

PHARMACOGNOSY-I

UNIT 2 NOTES

CULTIVATION, COLLECTION, PROCESSING & STORAGE OF CRUDE DRUGS

- CULTIVATION & COLLECTION OF DRUGS
- FACTORS INFLUENCING CULTIVATION OF PLANTS
- PLANT HORMONES & THEIR APPLICATION
- POLYPLOIDY
- MUTATION
- HYBRIDIZATION



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CRUDE DRUGS

- Crude Drugs are natural substances that have undergone minimal or no processing and are used for medicinal, pharmaceutical or therapeutic purposes.
- The crude drugs which reach the market & pharmaceutical industries will have passed through different stages in order to make a drug useful to the mankind by all means.
- These stages includes :
 - ① Cultivation
 - ② Collection
 - ③ Drying
 - ④ Dressing
 - ⑤ Packaging
 - ⑥ Storage

CULTIVATION

- The cultivation of crude drugs refers to the systematic process of growing and harvesting medicinal plants to obtain raw material (crude drugs) that containing bioactive compound with therapeutic value.
- These bioactive compounds are used in the preparation of medicines or pharmaceutical products.
- It involves selecting suitable species of plants known for their medicinal properties and providing the right environmental conditions to ensure optimal growth.

ADVANTAGES OF CULTIVATION

- It ensures quality & purity of medicinal plants.
- Collection of crude drugs from cultivated plants gives a better yield & therapeutic quality.
- It ensures regular supply of crude drugs.
- It provides disease free plant
- It increases industrialization

METHODS OF PLANT PROPOGATION

Medicinal plants can be propagated by two usual methods :

- ① Sexual Method (Seed Propagation)
- ② Asexual Method (Vegetative Propagation)

① SEXUAL METHOD (SEED PROPOGATION)

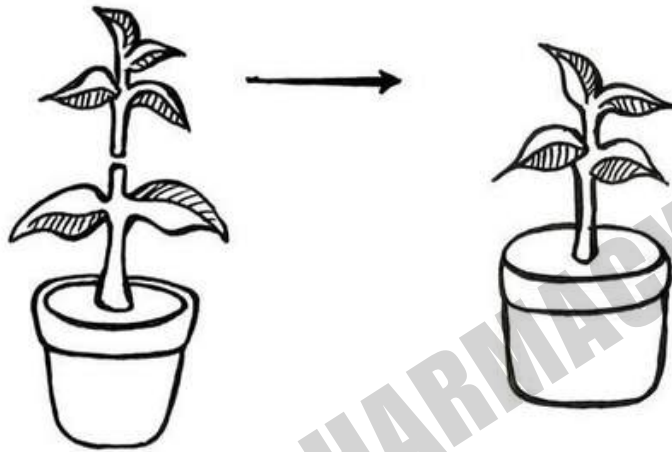
- In case of sexual reproduction, the plants are raised from seeds & such plants are known as seedlings.
For propagation, the seeds must be of good quality.
- There are following 3 methods of sexual propagation.
 - ① Broadcasting
 - ② Dibbling
 - ③ Miscellaneous

- ① Broadcasting :
- In this method the seeds are scattered freely in well prepared soil for cultivation.
 - Example : Isapgol , Linseed , Sesame etc.
- ② Dibbling :
- In this seeds are placed into individual holes made in the soil.
 - These holes are created at specific depths & intervals , ensuring proper spacing for the plants to grow.
- ③ Miscellaneous :
- Some seeds are sown in nursery beds
 - Example : Cinchona , cardamom , clove etc.

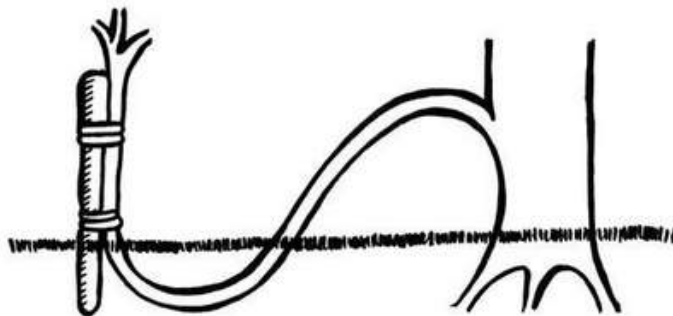
② ASEXUAL METHOD (VEGETATIVE PROPAGATION)

- Vegetative Propagation can be defined as regeneration or formation of a new individual from any vegetative part of plant body .
 - The method of vegetative propagation involves separation of a part of plant body , which develops into a new plant .
 - Following methods are used in vegetative propagation :
- ① Cutting
 - ② Layering
 - ③ Grafting
 - ④ Micropropagation

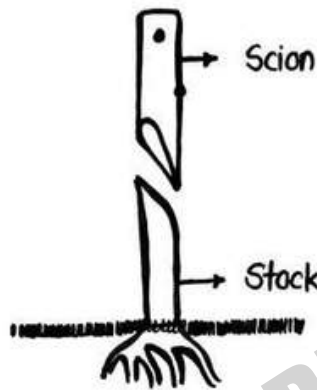
- ① Cutting :
- These are the parts of the plant (stem, root or leaf) which, if grown under suitable conditions, develops new plants.
 - Stem cutting are generally used to obtain new plants.
 - Example : Sugercane & rose etc.



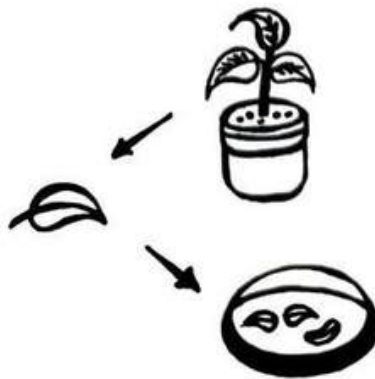
- ② Layering :
- Layering is a method of vegetative propagation in which a stem or branch of a parent plant develops roots while still attached to the main plant. Once roots form, the new plant can be separated and grown independently.



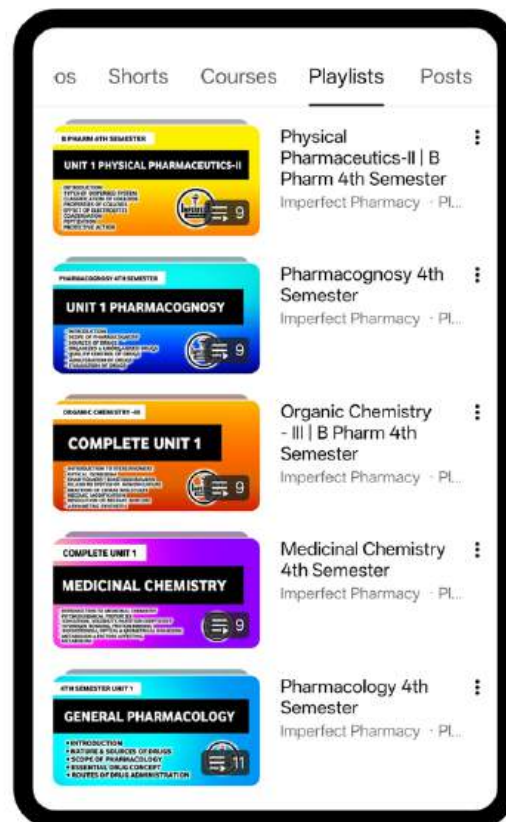
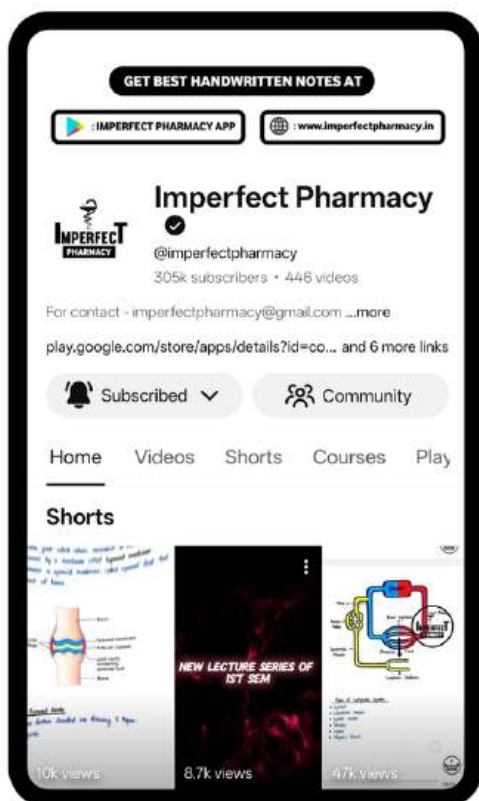
- © Grafting :
- In this a new variety is produced by joining parts of two different plants.
 - The rooted shoot of one plant, called **stock**, is joined with piece of shoot of another plant known as **scion**.
 - Example : Rose, citrus & rubber etc.



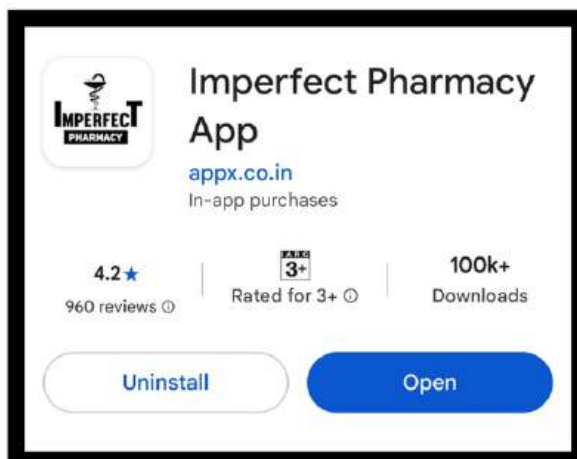
- © Micro Propagation :
- This method consists of growing cell, tissues and organ in culture.
- In this small pieces of plant organs or tissues are grown in a container with suitable nutrient medium, under sterilized conditions.



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FACTORS AFFECTING CULTIVATION OF CRUDE DRUGS

The cultivation of crude drugs can be influenced by several factors, including environmental, economical and biological aspects :

① CLIMATE & WEATHER CONDITIONS

- **Temperature :** Many medicinal plants have specific temperature ranges that are optimal for growth. Extreme heat or cold can hinder plant development.
- **Rainfall :** The amount & distribution of rainfall are crucial for plant growth. Some medicinal plants thrive in wet conditions, while others prefer drier climates.
- **Sunlight :** Adequate sunlight is essential for photosynthesis, which affects plant growth & production of medicinal compounds.

② SOIL QUALITY

- **Soil Type :** The texture & composition of soil can significantly affect plant health. Certain medicinal plants prefer sandy, clay-rich soils.
- **Nutrient Content :** Adequate levels of essential nutrients like nitrogen, phosphorus and potassium are important for plant growth.

③ WATER AVAILABILITY

- **Irrigation Systems :** Watering systems & availability of clean, uncontaminated water are vital for consistent plant growth.
- **Drainage :** Over watering & poor drainage can lead to root diseases & affect plant health.

④ PESTS & DISEASE

- **Insect Pests :** Many medicinal plants are susceptible to insect attacks such as caterpillars or root feeding insects.
- **Fungal & Bacterial Diseases :** Plant can suffer from diseases like root rot, blight etc.

⑤ GENETICS & PLANT VARIETY

- **Seed Quality :** The selection of high quality seeds or plant material can influence the yield production.
- **Plant Varieties :** Different varieties of same medicinal plant can have varying growth rates & levels of active compounds.

⑥ ATMOSPHERIC FACTORS

- **Altitude :** Altitude plays an important role in cultivation of medicinal plants. Tea, cinchona & eucalyptus are cultivated favourably at an altitude of 1000-2000 metres. Cinnamon & Cardamom are grown at height of 500-1000 metres, while senna can be cultivated at sea levels.
- **Humidity :** Humidity refers to amount of vapour that air holds at a given time. Optimum humidity for plant growth is 50-80%.

⑦ POLLUTION & ENVIRONMENTAL FACTORS

- **Air Quality :** Pollution can significantly impact the plant health & quality of medicinal compounds produced.
- **Soil Contamination :** Heavy metals or chemical pollutants in the soil can reduce the safety & efficacy of medicinal plants.

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COLLECTION OF CRUDE DRUGS

- The collection of crude drugs means gathering useful parts of medicinal plants (like leaves, roots, flowers, seeds or bark) after the plants have been grown & matured.
- This step is very important because it affects the quality & strength of medicine made from these plants.

Importance of Collection

- Collecting plants at the right time ensures they have the most useful chemicals (like alkaloids, tannins etc) needed for medicine.
- Plants are most effective when collected at right growth stage
- Proper handling reduces the chances of contamination by dirt, insects & microbes
- Careful collection helps protect plants & ensures they grow back properly.

RIGHT TIME FOR CULTIVATION

- Leaves : Collected when they are fully grown but still green & fresh.
- Flowers : Collected just before or during full bloom for maximum aroma & medicinal value.
- Roots & Rhizomes : Dug up at the end of the growing season or when the plant is not actively growing.
- Fruits & Seeds : Collected when they are fully ripe.
- Bark : Collected when it easily separates from the tree.

TECHNIQUES FOR COLLECTION

- Use Clean Tools : To avoid contamination.
- Avoid Direct Sunlight : Some chemicals can break down under sunlight.
- Handle Gently : To avoid damaging delicate parts.
- Separate Different Parts : Each part may need different drying & storage methods.

FACTORS AFFECTING COLLECTION

- Right Season : The amount of active chemicals in the plant changes with seasons.
- Weather Condition : Avoid collecting during rain or high humidity to prevent spoilage.
- Time Of Day : Early morning or late evening is best for collecting leaves & flowers to keep their essential oils intact.
- Stage of Plant Growth : Collecting too early or too late can reduce the strength of plant's medicinal value.

DRYING

- Drying is the process of removing moisture from crude drugs (like leaves, roots, flowers & bark) after collection to prevent spoilage & preserve their medicinal properties.
- It is an important step to ensure the stability & potency of active ingredients.
- The main aim of drying is to prevent the growth of bacteria, fungi & other microorganisms.
- It also helps to reduce the weight & volume of crude drugs, making them easier to store & transport while maintaining their medicinal strength.

DRESSING

- Dressing is the process of cleaning & preparing crude drugs after drying to improve their appearance, quality & usability.
- It involves the removal of unwanted parts and foreign materials.
- The main goal of dressing is to ensure that the crude drugs are clean, uniform & ready for further processing or use.
- It helps improve the drug's market value and medicinal effectiveness.

PACKAGING

- Packaging is the process of enclosing & protecting crude drugs after dressing to prevent damage, contamination & loss of potency during storage & transport.
- The main aim of packaging is to prevent crude drugs from moisture, light, air & pests, which can degrade their quality.
- It also makes handling & distribution easier.

STORAGE

- Storage is the process of keeping packaged crude drugs under suitable conditions to maintain their quality, potency & shelf life.
- The main aim of storage is to protect crude drugs from moisture, heat, light, insects & microbial contamination which can degrade their medicinal properties.

PLANT HORMONES

- Plant Hormones, also known as Phytohormones, are organic compounds produced in small amounts in plants that regulate growth, development & various physiological processes.
- These hormones control responses to environmental stimuli & help coordinate internal functions such as cell division, elongation, flowering, fruiting & stress responses.

TYPES OF PLANT HORMONES

Plant Hormones can be categorised into two categories:

- ① Plant Growth Promoters
- ② Plant Growth Inhibitors

① Plant Growth Promoters

They help to stimulate plant growth & includes:

- Auxins
- Cytokinins
- Gibberellins

② Plant Growth Inhibitors

They include:

- Abscissic Acid
- Ethylene

① AUXINS

- The term 'Auxin' is derived from the Greek word 'auxein' which means 'to grow'.
- They are of two types

① Natural Auxins

② Synthetic Auxins

① Natural Auxins : They occur naturally in plants :

Example : Indole Acetic Acid , Phenyl Acetic Acid .

② Synthetic Auxins : They are synthesized artificially & have properties like Auxins. Example : 2,4- Dichloro Phenoxy Acetic Acid .

FUNCTIONS

- It stimulates stem elongation by loosening cell walls.
- They help in root formation.
- They play a role in fruit development & delay leaf abscission.

② CYTOKININ

- They are purine type phytohormones .
- They contain purine ring in its structure
- They are primarily found in roots.
- It is made up of two words Cyt (cell) & kinin (division)
- Example : Zeatin , kinetin etc.

FUNCTIONS

- They stimulate cell division
- Work with auxins to promote balanced shoot & root development .
- Delay leaf senescence (anti-aging effect)

③ GIBBERELLINS

- They are acidic in nature.
- There are currently 136 GAs identified from plants, fungi & bacteria.
- They are present in different organs & tissues like - root, buds, leaves, fruits etc.
- Example : Gibberellic Acid (GA₃)

FUNCTIONS

- It stimulates stem & leaf elongation.
- Break seed dormancy & promotes germination
- Induces flowering in some plants.
- Enhances fruit growth

④ ABSCISIC ACID

- It is a natural plant growth inhibitor.
- It is also known as ABA.
- It is a naturally occurring sesquiterpenoid (15 carbon) compound in plants, produced via mevalonic acid pathway.
- It is found in mature leaves, roots and developing seeds.

FUNCTIONS

- It promotes falling of leaves.
- It inhibits shoot growth.
- It stimulates the closure of stomata.

⑤ ETHYLENE

- They are volatile hormones, simple organic molecules, present in the form of gas.
- It is present in ripen fruits, flower, seed, stem, root, leaf etc.
- In 1934, Gane reported that plants synthesize ethylene.
- In 1935, Crocker proposed that ethylene is responsible for fruit ripening.

FUNCTIONS

- Fruit ripening
- Induces leaf & fruit abscission
- Stimulates flowering in some species.

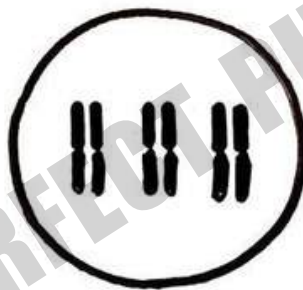
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POLYPLOIDY

- Polyploidy is a condition in which a plant's cells have more than two sets of chromosomes.

Poly + Ploidy
(Many) (Pair of Chromosomes)

- Polyploids are organisms with multiple sets of chromosomes.
- Most of the eukaryotes are diploid & have 2 pair of chromosome in which 1 pair is inherited from each parent, but in case of polyploidy, a cell contains more than two pair of chromosomes.
- It is a significant phenomenon in plant evolution, contributing to increased genetic diversity, larger plant size & improved adaptability.



Polyploidy

TYPES OF POLYPLOIDY

It is of two types

- ① Autopolyploidy
- ② Allopolyploidy

① Autopolyploidy

- It involves duplication of chromosome sets within a single species.
- For Example : a diploid plant ($2n$) might become a tetraploid ($4n$).

② Allopolyploidy

- It involves the combination of chromosome sets from two or more different species.
- It is particularly important in plant evolution, as it can create new species.

APPLICATION

- It provides significant information on the evolutionary history of plants which helps in better conservation of plant species.
- It helps in production of larger fruits, seeds due to increased cell size.
- Polyploidy is used to create seedless fruit varieties, making them more desirable for consumers.
- It also helps in increasing the concentration of medicinal compounds in plants.
- It leads to the formation of new species.

MUTATION

- A mutation is a permanent change in the genetic material (DNA/RNA) of an organism including plants.
- These changes can affect individual genes, larger chromosomal segment or the entire genome, leading to variations in plant traits

TYPES OF MUTATION IN PLANTS

① BASED ON THE EFFECT ON DNA SEQUENCE

- ① Point Mutation : • A change in a single nucleotide in the DNA sequence
- It can occur due to :
 - ① Substitution : One nucleotide replaces another
 - ② Insertion : Addition of an extra nucleotide
 - ③ Deletion : Loss of a nucleotide
- ② Frameshift Mutation : Insertion or deletion of nucleotides that alters the reading frame of the gene, often leading to a nonfunctional protein.

② BASED ON EFFECT ON CHROMOSOME

- ① Chromosomal Mutation : • Large-scale changes in chromosome segment & involves
- ① Deletion : Loss of chromosome segment
 - ② Duplication : A segment of a chromosome is copied
 - ③ Inversion : A segment reverse its orientation
 - ④ Translocation : A segment moves to another segment,

- ⑥ Polyploidy: Changes in the number of entire sets of chromosomes, leading to autopolyploidy or allopolyploidy.

③ BASED ON SOURCE OF MUTATION

- ① Spontaneous Mutation : Occur naturally due to errors in DNA replication or environmental influences.
- ② Induced Mutation : Caused by external factors such as:
- Physical Mutagens : UV radiation, X-rays.
 - Chemical Mutagens : Colchicine
 - Biological Agents : Viruses

APPLICATION OF MUTATION

- Can create new traits such as disease resistance, improved yield & environmental adaptability.
- Induced mutation are used to develop improved crop varieties with desirable traits.
- It helps scientist understand gene functions.
- It contribute to natural variation, allowing plants to adapt to changing environment.

HYBRIDIZATION

- Hybridization in plants is the process of crossing two different plant varieties or species to produce a new plant with desirable traits.
- The cross between two genetically different parents is known as Hybrid.
- This process helps create plants that are stronger, more productive, disease-resistant, or better suited for specific environments.

PROCEDURE

It involves the following steps :

- ① Selection of Parent Plant
- ② Pollination
- ③ Seed Formation
- ④ Growth of Hybrid Plants
- ⑤ Selection & Testing

① Selection of Parent Plant

- Two plants with desirable traits (like high yield, disease resistance) are chosen

② Pollination

- Pollen from one plant is transferred to the flower of another plant.
- This can happen naturally or manually by plant breeders.

③ Seed Formation

- The fertilized flower produces seeds that carry traits from both parent plants.

④ Growth of Hybrid Plants

- These seeds are planted & the new plants show a mix of characteristics from both parents.

⑤ Selection & Testing

The best hybrid plants are selected for further cultivation.

TYPES OF HYBRIDIZATION

- ① Interspecific Hybridization :
 - Crossing two different species.
 - Example : Wheat X rye = Triticale
- ② Intervarietal Hybridization :
 - Crossing two different varieties of same species.
 - Example : Two types of rice
- ③ Genetic Modification :
 - Scientist used advanced techniques like genetic engineering to create hybrids with specific traits.

CONSERVATION OF MEDICINAL PLANTS

- Conservation of Medicinal Plants refers to the protection, sustainable use and management of plant species that have medicinal properties.
- These plants are essential for traditional & modern medicine, but many are endangered due to overharvesting & climate changes.

IMPORTANCE OF CONSERVATION

- Medicinal Value: Many plants are used in herbal medicine, Ayurveda & Pharmaceuticals.
- Biodiversity Protection: Helps maintain ecological balance & plant diversity.
- Sustainable Resource Uses: Ensure future generation can benefit from medicinal plants.
- Livelihoods & Economy: Many rural communities depend on medicinal plants for income.

METHODS OF CONSERVATION

There mainly two methods of conservation of medicinal plants:

- ① In-situ conservation
- ② Ex-situ Conservation

① IN- SITU CONSERVATION

- 'In- Situ' means 'on-site' or 'In its natural place'
- In situ conservation is the protection of plants, in their natural environment .
- This method allows species to live and evolve in their environment without human interference .

Examples

- National Parks: Areas where plants are protected from deforestation & other threats
- Biosphere Reserves : Large areas of natural land where conservation & sustainable development happen together .

Advantages

- Species continue to evolve naturally .
- Protects biodiversity , including interdependent species .
- Maintains ecological balance .

② EX-SITU CONSERVATION

- 'Ex-situ' means "off-site" or 'outside the natural environment'.
- It is the process of protecting species by removing them from their natural habitats & placing them in controlled environments.
- This method is used when species are at high risk of extinction in the wild.

Examples

- Botanical Gardens : These are the places where endangered plants are grown and preserved.
- Seed Banks & Gene Banks : Storage facilities where seeds or genetic material of plants & animals are kept for future use.

Advantages

- Protects species that are near extinction
- Helps in breeding & increasing the population of endangered species.

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