX:-OPUNTIA

1. Opuntia is a **phylloclade. I**t is Thick, green, fleshy, sacculent modified stem meant to perform photosynthesis.
2. Root system is very well developed.
3. Leaves are modified into pointed spines to reduce transpiration.
4. Stem become flat green leaf-like structure to perform photosynthesis.
5. Spines are also acts as defense organs



Phylloclade of *Opuntia*

Ex: Nerium Casurina Opuntia

ANATOMY OF NERIUM LEAF

Nerium is a N**on sacculent xerophytic shrub**. T.S. of Nerium leaf shows the following anatomical structures :-

1. **UpperEpidermis:-**Epidermis is composed of 2-3 layers of compactly arranged barrel shaped parenchyma cells. With thick cuticle on its outer surface. Stomata are absent.
2. **Lower Epidermis**:-Epidermis is composed of single row of compactly arranged barrel shaped cells with cuticle. Sunken stomata are found in pits lined with hairs.
3. **Mesophyll: -** Mesophyll is Chlorenchymatous tissue present between the upper and lower epidermis. It is distinguished into palisade and spongy tissue. Calcium oxalate crystals are scattered between them.
4. **Vascular bundles:-**The bundles are collateral and closed ones with Xylem towards the upper epidermis and phloem towards the lower epidermis.

Xerophytic features

1. Thick cuticle is present on upper and lower epidermis.
2. Multi- layered upper epidermis.
3. Presence of sunken stomata in pits with hairs to reduce water loss.
4. Well developed vascular tissues.
5. Presence of calcium oxalate crystals.

ANATOMY OF CASUARINA STEM

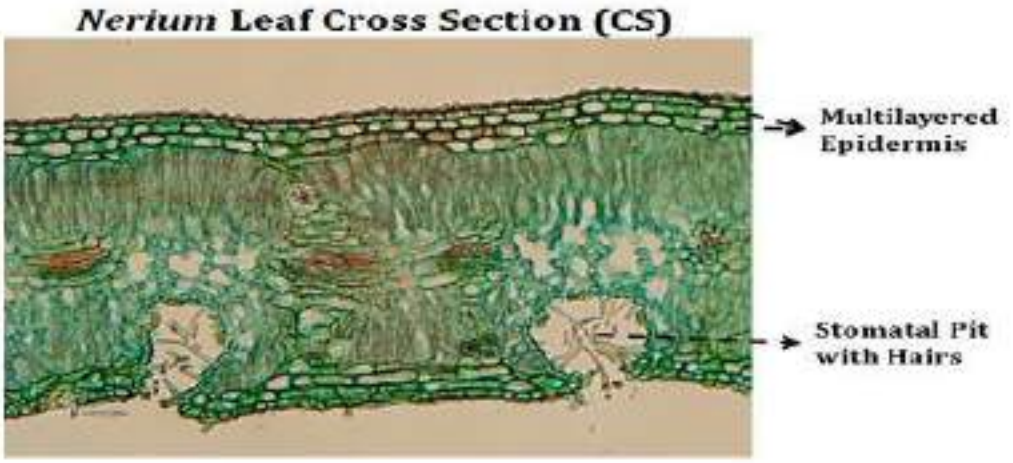
Casuarina is a woody, angiosperm, evergreen trees with dropping twigs. Leaves are scale-like connate, branchlets are needle-like cladode(Phyllode/Cladode), Cladode contains stomata and also perform photosynthesis.

T.S. of casuarina Phyllode/Cladode shows the following anatomical structures:-

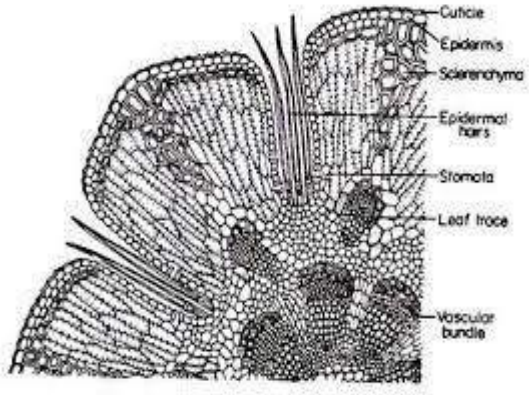
1. **Epidermis: -** Epidermis is composed of single row of compactly arranged barrel shaped cells. It is covered with silicified cuticle. Ridges and furrows are present all around the stem. Stomata are present in furrows and covered with hairs.
2. **Cortex: -** Cortex is composed of sclerenchymatous hypodermis, and compactly arranged thin walled angular chlorophyll containing palisade tissue, where leaf trace bundles are scattered.
3. **Vascular bundles: -** The bundles are arranged in ring fashion at the central region of the stem. Each bundle is of collateral open type with distinct sclerenchymatous bundle cap.
4. **Pith: -** Pith is distinct and parenchymatous.

XEROPHYTIC FEATURES

1. Thick cuticle on outer walls of epidermis.
2. Presence of stomata in grooves, covered with hairs.
3. Palisade parenchyma with chloroplast in stem.
4. Well developed mechanical tissue and vascular system.



T.S. of Nerium Leaf



Ground plan **A portionenlarged**

T.S. of casuarina Phyllode/Cladode

STUDY OF ECOLOGICAL ADOPTATIONS IN EPIPHYTES

Autotrophic plants which grow on other plants for shelter are called 'Epiphytes'. **Ex: vanda** (orchid) It shows the following ecological adaptations

External adaptations

1. Epiphytes grow on the branches of other plants but are not parasitic on them.
2. The root and stem are well developed.
3. They have two types of roots –clinging roots and hanging roots.
4. **Clinging roots**-These are small, creep into the cracks in bark of tree and fix the epiphyte. It also absorbs nutrients from the debris accumulated on the bark.
5. **Hanging roots**- These are an aerial, adventitious roots hanging freely in the atmosphere .It consists if velamen tissue which helps to absorb the moisture from atmosphere.

Internal adaptations

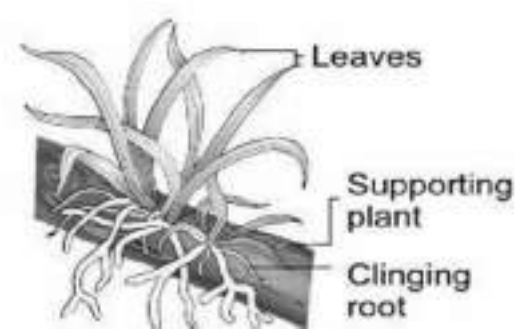
In T.S. the aerial root of orchid shows the following tissues layers:-

1. **Velamen**: It is many layered; the walls are usually porose and fibrose, so that the cells work like sponge and help to absorb moisture from air.

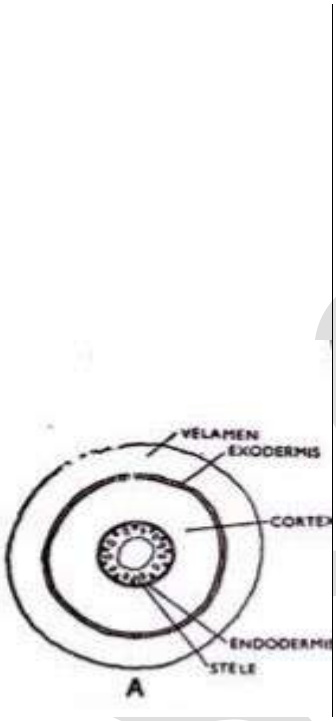
2. **Cortex**: The outermost layer of the cortex consists of a row of thick walled cells forming an Exodermis. There are some thin walled passage cells in the exodermal layer, below this exodermis cortex is composed of parenchymatous cells with scattered air chambers. The inner most layer of cortex is Endodermis.

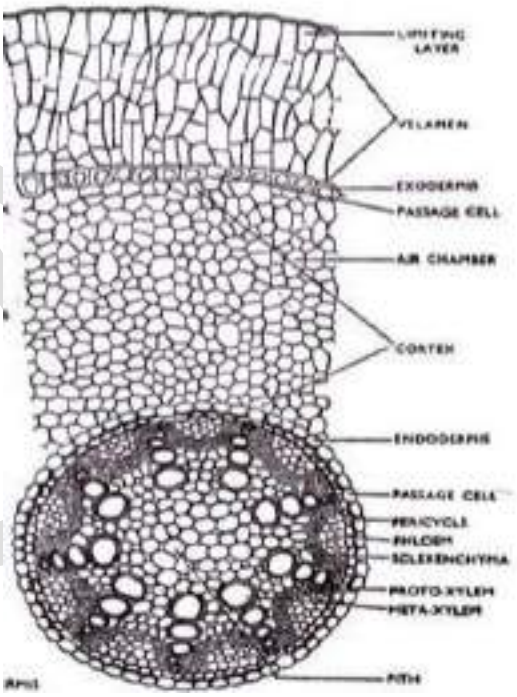
3. **Stele:** Vascular tissues are radially arranged without pericycle. Many xylem and phloem groups occur alternately in the stele. Xylem in exarch manner.

4. **Pith** is distinct and parenchymatous.



Epiphyte.Ex: Vanda





Ground Plan **A portion of Root enlarged**

T.S. the aerial root of orchid

STUDY OF ECOLOGICAL ADOPTATIONS IN HALOPHYTES

The plants which grow in **saline habitat** are called Halophytes. Halophytes growing near the sea shore forms special vegetation are known as **mangroves**. **Ex: Rhizophora**

It shows the following ecological adaptations:-

1. Rhizophora develops special respiratory roots called ‘’Pneumatophores’’.
2. Pneumatophore is negatively geotropic, grows vertically, and develops pores called ‘Lenticels. ‘On its surface, this helps in exchange of gases. These are also called as ‘Breathing roots’.
3. Stem is sacculent and fleshy.
4. Leaves are evergreen, thin, small but leathery.
5. Seeds germinate inside the fruit while it is still attached to the plant. This is called ‘VIvipery.

Internal Adaptations

T.S .of pneumatophore of Rhizophora shows following structures:-

1. **Epidermis:** -Epidermis is single layered and cuticularised. It is ruptured at various points due to lenticel formation after cork development.
2. **Cortex:** -Cortex is composed of parenchyma cells with air chambers. In the peripheral layer periderm is formed due to extra stellar cambial activity. It is composed of cork layer and phellogen layer. Innermost layer of cortex is endodermis.
3. **Vascular bundles**: - In the young stage, vascular bundles are collateral, open, endarch and arranged in a ring. During secondary growth cambial ring is formed and then a concentric ring of vascular tissue is formed, with xylem towards inside and phloem towards outside the cambial ring. Pericyle is sclerenchymatous.
4. **Pith** is distinct and parenchymatous.

STUDY OFECOLOGICAL ADOPTATIONS IN PARASITIC ADOPTATIONS

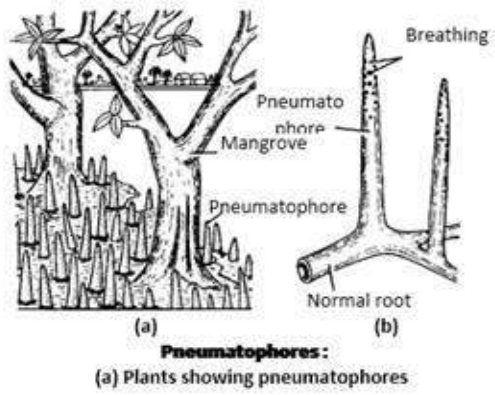
The plants which depend upon the other green host plant to fulfil their nutritional requirements are called parasites. To absorb food materials from the host plant. Parasites develop special roots called sucking roots or haustoria.

Parasites are classified into two type’s namely **Total parasites** and **partial parasites**.

Total parasites: - Total Parasites are non green totally depend upon the host plant for nourishment.Ex: Cuscuta

Partial parasites: - Partial parasites posses’ chlorophyll to some extent, it prepares its own carbohydrates by photosynthesis to some extent. Ex: Viscum Cuscuta is Total parasite. It shows following ecological adaptations:-

1. Cuscuta is yellowish, **wire like, leaf less** Total **stem parasite**.
2. It produces button shaped or knob like structures called **‘Haustoria’**.
3. Haustoria penetrate in to the host tissue, establish connection with vascular tissue of the host and suck nutrients from it. Hence Haustoria are also called as **‘Sucking Roots’**



Pneumatophores:
(a) Plants showing pneumatophores

Pneumatophore.Ex: Rhizophora

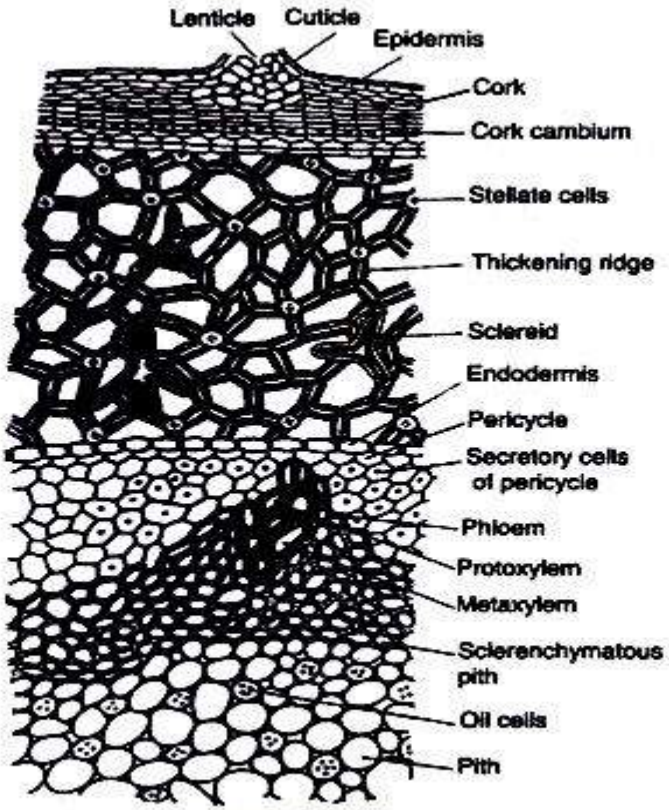
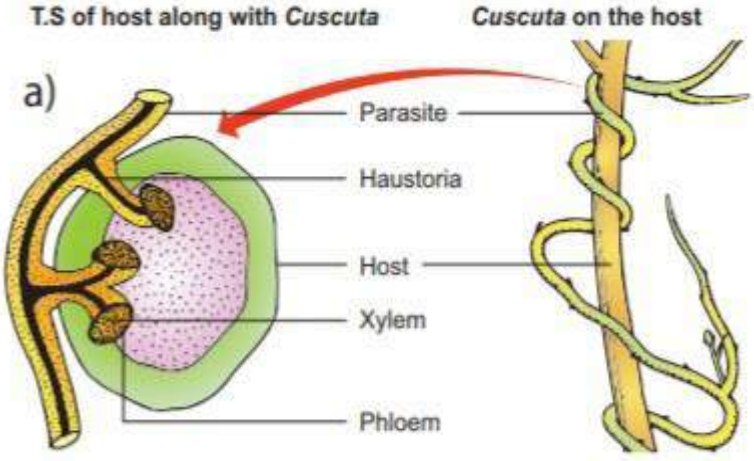


Fig. 10.11. *Rhizophora mucronata*. T.S. of a portion of subterranean stilt root.

A Portion of T.S of Pneumatophore Enlarged



Study of Ecological Instrumments (Hygrometer,Anemometer , Rain gauze and LUX meter)

Study of Ecological instrument- HYGROMETER

Aim- An instrument to measure moisture content.

Hygrometer is an instrument used to measure moisture content in the atmosphere. It consists of 2 Thermometers with same specifications which are suspended side by side. One is called Dry bulb thermometer that remains dry in air and second is called Wet bulb thermometer that is surrounded by cotton wick dipped in water.

PRINCIPLE:-

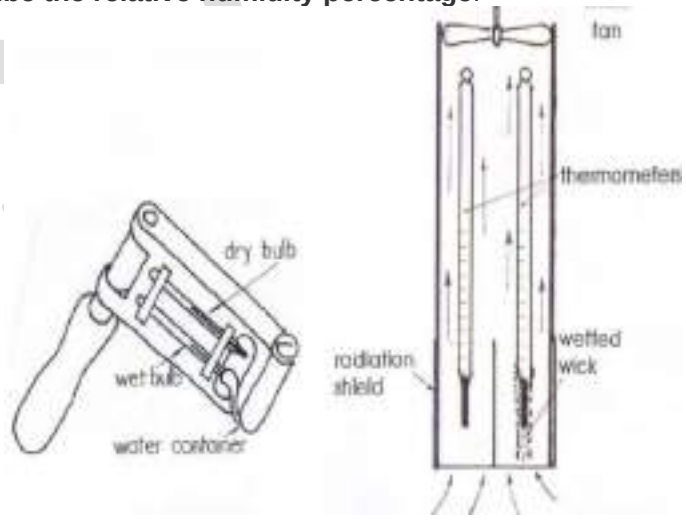
Hygrometer works on the phenomenon called Evoporative cooling. When water evaporates from any surface, it becomes cool because water molecules take heat energy from surface during evaporation. Due to this cooling effect Wet bulb always shows low temperature than dry bulb.

Method of working:

1. Evoporation of water from surface of Wet bulb is inversely proportional to humidity in the atmosphere.
2. In Dry atmosphere, evaporation of water will be more resulting in more decrease in wet bulbtemperature.
3. In In Humid atmosphere evaporation of water will be less resulting in less decrease in wet bulb temperature.
4. At 100% humidity the temperature of Dry and wet bulb same due to no water evaporation from wet bulb. Hence no cooling effect occurs.
5. Relative Humidity is determined by the difference of temperature of dry bulb thermometer and wet bulb thermometer.

Applications of Hygrometer

1. Hygrometer helps to **determine and measure the moisture in the atmosphere**.Used to **detect gaseous mixture present** in water vapour.
2. Helps to **predict weather**.
3. Used to **describe the relative humidity percentage**.



HYGROMETER

Study of Ecological instrument-ANEMOMETER

Aim: An instrument to measure Pressure and velocity of wind.

I**ntroduction**: - Anemometer is a device for measuring wind speed. Leon battista Alberti first described Anemometer. Anemometres are divided into 2 classes. Namely anemomer that measures wind's speed and Anemometer that measures Wind's pressure. There is close connection between pressure and speed; hence anemometer designed for one will give information about both.

CUP ANEMOMETER:- Cup Anemometer is an instrumentused to measure wind speed. It was invented by Dr. John Thomas and Romney Robinson. It consists of 4 hemispherical cups each mounted at equal angles to each other on a vertical shaft.The air flow past the cup in any horizontal direction turned the cups in a manner that was proportional to the wind speed.Therefore counting number of turns of cup over a set time period gives the average wind speed.

This was improved by Brevoort and joiner of USA which responded more quickly than 4 cup Anemometer. In 1991 Australian Derek Weston modified 3 cup Anememeter to measure both wind direction and wind speed. It is currently used as the Industry standard for wind resource assessment studies.

Applications of Anemometer

1. Anemometer is used for **measuring the wind pressure**.
2. For **measuring the flow of the wind** and the direction of the wind.
3. The **drone users or RC plane users** use it to check the **weather conditions before testing their devices**
4. **Long-range shooters and pilots also use it**.
5. **Skydivers** use it to **evaluate wind velocity before they leap into the abyss**
6. It is also **useful in aerodynamics to measure the airspeed.**

CUP ANEMOMETER

Study of Ecological instrument- RAIN GAUZE

Aim: To measure precipitation.

Introduction: - Rain gauze is an instrument used by meteorologists and Hydrologist to measure amount of rain fall at a given time.

Description of Apparatus:-The standard Rain Gauze consists of metallic cylinder fitted with wide funnel leading to graduated cylinder inside.

Method of Working:-

1. Place the rain Gauze in an open place during Rainfall.
2. When water fall into the funnel of apparatus, it get collected in the inner graduated cylinder.
3. Cylinder is marked in mm and will measure upto 250 mm.(9.8 inches) of rainfall.
4. Each horizontal line on the cylinder is 0.5 mililitre (0.02 Inches).
5. Length of 1 inch of rain measures as one inch when it collects inside.
6. Rainfall as low s 0.1 inch can be measured with this instrument. 0.01 is considered as trace.
7. The excess over flow in the large cylinder is carefully poured into another graduated cylinder and measured to give total rainfall.

Applications of Rain gauze

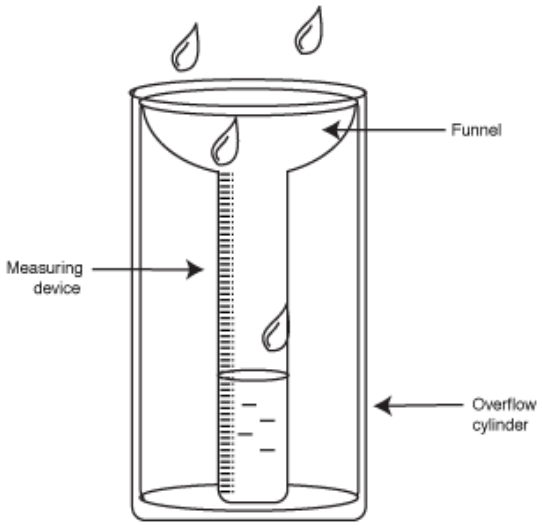
1. Rain gauze helps to measure **the fluid amount in a defined precipitated space** over time reference.

2. Helps to know the **amount of precipitation over an area.**

3. Pluviometer reads the **amount of rainfall of an area.**

4. It also helps to critically **mark drought areas.**

5. Helps to study **climatic adversities in time** and help to **prepare for an upcoming disasters.**



RAIN GAUZE
Study of Ecological instrument - LUX meter

Aim: To measure Illumination.

Introduction: - A Lux meter is a for measuring illuminance in workplaces. The Lux (lx) is the SI unit of illuminance and luminous emitance measuring luminous flux per unit area**.**

Principle: A **lux meter works** by using a photo cell to capture light. The **meter** then converts this light to an electrical current. Measuring this current allows the device to calculate the **lux** value of the light it captured. The **lux** light **meter's** calculation of illuminance is done by using the Point Source process

Working method:-Lux meter register brightness with an integrated photodetector which is positioned perpendicular to the light source for exposure.

Photo detectors are composed of Selenium or Silicon that determines brightness photo voltaically.The generated current is proportional to photons received. Silicon based detectors amplify voltage generated by light exposure. Selenium based detectors convert photons to high voltage that they be directly connected to Galvanometer, but difficult to measure light below 1000 lumens.

Photo detectors that measure brightness via Photo resistance are composed of ceramic substrate dropped with cadmium sulphate. An electronic switching current is supplied to the cell and resistance increases as micro photons are detected to provide proportional read out. measuring this current allows the device to calculate the lux value of light captured.

Applications of Lux meter

i) **Photography and Video Filming**. Photographers can adjust their shutter speed and depth of field to get the best picture quality,very useful for filming outdoor scenes .

ii) **Health and Safety regulations**: Used to check whether the brightness of a room is enough to meet any rules designed to protect workers from suffering damage to their eyesight.

iii) **Photographic Mesurements**; It also measures the photography subject's illuminance. The photographer can determine the aperture number and the exposure setting.

LUX meter

PLANT PATHOLOGY

1. Koleroga of Arecanut

The disease is caused by fungal pathogen it is also called fruit rot. It is most common in rainy season during the month of june - september.

Causal organism : *Phytophthora arecae*

Symptoms :-

1. The symptoms are first infected on nuts. The infected nuts are discolored and covered with a white fungal mycelium.
2. Infected nuts shows water- soaked area towards base, Which results in loss of green color.
3. The pericarp of the nut Shrivelled and seed kernel gets destroyed.
4. The infection may even spread to the crown of the tree and the plant dries up and it leads to wither such condition is called crown rot.

Control measures :-

1. By spraying Bordeaux mixture of 1% before mansoon and pre- mansoon.
2. By removing, destroying and burning the infected diseased nuts to prevent the spread of disease.
3. Spraying of 0.25% perenox is also effective.

Infected Nuts

2. Late blight of potato

It is a most serious fungal disease in potatoes. It spreads rapidly in the winter especially in January.

Causal organism : *Phytophthora infestans*

Symptoms :-

1. Small water-soaked, light brown patches appear on the leaf.
2. In humid and cloudy weather, the patches(lesions) enlarge in size and become black rounded with concentric markings.
3. A white growth of fungus arises on the lower surface of the infected leaf.

4. Appearance of rusty Brown patches on the infected tubers and later they rot.

Control measures :-

1. The seed tubers should be obtained from diseased free area.
2. By close examination infected tubers should be rejected and healthy tubers should be selected for planting.
3. Dusting the foliages with copper-lime in the early morning is a promising method. Foliar spray with 1% Bordeaux mixture, perenox, Blitox-50 helps to control the disease.
4. Growing disease resistant varieties will help us to control the disease. Kufri swarna, Kufri kuber etc. are resistant to late blight disease.

Infected Leaf **Infected Tuber**

3. Grain smut of sorghum

This is seed borne disease. smut disease of jowar is most common in Karnataka, Andra Pradesh and Tamilnadu.

Causal organism :-***Sphacelotheca sorghi***

Symptoms-

1. The fungus infects only at the time of grain formation in the ear.
2. The fungal mycelium get converted into spores replacing the ovary with sorus.
3. The smut sori are larger than the normal grains. They are oval to cylindrical, broad and dirty grey in color.

Control measures :-

1. Collection of seeds for cultivation from smutted plants should be strictly avoided.
2. Seed dressing with 0.5% formalin for two hours or with 0.5-3% $CuSo_4$ for 3-5 minutes, before sowing them in the field.
3. Treating seeds with sulphur dust before sowing.
4. By removing, destroying and burning the infected plants.

5. Growing disease resistant varieties like SPV 115, CJH-5, Nandyal etc.

Infected Inflorescence

4. Blast disease of Rice

The disease is most destructive and reported from all the rice growing countries of the world. In India, this disease is more commonly found in southern rice growing areas.

Causal organism :- ***Pyricularia oryzae***

Symptoms :-

1. The fungi attacks all the aerial parts of the plant.
2. The characteristic, isolated, necrotic lesions with water-soaked appearance are formed on the leaf blades.
3. Symptoms on the leaves appears as spindle shaped spot, Bluish-green in the centre, and remains surrounded by brown zones.
4. When the neck of the panicle is infected at the base it becomes blackened and shriveled. Hence this stage is black neck or neck blast or rotten neck disease.
5. In case of severe attack the entire field presents a blasted or burnt appearance.

Control measures :-

1. The seeds obtained from disease free crops are used for raising the crop.
2. The most economic method is cultivation of resistant, high yielding varieties. Ex:- TKM-1, CO 30.etc.
3. By spraying Bordeaux mixture has been proved quite effective against neck and node infection.
4. By treating seeds with copper fungicides and organomercuriales.
5. The plant debris should be collected and destroyed.



Infected Leaf Infected Node Infected Inflorescence

5.Red rot of sugarcane

It is a fungal disease, appears after rainy season.

Causal organism ***:- Colletotrichum falcatum***

Symptoms:-

1. The first symptom of red rot is the discolouration of young leavesin the field.
2. The cane starts shriveling, the rind shrinks and becomes longitudinally wrinkled.
3. The stem shows longitudinal red streaks crossed by white patches.
4. As the disease advances, the entire stem rotsand central tissues become soft with large cavities filled grayish mycelium.
5. At the final stage,acervuli appear on the wrinkled areas of the canes.

Control measures:-

1. Healthy, disease free setts are planted in the plant.
2. By dipping the cut ends of seed setts in1% Bordeaux mixture.
3. The diseased leaves and canes should be collected from the field and destroyed by burning.
4. By growing disease resistant varieties.
5. Crop rotation in every two or three years keeps the pathogen in control in the fields.

6. Tikka disease of groundnut

Pathogen : Disease incited by a fungus **Cercospora personata**, **Cercospora arachdicola**

Symptoms :

1. **Lesions appear on the leaves**, when the plants are two months old.
2. The lesions on the leaves are rounded and 1 to 6 mm in diameter.
3. These spots are dark brown or black and found on both surfaces of the leaf. Yellow border develops around each such leaf spot.

Control measures

1. The disease can be controlled by **sanitation and crop rotation**.
2. The use of **phosphatic and potassic manures** reduce the disease.
3. **Sulphur dusting** is quite effective. Resistant variety should be sown.
4. **Use of Disease resistant varities**

7. Citrus canker

It is a bacterial disease produces lesions and cankers on citrus plants.

Causal organism :-***Xanthomonas citri***

Symptoms :-

1. The disease first appears as a yellow spot on the lower surface of young leaves.

2. The lesions becomes raised and turn brown in color.
3. All green parts and maturing fruits become more or less covered with brown scabby spots surrounded by dark brown glossy margins.

Control measures :-

1. By removing the infected branches.
2. Spraying the plants with 1% Bordeaux mixture.
3. Disease free nursery stock should be planted.
4. Disease resistant varieties should be cultivated.
5. Spraying the suspension of Neem cake at t 1Kg in 20liters of water.
6. Spraying of antibiotics like streptomycin

Infected Leaf

Infected Stem

Infected Fruit

8.Study of Coffee Rust disease

It is a fungal disease, appears in important commercial crop Coffee plants.

Causal organism: - **Hamelia Vastatrix.**

Symptoms:-

1. Disease is restricted to leaves, and rarely on berries. Yellowish spots appear on ventral surface of leaves.
2. Yellowish spots enlarges, develop brown patches on upper surface of leaves due to production of orange colored uredospores.
3. As diseases advances leaves dry up, becomes dark brown and leaves drop off.

Control measures: - Coffee rust can be controlled by following methods:-

1. By dipping the cut ends of seedlings in Boradeaux mixture.
2. Destroy of Diseased leaves by burning.
3. By growing disease resistant varieties.
4. Rotation of crops after 2 to 3 years.

1.Determination of pH of soil

Aim: - To determine the soil pH of different soil samples.

Principle: - pH is a property to know the chemical nature of soil. If the reaction is predominated by hydrogen ions, it is Acidic. If the reaction is not predominated by hydrogen ions, it is said to be Basic. PH of the soil can be estimated by pH meter or pH paper or by universal indicator, by following methods.

I-Method:-

Requirements: - Soil samples, Distilled water, pH paper, Beaker, Funnel, Glass rod, weighing balance, filter paper.

Procedure:-

1. Take equal weight of sandy soil, Black soil and Red soil in three separate beakers.
2. Add 100 ml of distilled water and stir it for about 5-10 minutes.
3. Fix three funnels with filter papers to the separate stands and place an empty beaker below each funnel.
4. Pour the soil-water suspension in to the funnel and filtrate is collected in the beaker.
5. Then dip the pH paper in filtrate, air dry, compare with standard index.

Observation: - pH of the soil filtrate is as follows:-

Black soil – Red soil – Sandy soil -

Inference: - Thus by using pH indicating paper, pH of the soil samples can be determined . PH of Black soil is---------- It is acidic/ basic/ Neutral. PH of red soil is ----------. It is Acidic/ basic/ Neutral. PH of Sandy soil is ----------. It is Acidic / basic / Neutral.

II-Method:-

Requirements: - Soil samples, Barium sulphate, B.D.H (universal indicator), Test tubes, distilled water.

Procedure:-

1. Take equal weight of sandy soil, black soil and red soil in three separate test tubes.
2. Mix thoroughly soil in the test tube with equal amount of barium sulphate and 20 ml of distilled water.
3. Filter the soil suspension using funnel with filter paper; collect the filtrate in beakers separately.
4. Take 1 ml of the filtrate in the each test tube and add equal amount of universal indicator.
5. Match the colour of the soil solution with the colour chart and note the pH value.

Observation: - pH of the soil filtrate is as follows,

Black soil – Red soil – Sandy soil -

Inference: - Thus by using B.D.H Indicator, pH of the soil samples can be determined. PH of Black soil is---------- It is acidic/ basic/ Neutral. PH of red soil is ----------. It is Acidic/ basic/ Neutral. PH of Sandy soil is ----------. It is Acidic / basic / Neutral

Observation:-

Soil sample	pH	Nature of soil Acidic/ Basic/ Neutral

2.Determination of Porosity of Different Soil samples

Aim: - To determine the porosity of different soil samples.

Principle:-Soil is composed of major components of minerals, particles of various sizes and chemical structures and organic matter in different proportions. Hence porosity is defined as space between the soil particles. Porosity directly depends on soil texture and structure. Porosity of the soil is also directly proportional to the water holding capacity of the soil type.

Using known volume of water we can find out the porosity of soil samples.

Requirements: - Soil samples, distilled water, funnel, stand, filter paper, weighing balance, measuring cylinder, beakers.

Procedure:-

1. Take three funnels of equal diameter fitted to a stand with filter paper.
2. Place 30 grams of finely powdered soil sample in each funnel.
3. Pour 90 ml of distilled water gently over the soil through the sides of the funnel.
4. Collect the water coming down from each funnel separately in a graduated beaker.
5. The water is collected until last drop is drained.
6. The amount of water collected is measured and tabulated. This gives the porosity of soil samples.

Observation: - Collected volume of water is more in sandy soil .less in Red soil and least in clay soil.

Inference: - sandy soil has highest porosity and least water holding capacity. Clay soil has least porosity and maximum water holding capacity. Red soil shows intermediate values between sand and clay.

Observations :-

Soil sample	Sandy soil	Red soil	Clay soil
Amount of soil sample	30 grams	30 grams	30 grams
Amount of water	90 ml	90 ml	90 ml
Amount of water collected			
Amount of water retained			

3.Determination of Water Holding capacity of Soil Samples

Aim: - To determine the water holding capacity of different soil samples.

Principle: - Water holding capacity is the measure of the amount of water present in a given soil sample when it is saturated. It depends on the nature of the soil particles, porosity, temperature and presence of hydrophilic colloidal materials in the soil.

Requirements: - Soil samples, filter papers, Tin boxes with perforated bottom, weighing balance, distilled water, oven.

Water holding capacity of the soil can be determine as follows:

Procedure:-

1. Take Tin box with perforated bottom and Place a filter paper inside the box at its perforated bottom.
2. Now fill the boxes with 100 grams of dried clay and sandy soils separately in it.
3. Pour water slowly and allow it to percolate through the soil by gravitational pull. when soil is saturated, stop pouring water. Weigh the box.
4. Put the container in an oven at 105^{o}c for 24 hours and weigh it again.
5. Take a filter paper similar to the one used earlier in the container, dip in water and find out the amount of water absorbed by filter paper by weighing.
6. Subtract this weight with final weight.
   Calculate the water holding capacity of the soil sample by the following formula

$$\boldsymbol{Water\ holding\ capacity} = \frac{\textbf{Amount of water in the soil}}{\textbf{weight of the dry soil}} \times \textbf{100}$$

Observations: - Size of the particles in soil determines the water holding capacity of the soil. Larger the size of particles and their proportion, more aeration and less water holding capacity.

Inference: - Sandy soil has least water holding capacity due to coarse sand and more aeration. Clay soil has more water holding capacity due to fine sand.

Result:-

Sl. No	Sample	Amount of Water collected	Type of soil
1	A		
2	B		

Calculations:-

Weight of wet soil = Weight of wet soil + box+ weight of wet filter paper

Weight of oven dry soil = Weight of dry soil +box+ weight of dry filter paper

Water in soil =Weight of wet soil - weight of dry soil

$$\textbf{Water holding capacity} = \frac{\text{Amount of water in the soil}}{\text{weight of the dry soil}} \times 100$$

4.Determination of total Hardness of Water

Aim: - To determine the total hardness of given water sample by EDTA method.

Introduction: - Hardness of water is due to presence of carbonates, Bi carbonates, Sulphates, Chlorides and nitrates of calcium and magnesium.

There are two types of hardness.

1. Temporary hardness 2. Permanent hardness

Temporary hardness is due to presence of bi carbonates of calcium and magnesium and it can be removed by boiling. Permanent hardness is due to the presence of Chlorides and sulphates of Calcium and Magnesium. This type of hardness is removed by ion exchange process.

Principle: - Water sample is buffered to pH 10.1 and taken in to a conical flask. If an indicator dye like Erichrome BlackT, when added to a water sample containing calcium and magnesium ions, the color of the solution turns to wine red. EDTA, the titrant Complexes with Mg and Ca ions, removing them from association with the indicator. When all the Mg and Ca ions are complexed with EDTA, the indicator will turn blue this is end point of titration.

Requirements:-burette with burette stand, pipettes, conical flask, Beaker, measuring cylinder, Water sample.

Reagents required: - Ammonium chloride, Ammonium hydroxide, EDTA (Disodium salt of EDTA), Erichrome blackT, magnesium sulphate.

Procedure:-

1. Pipette 20 ml of water sample and transfer it to a 250 ml conical flask.
2. Add 2ml of buffer solution to it.
3. Add few drops of EBT indicator to the conical flask and the sample turns to wine red in colour.
4. Rinse the burette with standard EDTA and fill the burette with up to the mark
5. Titrate the sample against standard EDTA solution till the appearance of blue colour indicates that all the Ca and Mg ions are complexed with EDTA and form metal EDTA complex i.e., the end point of titration
6. Note down the burette reading and repeat the titration to get concordant values.

Result: - The total hardness of the given sample of water=

Preparation of Reagents:-

1. **Standard EDTA Solution (0.02M)**

Dissolve 3.723 grams of DiSodium salt of EDTA in 1L distilled water (1000 ml) taken in a standard flask.

2. **Buffer solution**

Measure 50 ml of distilled waterand transfer it to the 250 mL of standard flask then add 1.179 gram of EDTA and dissolve thoroughly, then add 16.9 grams of ammonium chloride and 0.780 grams of magnesium sulphate and 143 mL of ammonium hydroxide into the beaker.Make the volume upto 250 Ml mark by adding distilled water.

3. **Erichrome Black T**

Dissolve 0.5 grams of Erichrome Black-T is in 100 ml of distilled water taken in the standard flask.

Observations and calculations:-

Burette solution: EDTA
Conical flask: sample+ buffer solution
Indicator: Erichrome Black T
End point: Appearance of blue colour

Tabulation:-

Trial number	Volume of sample (mL)	Burette reading (mL)		Volume of EDTA(mL)
		Initial	Final	
1				
2				
3				

Volume of EDTA used =
Normality of EDTA= 0.02 N
Volume of the sample= 20 ml
Equivalent weight of $CaCO_3$=50

$$Total\ hardness = \frac{\text{Volume of EDTA used} \times N \times 50 \times 1000}{\text{Volume of sample taken}}$$

5.Determination of Relative density of plant species by quadrant method

Aim: To study the plant population by Quadrant method.
Requirements:- Measuring tape**,**Thread, Hammer, Nails.
Introduction:- A Quadrant is a square that encloses an area with in the habitat for herbaceous vegetation assessment including plant density, plant frequency and plant biomass.

Principle: - The density of a species expresses its numerical strength with in the community in relation to a definite area. Herbaceous species are extremely sensitive to different micro-climatic condition; hence their density varies greatly even in different portions of particular type of vegetation. Plant density is calculated by counting individuals present at a given time in a given space divided by the number of units of area or space as follows:-

Procedure:-

1. Select the study area; hammer the nails firmly in soil without damaging vegetation.
2. Fix 4 nails to make a square. Tie each end of the nails using thread, to make 1m x 1m quadrant.
3. Similarly, make five more quadrants randomly in the site of study.
4. Select the plant species for study of population density. Observe presence of species 'A' in the first quadrant and mark it in the table.
5. Similarly check for presence of species 'A' in other quadrants and record the data in the table.
6. Observe the presence of species Species "B' in all quadrants and mark it in the table.
7. Repeat the same procedure for species "C" and record the data in the table.

Sl. no	Name of plant species	No.of individuals per quadrant 1 2 3 4 5	Total no of individuals of a species	No.of quadrants in which species occured	Total no of quadrants	Density	Abundence
1							
2							
3							

Calculate the density of plant populations by this equation.

$$D = \frac{\text{Total number of individuals of a species}}{\text{Total number of individuals of quadrant studied}}$$

Density (D) is an average number of individuals of a given species over the total number of samples studied in an area.

Inference: - Density gives the numerical strength of a species in a community**.**