

Unit-2

Pharmacognosy-I

B.Pharma 4 Semester Notes

UNIT-II

Cultivation, Collection, Processing and storage of drugs of natural origin:

- Cultivation and Collection of drugs of natural origin

Factors influencing cultivation of medicinal plants.

Plant hormones and their applications.

Polyploidy, mutation and hybridization with reference to medicinal plants.

Conservation of medicinal plants



Cultivation:

- Cultivation is the process of preparing land to grow crops, or the act of growing crops. It can also refer to the care of plants, such as tilling, weeding, and promoting growth.
- The cultivation ensures quality and purity of the plants medicinal plants.
- It require intensive care and managements
- It involves convergence of various pharmaceutical and environmental factors like rainfall, irrigation, fertilizers, pests, humidity, light and temperature.
- When all these factors are precisely controlled to grow plants, the process is known as Cultivation.

Advantages

- Production of better quality plants.
- Better yield and therapeutic activity.
- Regular supply of herbs is possible.
- It leads to industrialization.
- It permits application of modern and scientific technology. Example- Mutation and Hybridization.

Disadvantages

- High cost
- The loss may be due to ecological imbalance.
- The plants which are sufficiently obtained from wild sources for them cultivation is not beneficial.

Method of Cultivation:

- A. Sexual Method
- B. Asexual Method

A. Sexual Method:

- This method plants are cultivated from seeds and such plants are called seedling.
- This method is also known as seed propagation. Generally good quality seeds of High germination rate should be used for cultivation. Seeds should be free from other seeds and impurities.

Examples: Mango, Papaya, Methi, Lichi etc.

Method for Seed propagation:

a. Broad Casting Method:

- In this method, small seeds are scattered on the area of cultivation.
- **Eg. Linseed, Isabgol, etc.**

b. Dibbling method:

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- In this method average size seeds are sown in a hole.
- Eg. Papaya seeds, Castor seeds etc.

c. Miscellaneous method:

- There are also some plants (seeds) which sown in nursery beds (require more care).
- Eg. Cinchona, Cardamom, Clove etc.

Advantages:

- It is an easy method to cultivate plants.
- It gives high yields.
- It gives more number of varieties.
- It is applicable for both monocot and dicot plants.

Disadvantage:

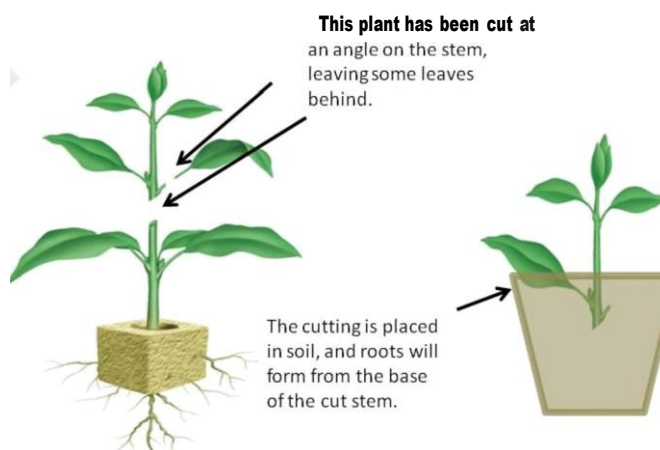
- Asymmetric growth of the plants may occur.
- Sometimes it takes more time to grow.
- Hybrid plant may not get.
- Healthy plants may not get from the same field.

B. Asexual Method:

- In this method, any of the vegetative part of the plant like root or stem is provided such an environment that it develops into a new plant.
- The environment is provided by setting various parts of the plant in well prepared soil

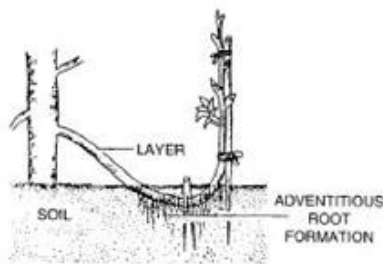
Method of Asexual Method:

Cutting: A clear cut is made preferably below the node and the lower leaves are removed. It is then placed in a suitable medium and provided with suitable conditions of moist atmosphere, temperature which favouring the development of roots e.g., mint, vanilla.



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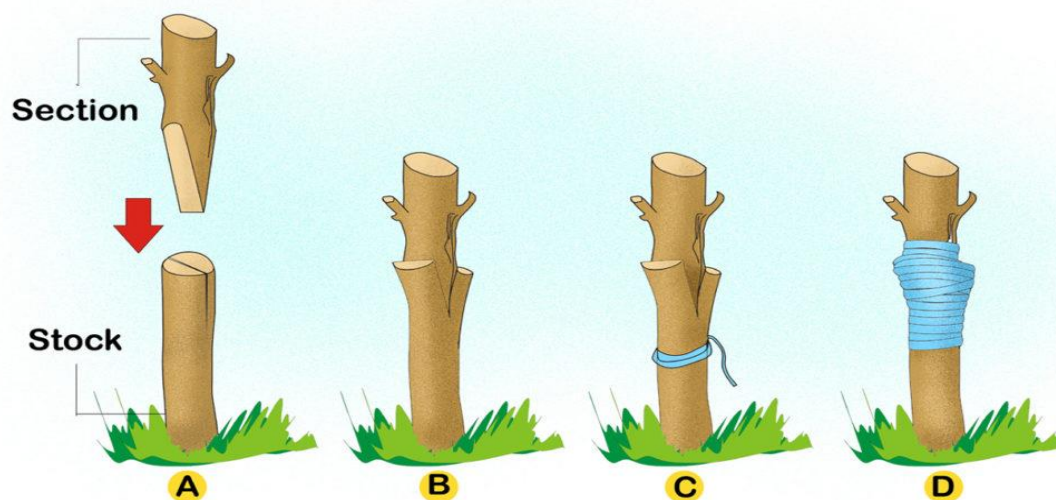
Layering: A layer is a branch or a shoot which is induced to develop roots before it is completely severed from the parent plant. It is done by a cut or ligature and embedding the part so treated in the soil e.g., cascara.



Layering

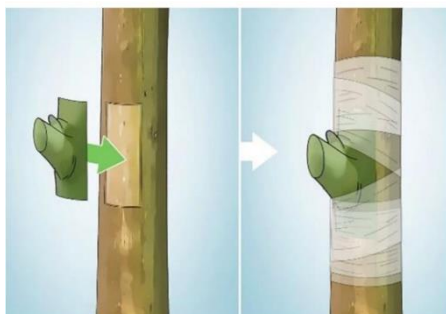
Grafting:

- In this method, the parts of two different plants are joined together such that they continue to grow as a single plant.
- The rooted plant is known as the stock. The other plant is known as the graft.



Budding:

- Budding is the mode of asexual reproduction wherein a new plant is developed from an outgrowth known as the bud. A bud is generally formed due to cell division at one particular site.
- For example, if you keep a potato for a long time, you can notice a number of small outgrowths, which are commonly referred to as 'eyes'



Advantages:

- It gives high yield.
- It develops hybrid plants.
- It gives fruits and flowers throughout the year.
- Quality of cultivated plant can improve.

Disadvantages:

- It requires a skilled person.
- Initially temperature and soil nature have to be controlled.
- Time consuming method.

Collection of drugs:

After cultivation of the plants it is essential to collect the plant parts for the next step of harvesting.

Crude drugs are collected from wild or cultivated plants and hence proper selection of the plant parts and their proper collection give the improved quality of the plants.

It even helps to increase the content of secondary metabolite in the plant parts. Hence drugs should be collected when they contain maximum amount of constituents in a highly scientific manner.

Method of collection(harvesting):

It is depend on type of drugs for speed and reduced cost the collection of crude drug is done by mechanical devices like pickers, mover, stripper etc.

The underground parts of plant like root and rhizomes may be drug be hand or by mechanical devices like plow, digger, litter, etc.

Processing and storage of drugs of natural origin:

After collection the drug is subjected to processing then storage:

Washing:

They are washed in special washing machine to remove adhering dirt, soil and undesirable materials.

- Also prevent from pest and disease during washing.

Drying:

- This is the most common processing technique. Drying removes moisture, preventing mold growth and preserving the material. Sun drying is traditional, but shade drying or controlled-environment drying might be used to prevent active ingredient degradation.

Dressing:

- Raw materials are cleaned to remove dirt, debris, and other impurities. Sorting ensures that only high-quality materials are used for further processing.

Storage:

Storage of drugs of natural origin requires meticulous attention to maintain their potency and stability. These substances are often sensitive to temperature, humidity, light, and oxidation.

Factors influencing cultivation of medicinal plants:

- There are various factors which influence the cultivation of medicinal plants. Some are briefly given below:

1. LIGHT: Light is needed for:

- Continuation of life in plants
- Regulation of carbondioxide and oxygen exchange between plants and atmosphere.
- Plant movements
- Seed germination
- Flowering
- Photosynthesis

2. TEMPERATURE:

- Affects the growth of plant and metabolism.
- Affects the rate of transpiration.
- Regulates the physiological processes by regulating the activity of enzymes.

3. ALTITUDE:

- Is important factor influencing the cultivation of medicinal plants.
- Also affects the chemical composition of medicinal plants. For eg: at high altitudes Pyrethrum provides the better yield of flowe heads and pyrethrins

S.No.	Plant	Altitude (Meters)
1.	Coffee	1000-2000
2.	Cinchona	1000-2000
3.	Camphor	1500-2000

4. RAINFALL:

Most plants require:

- Either proper arrangements for irrigation or sufficient rainfall for their development
Few exceptions are there like xerophytic plants like aloe, acacia etc.
- No doubt rainfall is essential factor influencing the cultivation of medicinal plants but there can be loss of water soluble substances from leaves and roots due to continuous rainfall.
- Rainfall also has affect on constituents of plants. Like in *Cassia angustifolia*, the main constituents is sennosides A and B, if there is short term drought, it increases the concentration of sennosides A and B but in longer terms it causes the loss of biomass.

5. PEST AND PEST CONTROL:

Pest damages the agriculture through-

- (i) Feeding on crops
- (ii) Parasitizing livestock

Types of pests:

- a. Fungi
- b. viruses
- c. Insects
- d. Weeds

- Non-insect pest:
 - i. Vertebrates like rabbit, monkey, pigs, hares, squirrel, deer etc.
 - ii. Invertebrates like crabs, snails, mites etc.

6. Fertilizers:

- The fertilizer are added to the soil to supply nutrients for the growth of plants.
 - Chemical Fertilizers: Urea, Ammonium sulphate etc.
 - Bio fertilizers: Rhizobium, Blue green algae, etc.

7. Humidity:

- Also effect of cultivation of plants. Eg Safron needs only cold climate and pyrethrum requires dry weather for cultivation.

Plant hormones and their applications:

Plant hormones:

- Plant hormones, also known as phytohormones, are chemical messengers that regulate various physiological processes in plants, influencing growth, development, and responses to environmental stimuli.

Major Plant hormones and their Applications:

- Auxin:** Promotes cell elongation, root growth, and gravitropism (growth towards gravity). **Applications:** Promoting root development in cuttings, delaying fruit drop, and controlling weed growth (herbicides).
- Gibberellins (GAs):** Stimulate stem elongation, seed germination, and fruit development. **Applications:** Increasing fruit size and yield, breaking seed dormancy (inducing germination), and promoting bolt formation (flowering) in vegetables.
- Cytokinins:** Encourage cell division, bud formation, and delay senescence (aging) in leaves. **Applications:** Promoting shoot multiplication in tissue culture, delaying leaf yellowing, and enhancing fruit set.
- Abscisic Acid (ABA):** Regulates stomatal closure (water loss), seed dormancy, and stress responses.

Applications: Inducing seed dormancy for storage and promoting drought tolerance in plants.

- Ethylene:** A gas hormone involved in fruit ripening, senescence, and responses to stress or injury. **Applications:** Inducing fruit ripening (ethylene gas treatment), promoting flower abscission (removal of flowers), and stimulating seed germination in some species.
- Brassinosteroids:** Promote cell division, stem elongation, and stress tolerance.

Applications include increasing crop yield and improving plant tolerance to environmental stresses.

Polyploidy, mutation and hybridization with reference to medicinal plants.

Polyploidy:

- Polyploidy is a type of mutation that can be used to enhance secondary metabolite production in medicinal plants.
- Polyploidy can cause gene redundancy and heterosis, but it can also disrupt cell and nuclear enlargement, alter gene regulation, and cause errors in meiosis.
- This can affect the production of specialized plant metabolites, leading to an increase or decrease in production depending on the plant species.

Causes:

It may occurs during abnormal cell division or through cell generation.

- **Physical agents:** X-rays, Centrifugation, Temperature, etc.
- **Chemical Agents:** Colchicine, veratrine, Sulphanilamide, etc.
- The chemical agent cause disturbance to mitotic spindle of dividing diploid cell and cause duplication of chromosome and thus convert diploids into tetraploids cells.

Classification:

On the basis of their chromosomal composition:

1. Euploids:

When a cell has one or more than one complete set of chromosomes.

- Autopolyploidy (Polyploidy between Some species)
- Allopolyploidy (Polyploidy between different species)

2. Aneuploidy:

- It can also be defined as the presence of one or more extra chromosomes or the absence of one or more chromosomes.
- Aneuploidy is a genetic disorder that occurs when chromosomes are not accurately separated during cell division.
- The abnormal condition where chromosomes complement are not exact multiple of basic no. There is addition or loss of usually 1 or 2 chromosomes.
Hypoploidy (No. is less) — $2n-1$
Hyperploidy (No. is More) — $2n+1$

Applications:

- Polyploidy has several practical applications in various fields. In agriculture, polyploid crops, such as polyploid wheat and cotton, have been developed to improve yield, disease resistance, and stress tolerance.
- It increase in tropane alkaloids in belladonna, cinchona etc.
- Chemically induced polyploidy do a variation in composition of plants and make it more potent.

Mutation:

- Mutation, a fundamental process in genetics, refers to any alteration in the DNA sequence of an organism's genome.
- A cell or an organism which shows the effect of mutation is called a mutant and the agent which cause mutation is known as mutagens or mutagenic agents.
- This molecular phenomenon is the driving force behind genetic diversity, evolutionary adaptation, and the development of genetic diseases.

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Types of Mutation:

1. Spontaneous Mutation
2. Point Mutation
3. Frameshift mutation

1. Spontaneous Mutation:

It occurs due to some unknown reason from nature.
eg: in Plants, bacteria, viruses etc.

2. Point mutation:

It also called as base substitution. It occurs as a result of substitution of a single nucleotide in a different nucleotide (one nucleotide is replaced with another).

Transition type (one purine to another purine)

Transversion type (Purine converted into pyrimidine)

3. Frameshift Mutation:

It results from an addition or loss of one or more nucleotides in a gene and it termed as insertion or deletion mutation respectively.

Application of Mutation:

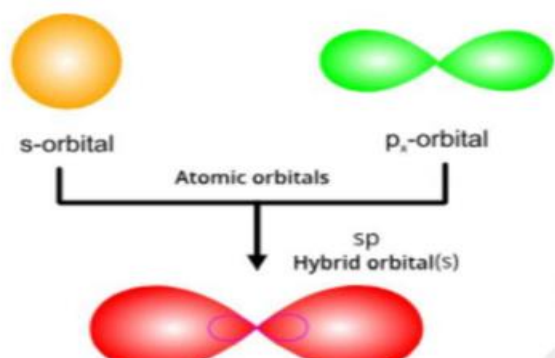
Mutation breeding has been used for improving both oligogenic as well as polygenic characters.

It has been employed to improve morphological and physiological characters, disease resistance and quantitative characters including yielding ability.

Mutations have been powerful tools for genetic studies as well as to study biological functions, for example, growth and development.

Hybridization:

- Hybridization, the process of cross-breeding individuals from different plant varieties or species, plays important role in medicinal plant cultivation and improvement.
- By combining desirable traits from different parental lines, hybridization offers a means to enhance the therapeutic potential, yield, and adaptability of medicinal plants.



Type of Hybridization:

- Intra-varietal hybridization:** Crossing should be done between the plant of the same variety.
- Inter-varietal (Intraspecific):** Crossing should be done between the different varieties.
- Inter specific (intra generic):-** Crossing are made between different species of the same genus.

Process of Hybridization:

Following steps involve:

- Selection of parent plants with different qualities
- Removal of stemens from the female flower
- Collection of pollen grains from the male flowers.
- Pollination the female flowers using the collection pollen grains
- Covers the mother plant with polythene bag
- Collection of mature seeds from mother plant
- Select and grows better varities of off springs

Applications of Hybridization:

- Hybridization is used in the breeding of domesticated plants to generate new phenotypes, move variation among lineages, and take advantage of transient hybrid vigor.
- Hybridization has also been an important force in generating angiosperm species diversity, as recent developments in genomics have demonstrated that all angiosperms may have likely undergone at least one round of polyploidization.

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Conservation of medicinal plants

Medicinal plants have been a cornerstone of healthcare for centuries. However, unsustainable harvesting and habitat loss threaten the very existence of these vital resources.

Conservation efforts are crucial to ensure their availability for future generations.

Methods of Conservation:

In-Situ Conservation: Protecting natural habitats where medicinal plants grow. This can involve establishing protected areas and managing them sustainably.

Ex-Situ Conservation: Preserving medicinal plants outside their natural habitat, such as in botanical gardens or seed banks. This allows for research, cultivation, and reintroduction programs.

