÷ Unit - 2 ÷

Cultivation collection processing & Storage of crude drugs.

÷ Advantages of Cultivation ÷

→ It ensure quality and purity of medicinal plant.
→ Collection of crude drugs from cultivated plants gives a better yield and therapeutic quality.
→ Cultivation ensure regular supply of a crude drug
→ The cultivation of medicinal and aromatic plants also leads to industrialisation to a greater extent.
→ Cultivation permits application of modern technological aspects such as mutation, polyploidy and hybridisation.

÷ Disadvantages of Cultivation ÷

The high cost of cultivation drugs as compared to wild source and losses due to ecological imbalance such as storms earthquakes, floods, droughts etc. are major disadvantages of

÷ Methods of Propagation ÷

(i) Sexual Method
(ii) Asexual Method.

÷ Advantages of Sexual propagation ÷

→ This is very simple and easy method of propagation.
→ Some species of trees ornamental annuals and vegetables which cannot be propagated by sexual means should be propagated by this method.
Ex - Papaya, Marigold, Tomato etc.
→ Hybrid seed can be developed by this method.
→ New variety of crops are developeped only by sexual method of propagation.
→ Root stocks for budding and grafting can be raised by this method.
→ The plant propagated by this method are long lived and are resistant to water stress.
- Transmission of viruses can be prevented by sexual method.
→ Seed can be transported and stored for longer time for propagation.

÷ Disadvantages of Sexual propagation ÷

→ Characteristics of seedling propagated by this method are not genetically true to type to that of their mother plant.
→ Plant propagated by sexual method requires long period for fruiting.
→ Plants grow very high, so they are difficult for intercultural practices like spraying, harvesting etc.
→ The plants which have no seed cannot be propagated by this method ex - Banana, Fig, Jasmine, Rose, Etc.

÷ Sexual Method ÷

÷ Methods of sowing the seeds ÷

→ Broad Casting.
→ Dibbling.
→ Miscellaneous.

(i) Broad Casting ÷

→ In this method the seeds are scattered freely in well prepared said for cultivation.
→ The seed only need raking.
→ If they are deeping sown or coverd by sail.
→ Necessary thinning of the seddling is done by keeping a specific distance.
→ Ex ÷ Jsapgal linseed, sesame

÷ Dibbing ÷

→ When the seeds of average size and weight are available.
→ They are sown by placing in holes.
→ Number of seeds to be put in holes vary from 3 to 5 depending upon the vitlity.

÷ Miscellaneous ÷

→ Many a times the seed are sown in nursery beds.
→ The seedling thus produced are transplanted to farms for further growth.
→ Such as cinchona, cardamom, clove etc.

÷ Asexual method ÷

→ (A) ÷ Natural method of vegetative propagation.

Ex: → Bulbs → Squill, Garlic.
→ Corms → Colchicum.
→ Rhizomes → Ginger, Turmeric.

÷ Advantages of Asexual propagation ÷

→ The horticultural crops which donot produce viable seeds are propagated by vegetative method.
→ Most of the important fruit crops are cross pollinated and are highly heterozygous.
→ When propagated through seed the progenies shows large variation. So vegetative propagation is remedy for these crops.
→ The sexual propagation method give true to type plants.
→ The vegetative way propagated plants bear fruits early.
→ In case of fruit crops where root stocks are used, the root stocks impart insect or disease resistance to the plant

→ Vegetative propagation helps to alter the size of the plant that is dwarfing effect.

→ This helps spraying intercropping and harvesting of crop easy and economical.

→ By grafting method different variety of fruit crop can be grown & harvested.

→ Inferior quality fruit plants can be converted into good quality plants

→ By means of bridge grafting a repairing of injured plant can be done.

∴ Disadvantages of the vegetative propagation :-

→ By vegetative propagation new variety can not be developed.

→ It is an expensive method of propagation and required specialized skill.

→ The life span of vegetatively propagated plants is short as compared to sexually propagated plants.

→ As all the plants are homozygous the whole plantation may get attacked by a particular pest or disease

→ Viral disease could be transferred through vegetative parts.

(B) Artificial Method of vegetative propagation :-

→ Cutting
→ Layering
→ Grafting

:- Cutting :-

- Stem cutting
- Root cutting
- Leaf cutting
- Leaf bud cutting.

:- Layering :-

- Simple Layering.
- Sepontine Layering.
- Air Layering.
- Mount Layering.
- Tip Layering.

:- Grafting :-

- Whip Grafting
- Tongue grafting.
- Side Grafting.
- Stone Grafting.

:- Factors affecting cultivation :-

→ Climatic Conditions :-

(A) Altitude.
(B) Temperature.
(C) Rain fall
(D) Type of soil.
(E) Fertilizers.
(F) Pest control.

÷ Cultivation details ÷

- → Type of Propagation
- → Time of cultivation.
- → Duration of crop.
- → Preparation of Land.
- → Nursery bed.
- → Transplantation.
- → Irrigation.
- → Fertilizers.
- → Inter Crops.
- → Harvesting

* Yield.
* use.
* Storage.

Altitude

Ex:
- Tea → 1000-1500 m
- Cinchona → 1000-2000 m
- Coffee → 1500-2000 m
- Clove → UPTO - 900 m
- Cardamom → 600-1600 m

÷ Temperature ÷

Ex:
- Cinchona → 60-75 F
- Coffee → 55-70 F
- Tea → 70-90 F
- Cardamom → 50-100 F

÷ Rain fall or Irrigation ÷

→ Except the xerophytic plants like Aloe, Acacia and few others, most of the plants need either proper Arrangements for irrigation or sufficient Rainfall for their favourable development.

→ In new cases well distributed rainfall throughout the year is desired.

÷ Method of Irrigation ÷

→ Hand watering.
→ Flood watering.
→ Boom watering.
→ Drip irrigation.
→ Sprinkler Irrigation.

÷ Soil ÷

÷ Depending upon the size of the mineral matter ÷

Particle Size	Type of soil ÷
Less than 0.002 mm	Fine Clay
0.002 – 0.02 mm	Coarse Clay (or) silt.
0.02 – 0.2 mm	Fine sand.
0.2 – 2.00 mm	Coarse sand.

÷ Depending Upon the Percentage covered by clay ÷

Type of Soil	÷ Percentage covered ÷
Clay	more than 50% of clay
Loamy	30 to 50% clay
Silt loam	20 to 30% of clay
Sandy loam	10 to 20% of clay
Sandy Soil	more than 70% sand.
Cal carious soil	more than 20% of lime.

÷ Soil Fertility ÷

→ It is the capacity of the soil to provide nutrient in adequate amounts and in balanced proportion to plants.

→ Soil fertility can be maintained by Addition of Animal manures, Nitrogen, fixing bacteria or by application of chemical fertilizers.

÷ Fertilizers ÷

→ Chemical Fertilizers :-

(1) Primary Nutrients.

(2) N. P. K.

(3) Secondary Nutrients

(4) Copper, Manganese, iron, boron etc.

:- Manures :-

- FYM / compost.
- Castor Seed Cake
- Neem Cakes.
- Vermi compost etc.

:- Pest and Pest control :-

Types :-

- Fungi
- Viruses
- Insects.
- Weeds
- Non Insect Pests.

:- Methods of Pest control :-

Mechanical
Agricultural
Biological
Chemical
Fungicides
Herbicides.

:- Mechanical Method :-

- The simple techniques used are hand picking, Pruning trapping of pest.
- A proper approach is made for collection and destruction of eggs Larvae, Pupae, Adults of Insects

÷ Agricultural Method ÷

→ It covers Advanced plant breeding techniques capable of Inducing genetic manupulation Resulting in Production of pest-Resistant species.

→ It has achived much success in producing hybrid verieties which are resistant to fungal and bacterial Attack.

÷ Biological Method ÷

→ This method is practised by combating the pests, mostly the insects with other living organisms.

→ It may emerge as an effective safe and economic method of pest control.

÷ Collection of Medicinal Plants ÷

→ Harvesting
→ Drying
(i) Natural Drying.
(ii) Artificial Drying.
→ Tray Dryers
→ Vaccum Dryers.
→ Spray dryers.
→ Packing
→ Storage & Preservation of Crude drugs.

Harvesting

→ Harvesting can be done efficiently in every respect by the skilled worker.

÷ Drying ÷

→ Drying consist of removal of sufficient maisture content of crude drug.

→ So as to Improve its quality and make it Resistant to the growth microorganisms.

÷ Natural Drying ÷

→ In case of Natural drugging it may be either direct sun drying or in the shed.

→ If the natural colour of the drug (Digitalis), Clove, Senna) and the volatile principle of the drug (Pepperment)

÷ Tray dryers ÷

In the process, hot, air of the desired temprature is circulated through the dryers and this facilitates the removel of water content of the drug.

÷ Vaccume Dryers ÷

The drug which are sensitive to higher temprature are dried by this process.

Ex ÷ Tannic acid, Digitalis leaves.

:- Spray dryers :-

The technique is followed for quick drying of economically important plant or animal constituents rather than the crude drugs.

Garbling (Dressing)

→ The next step in preparation of crude drug for market after drying is garbling.

→ This process is desired when sand dirt and foreign organic parts of the same plant, not constituting drug are required to be removed.

:- Packing :-

→ The morphological & chemical nature of drug, its ultimate use & effects of climatic conditions during transportation & storage should be taken into consideration while packing the drug.

→ Aloe is packed in goat skin.

→ Colophony & balsam of tolu are packed in kerosene tins.

→ While asafoetida is stored in well closed containers to prevent loss of volatile oil.

→ The leaf drugs are stored in plastic bags

→ The crude drugs like roots barks, seed are packed in gunny bags.

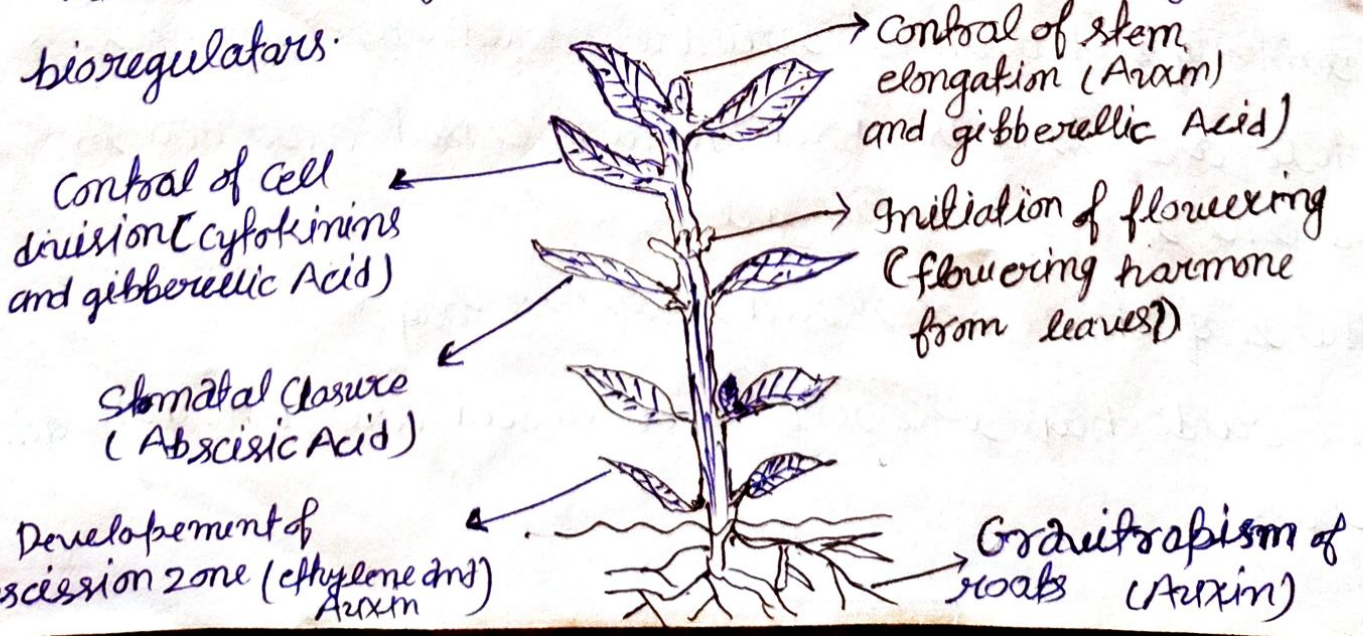
Storage and preservation of Crude drugs

- Preservation of crude drugs needs should knowledge of their physical & chemical properties.
- All the drugs should be preserved in well closed and possibly in the filled containers.
- They should be stored in the premises which are water proof, fire proof and rodent proof.
- A number of drugs absorb moisture during their storage and became susceptible to the microbial growth
- A part from protection against adverse physical and chemical changes, the preservation against insect or mould attacks is also important.

Plant Harmones

They are various organic compounds other than nutrients produced by plants that control or regulate germination, growth, metabolism, or other physiological activities.

- Also called phytohormone and recently called growth bioregulators.



÷ Definition ÷

Plant hormones, which are active in very low concentrations are produced in certain parts of the plants and are usually, transported to other parts where they elicit specific biochemical, Physiological, or, morphological responses.

They are also active in tissues where they are produced.

→ Each hormones perform its specific functions however nearly all of the measurable responses of plants to heredity or environment are controlled by interaction between two or more hormones.

→ Such interactions may occur at various levels, including.

A) The synthesis of hormones

B) Hormone receptors, and second messengers.

C) Ultimate hormone action.

→ Furthermore hormonal interactions may be. cooperative, antagonistic, or imbalance.

÷ Characteristics ÷

→ The concentration of hormones required for the plant response is very low (10^{-6} to 10^{-5} M) comparing with the requirement of mineral and vitamin for plants.

→ The synthesis of plant hormones is more diffuse and not always localized.

∴ Classes of Plant Hormones ∴

→ It is accepted that there are two major classes of Plant hormones.

Class	Action	Examples.
Promoters.	Cause faster Growth	Auxins Cytokinins (CKs) Gibberellins (Gas) Brassinosteraids.
Inhibitors.	Reduce Growth	Ethylene Abscisic Acid (ABA) Jasmonic acid.

∴ What do hormones control in plants ∴

- → Roots and shoots growth.
- → Seed germination.
- → Leaf fall
- → Disease resistance.
- → Fruit formation and ripening.
- → Flowering time.
- → Bud formation.
- → Anything related to plant growth.

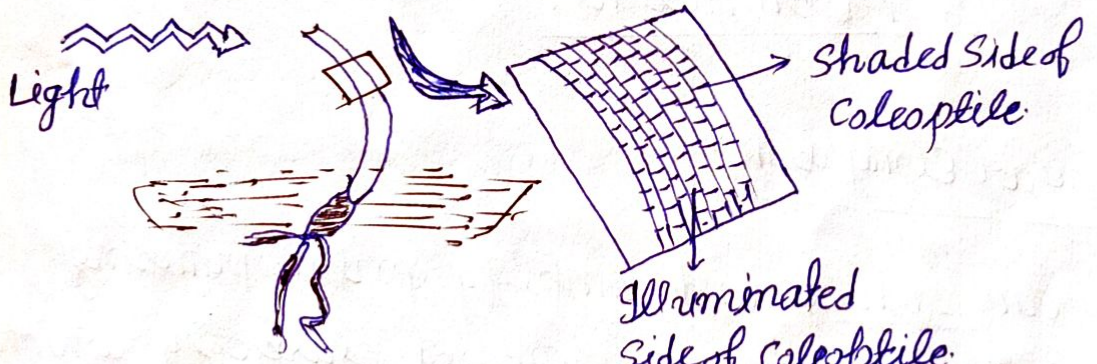
(1) Auxin :-

Introduction:- Auxin is a general name for a group of hormones that are involved with growth responses (that is) elongate cells, stimulate cell division in callus.

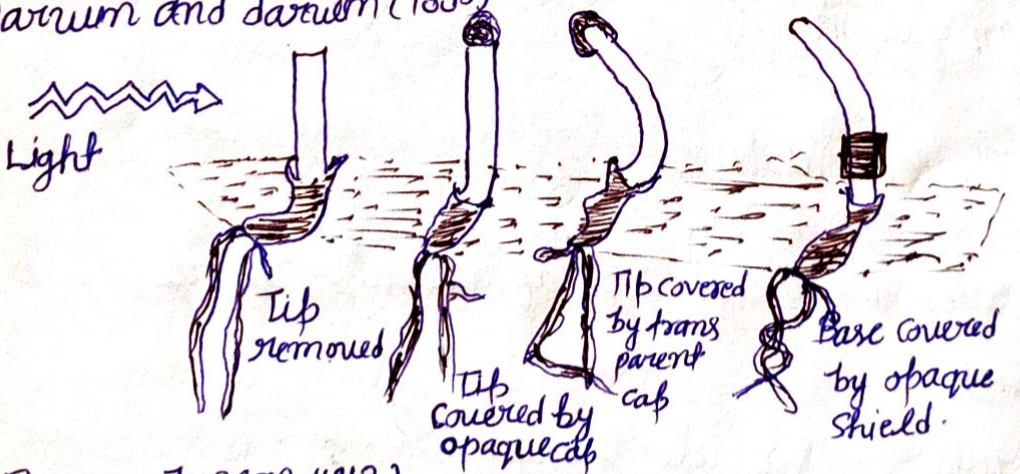
- Not surprisingly, the term "Auxin" is derived from the Greek word "to increase of grow".
- This was the first group of plant hormones discovered.

:- Discovery of Auxin :-

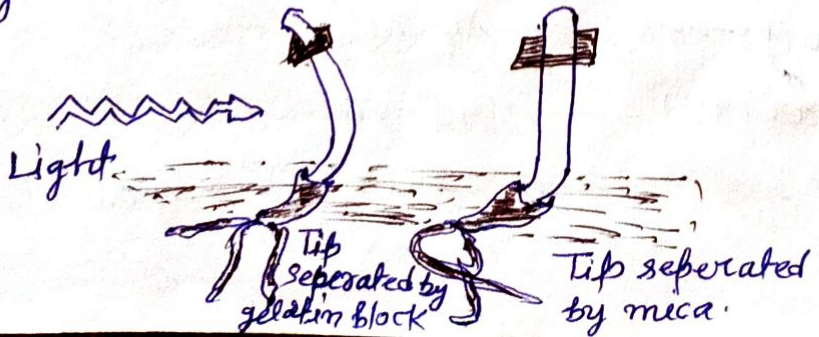
Control.



Darwin and darwin (1880)



Boysen-Jensen (1913)



÷ Site ÷

→ Auxin is made in actively growing tissue which includes young leaves, fruits and especially the shoot apex.
→ Made in cytosol of cells.

÷ Transport ÷

→ Basipetal (or polar) Transport Auxin is transported in a basipetal (towards the base, base-seeking) direction.
→ In other word auxin, moves from the shoot tip towards the roots and from the root tip towards the shoot.

÷ Auxin Actions ÷

(1) Cellular Elongation ÷

→ Auxin can induce and amplify proton pumping.
→ Acidified cells walls have increased elasticity which lead to cell elongation.

(2) Cell differentiation ÷

→ Auxin promotes differentiation of vascular tissue (that is, xylem & Phloem).
→ Auxin and sugar → Vascular tissue.
→ Auxin and low sugar (1.5-2.5%) → Xylem.
→ Auxin and high sugar (4%) → Phloem.
→ Auxin and moderate levels of sugar (2.5-3.0%) → Sylem & Phloem.

(3) Ethylene Production :-

→ IAA Apparently stimulates the production of ethylene.

(4) Inhibition of Root growth :-

→ [IAA] > 10^{-6} M inhibit root elongation

→ However, very low [IAA] ($< 10^{-8}$ M) favor root elongation.

(5) Stimulate root initiation (lateral roots, Adventitious roots)

→ Roots always form at the basal end of cutting.

(6) :- Flowering :-

→ Although most plants don't initiate the production of flowers after auxin treatment, pineapple and its relatives (Bromeliaceae) do.

→ Once flowers are initiated, in many species, IAA promotes the formation of female flowers.

(7) Parthenocarpic fruit development :-

→ Pollination of the flower of angiosperms initiates the formation of seeds.

→ As the seeds mature, they release auxin to the surrounding flower parts which develope into the fruit that covers the seeds.

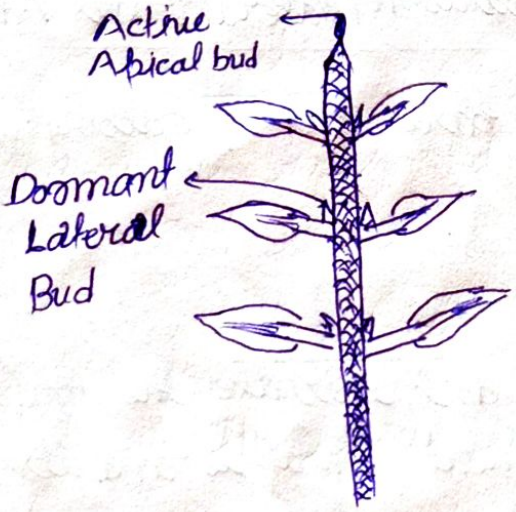
→ Some Commercial growers deliberately initiate fruit development by applying auxin to the flowers. Not only does this ensure that all the flowers will "set" fruit, but it also maximizes.

The likelihood that all the fruits will be ready for harvest at the same time.

(8) Apical dominance :-

→ Lateral branch growth are inhibited near the shoot apex, but less so farther from the tip.

→ Apical dominance is disrupted in some plant by removing the shoot tip, causing the plant to become bushy.



(9) :- Tropic responses :-

→ Such as gravitropism and phototropism.

(A) :- Phototropism :-

→ Is a growth movement induced by a light stimulus.

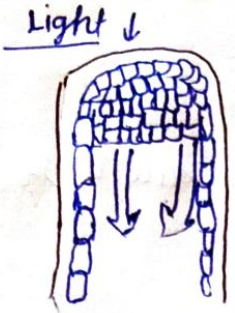
→ Sunlight breaks down auxin.

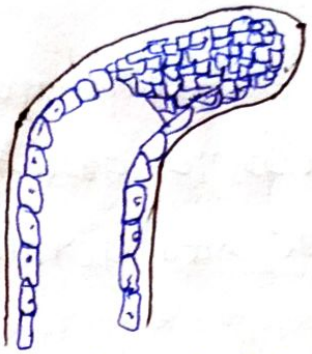
→ Plant stems indirect sunlight will have the least amount of auxin.

→ Area of the plant that is more shaded will have more auxin.

→ More cell growth on shaded side.

→ Plant bends towards light.





- Light directly over the Plant.
- Auxins are in equal quantity.
- Cell elongation is equal on all sides of the cell.

- Greater light on the right side of the plant.
- Auxin quantity becomes greater on the left cell.
- Auxins trigger cell elongation on the left side.
- Plant stretches to the light.

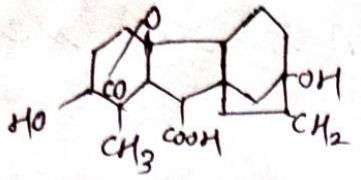
÷ (B) Geotropism or Gravitropism ÷

- The plant stem that was once upright is on its side.
- The auxin are settle on the bottom side of the stem.
- More auxin accumulate on the stems bottom side.
- More cell growth occurs on bottom side
- Plant bends upward.
- A growth response to gravity which caused roots to grow downward and shoots to grow upward

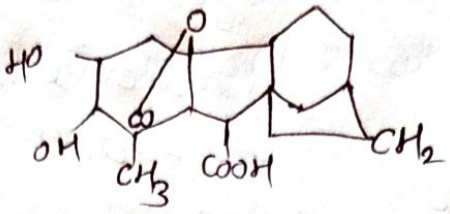
(2) Gibberellins ÷

- Gibberellins are plant hormons that promote, growth, seed germination and leaf expansion.
- The occur at low concentrations in vegetative tissues but at higher conc. in germinating seeds.

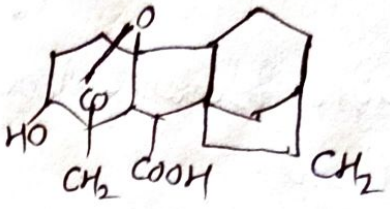
→ Induce cell elongation and cell division.
→ Important for plant growth and development through flowering and/or seed germination.



Gibberellic Acid(GA_3)



(GA_{13})



GA_4

→

÷ Site ÷

→ Young leaves, roots and developing seeds (developing endosperm) and fruits.

÷ Transport ÷

→ Made in the tissue in which it is used.
→ Transport occurs through, xylem, Phloem, or cell to cell.
→ Phloem seems to be most important transport route.
→ Transport is not polar as it is for auxin.

÷ Gibberelling Action ÷

(i) Promotes stem elongation ÷

→ When applied to intact plant, GA usually causes an increase unlike auxin.
→ It overcomes dwarfism in mutants that have a mutation in the GA Synthesis pathway.

dwarf = short.

Wild type = tall

dwarf + GA = tall.

→ Thus, GA Application.

(1) Stimulates elongation and.

(2) Acts on intact plant.

(2) Overcomes dormancy in seeds.

→ Gibberellins also have a fundamental role in breaking seed dormancy and stimulating germination.

⇒ The endosperm of many seed contains protein and carbohydrate reserves upon which a developing embryo relies for energy and nutrition.

⇒ These reserves must be mobilised and transported to the embryo.

→ A range of hydrolytic and proteolytic enzymes break down endosperm starches and proteins into smaller, more easily transported molecules such as sugars and amino acids.

(3) Involved in parthenocarpic fruit development :-

(4) GA can induce fruit enlargement :-

External application of gibberellins can also enlarge fruit size in grapes.

(5) Promotes cell division and & elongation

(6) ÷ Flowering ÷

→ GA stimulates bolting in long day plants and can substitute for long days or cold treatments that are necessary for flowering.

(7) Sex - Expression ÷

→ In plants with separate male and female flowers, GA Application can determine sex.

→ For example, in cucumber and spinach, GA treatment increases the proportion of male flowers.

→ In maize, GA treatment causes female flower development.

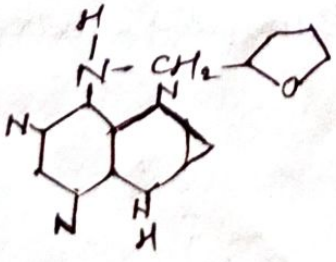
(3) Cytokinins ÷ Cyto (cell) + kinins (division)

→ Cytokinins are hormones that stimulate cell division or cytokinesis.

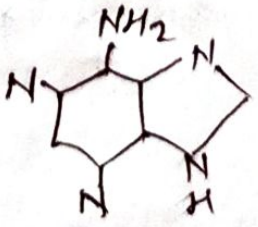
→ These hormones may also be involved in controlling leaf senescence and the growth of lateral branches.

→ The most active, naturally - occuring cytokinin is zeatin.

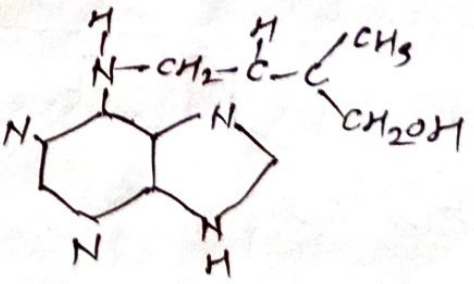
→ Cytokinins occur in most plant including mosses, ferns conifers, Algae and diatoms.



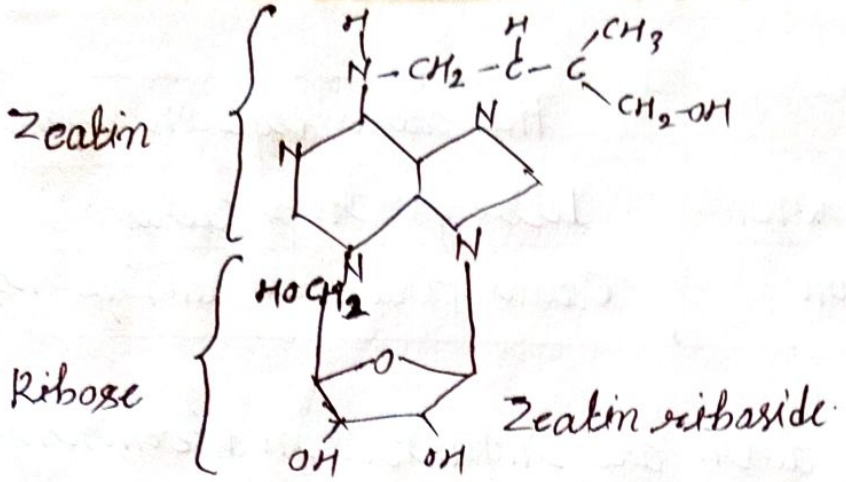
kinetin



Adenine.



zeatin



:- Site :-

→ Synthesized primarily in the meristematic region of the roots.

→ This is known in part because roots can be cultured (grown in artificial medium in a flask) without added cytokinin but, stem cells cannot.

→ Cytokinins are also produced in developing embryos.

:- Transport :-

→ Via xylem (transpiration steam)

→ Zeatin ribosides are the main transport form converted to the free base or glucosides in the leaves.

→ Some cytokinin also moves in the phloem.

÷ Cytokinins Actions ÷

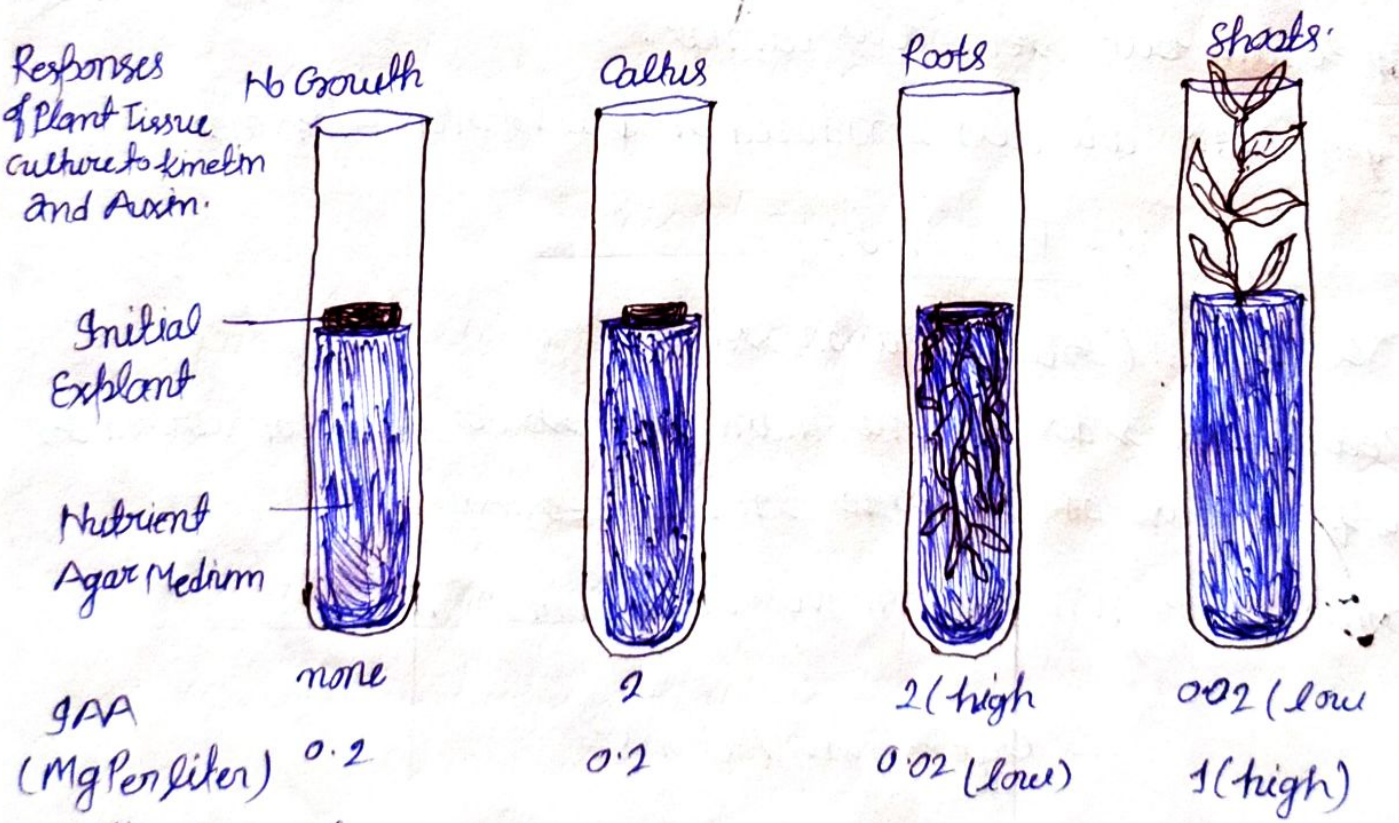
(1) Control Morphogenesis :-

In plant tissue cultures, cytokinin is required for the growth of a callus (an undifferentiated tumor-like mass of cells.

The medium	The callus differentiation
Callus + Auxin + no cytokinin	little growth of callus.
Callus + Auxin + Cytokinin	Callus grows well, undifferentiated

Ratio of cytokinin and auxin are important in determining the fate of the callus.

The concentration	The callus differentiation -
Callus + low [cytokinin/Auxin]	Callus grows well, forms roots
Callus + high [cytokinin/Auxin]	Callus grows well forms meristem & shoots.



(2) Regulates the cell cycle/cell division :-

⇒ (hence, the name "cytokinins") - especially by controlling the transition from G_2 → Mitosis.

→ This effect is moderated by cyclin-dependent protein kinases (CPK's) and their subunits cyclins

(3) Bud development :-

→ Direct application of cytokinin promotes the growth of axillary buds.

→ Exogenous cytokinin and auxin are thus antagonistic in their effects on axillary bud growth.

(4) Delay Senescence :-

→ Senescence is the programmed aging process that occurs in plant.

→ Loss of chlorophyll, RNA, protein and lipids.

→ Cytokinin application to an intact leaf markedly reduces the extent and rate of chlorophyll and protein degradation and leaf drop.

(5) Greening :-

→ Cytokinins promotes the light-induced formation of chlorophyll and conversion of etioplasts to chloroplasts. (Greening process)

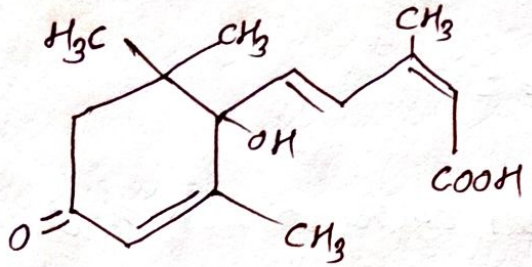
(6) Promote Cell Expansion :-

→ Cytokinins stimulate the expansion of cotyledons.

→ The mechanism is associated with increased plasticity of the cell wall, not associated with acidification.

(4) Abscisic Acid :-

- Inhibits growth.
- Promotes dormancy.
- Closes Stomata
- Produced in response to stress.



ABA

:- Sites :-

- Plastids.
- Most tissues, especially leaves and seeds.

Transport :-

Xylem and Phloem (Greater Amounts)

:- Abscisic Acid Actions :-

(i) ABA - Drought resistance :-

→ Abscisic acid is the key internal signal that facilitates drought resistance in plant.

→ Under water stress conditions, ABA accumulates in leaves and caused stomata to close rapidly, reducing transpiration and preventing further water loss.

→ ABA causes the opening of efflux K^+ channels in guard cell plasma membranes, leading to a huge loss of this ion from the cytoplasm,

→ The simultaneous osmotic loss of water leads to a decrease in guard cell turgor, with consequent closure of stomata.

(2) ABA - Freezing resistance :-

→ Elevated ABA levels are associated with increased freezing resistance.

→ ABA appears to mediate a plant's response to environmental stresses, such as freezing, by regulating gene expression.

→ Certain genes are switched on by ABA while others are switched off.

(3) ABA - Seed Dormancy :-

→ ABA plays a major role in seed dormancy.

→ During seed maturation, ABA levels increase dramatically

→ This inhibits germination and turns on the production of proteins that enable the embryo to survive dehydration during seed maturation.

→ As dormancy can only be broken by specific environmental cues, it ensures that a seed will germinate only under suitable conditions of moisture light and temperature.

→ The breaking of dormancy is associated with a decline in the level of ABA.

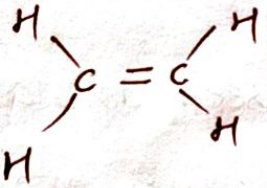
(5) Ethylene

→ Ethylene is the only gaseous plant hormone (C_2H_4).

→ It is produced naturally by higher plant and is able to diffuse readily, via intercellular spaces, throughout the entire plant body.

→ Ethylene is involved primarily in plant responses to environmental stresses such as flooding and drought, and in response to infection wounding and mechanical pressure.

→ It also influences a wide range of developmental processes, including, shoot elongation, flowering, seed germination, fruit ripening and leaf abscission and senescence.



(C_2H_4)

∴ Ethylene Action ∴

(1) Ethylene – Signal transduction

→ Several transmembrane proteins have been identified have been identified that bind to ethylene at the cell surface and function as signal transduces.

(2) Ethylene – Fruit Ripening ∴

→ Under natural conditions, fruits undergo, a series of changes including changes in colour declines in organic Acid content and increases in sugar content.

→ In many fruits, these metabolic processes often coincide with a period of increased respiration, the respiratory climacteric.

→ During the climacteric there is also a dramatic increase in ethylene production.

→ Ethylene can initiate the climacteric in a number of fruitmelons, Kiwi fruit and bananas

(3) Ethylene - Shoot Growth :-

→ Applied ethylene has the capacity to influence shoot growth.

→ Application of ethylene to dark-grown seedlings can cause reduced elongation of the stem, bending of the stem and swelling of the ~~cata~~ epicotyl or hypocotyl.

(4) Ethylene - Flowering :-

→ The ability of ethylene to affect flowering in pineapples has important commercial applications.

→ Ethylene also promotes flower senescence (ageing) in plant such as petunias carnations and peas.

(5) Thigmomorphogenesis :-

→ The change in growth from in response to a mechanical stimulation such as touch.

÷ What is polyploids ? ÷

→ Ployploids are organisms with multiple sets of chromosome in excess of the diploid number.

→ Polyploidy is common in nature and provides a major mechanism for Adaptation and speciation.

→ Approximately 50-70% of angiosperms which include many crop plants, have undergone polyploidy during their evalutionary process.

÷ Classification of polyploids ÷

Based on their chromosomal composition.

(i) Euploids.

(ii) Aneuploids.

Euploids constitute the majority of polyploids.

÷ Euploidy ÷

→ Euploidy are polyploids with multiples of the complete set of chromosome specific to a species.

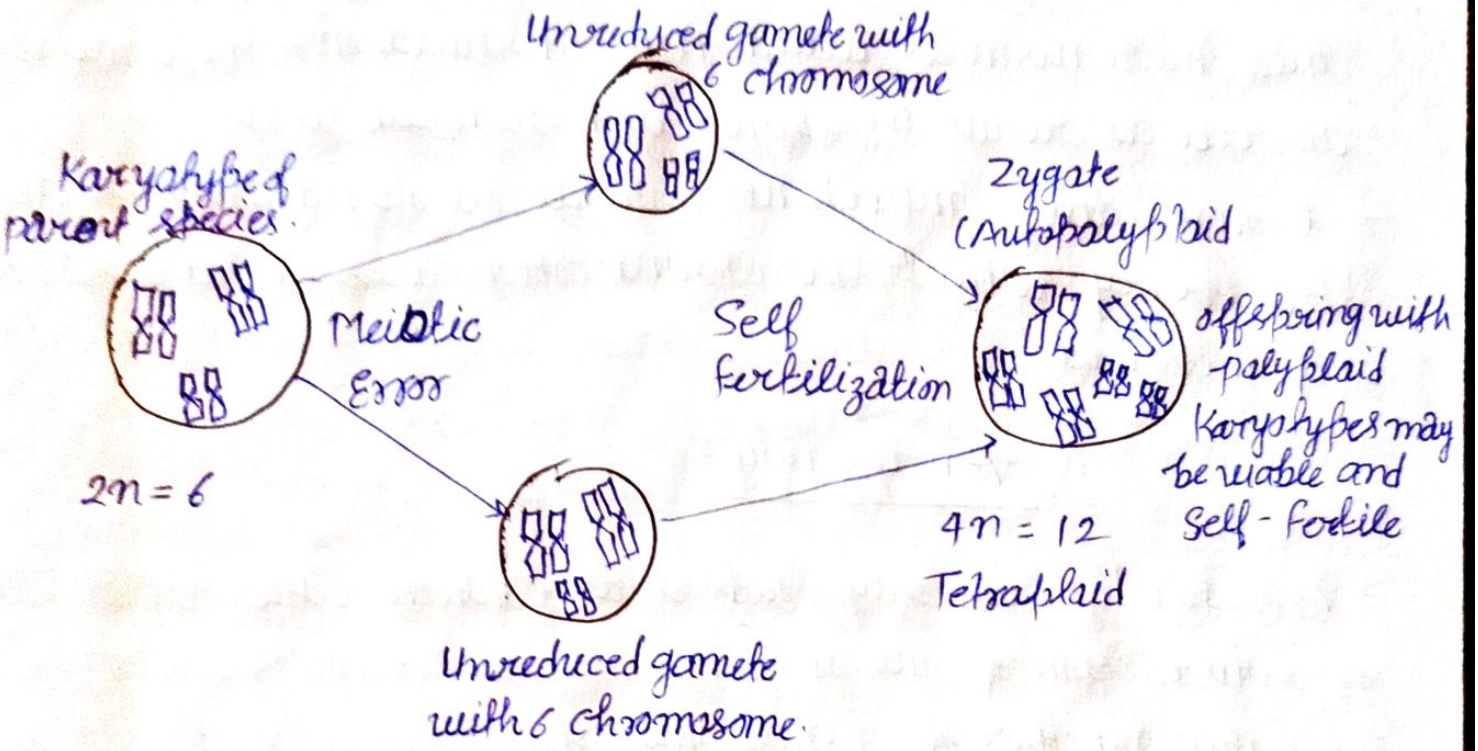
→ Depending on the composition of the genome euploids can be further classified into.

(i) Autopolyploids.

(ii) Allopolyploids.

Autopolyploidy

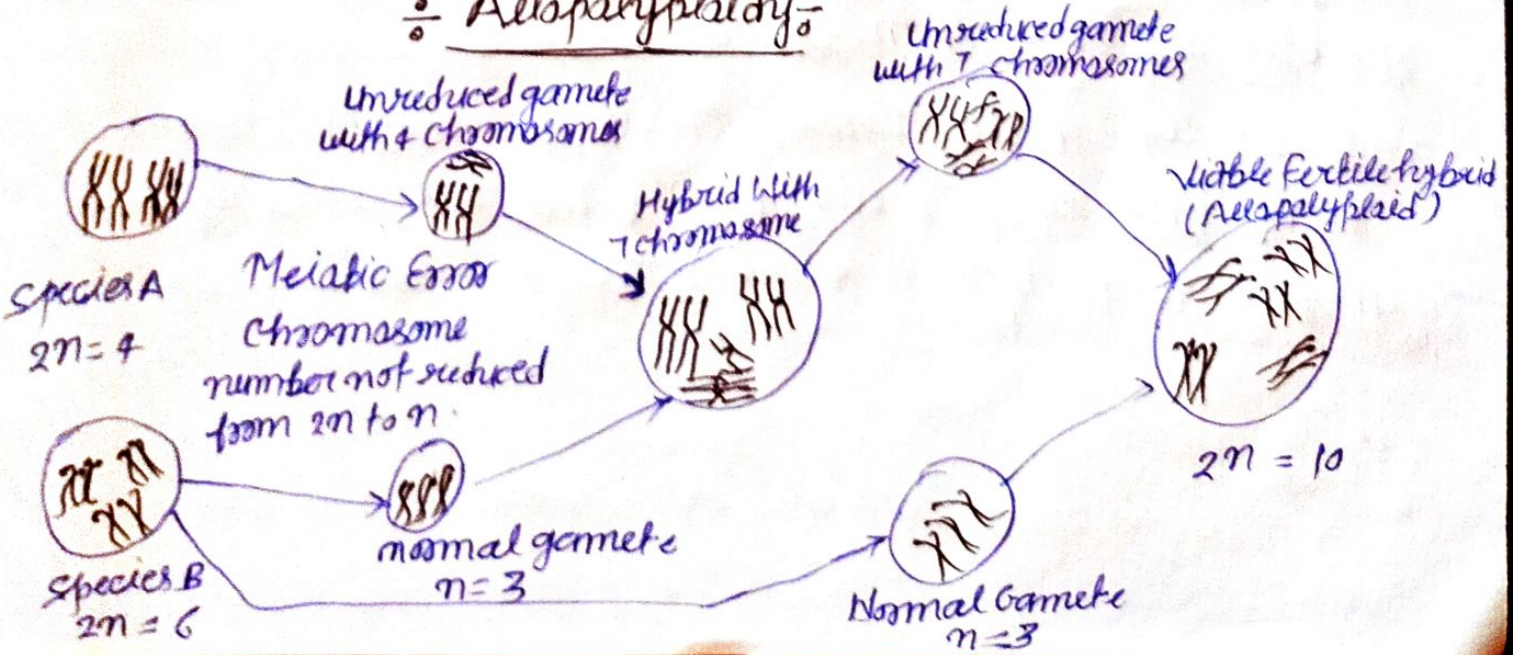
- Containing of multiple copies of the basic set (x) of chromosomes of the same genome



→ Autopolyploids occurs in nature through union of unreduced gametes.

→ Natural autoploids include tetraploid crops such as alfafa, peanut, potato and coffee and triploid bananas.

÷ Allopolyploidy ÷



→ A combination of genomes from different species.
→ They result from hybridization of two or more genomes followed by chromosome doubling or by the fusion of unreduced gametes b/w species.
→ This mechanism is called non-disjunction. These meiatic aberrances result in plant with reduced vigor
→ Economically important natural Alloplaid crops include strawberry, wheat, oat upland cotton, oilseed rape blueberry and mustard.

:-Aneuplaidy:-

→ Aneuplaidy are polyploids that contain either an Addition or subtraction of one or more specific chromosome(s) to the total number of chromsomes that usually make up the plaidy of a species.
→ Aneuplaids result from the formation of univalents and multivalents during meiosis of euplaids.
→ With no mechanism of dividing univalents equally among daughter cells during anaphase I, some cells inherit more genetic material than others.
→ Similarly, multivalents such as homologous chromosomes may fail to separate during meiosis leading to unequal migration of chromosomes to opposite poles.

÷ Classification of Aneuploids ÷

Term	Chromosome number.
Monosomy	$2n-1$
Nullisomy	$2n-2$
Trisomy.	$2n+1$
Tetrasomy	$2n+2$
Pentasomy	$2n+3$

÷ Mutation - Oduction ÷

→ Sudden heritable change in genetic material or character of an organism is known as "mutation".

→ Individuals showing these changes are k/a "mutants."

→ An individuals showing an altered phenotype due to mutation are known as variant.

→ Factor or agents causing mutation are k/a "mutagens"

→ Mutation which causes changes in base sequence of a gene are known as "gene mutation" or "point mutation"

÷ Characteristics of Mutation ÷

→ Generally mutant alleles are recessive to their wild type or normal alleles.

→ Most mutations have harmful effect, but some mutations are beneficial.

→ Spontaneous mutations occurs at very low rate.

→ Some genes show high rate of mutation such gene are called as mutable gene.

→ Highly mutable sites within a gene are k/a hot spots.

→ Mutation can occur in any tissue/cell (Somatic or Germinal) of an organism.

÷ Based on Causes of Mutation ÷

(i) Spontaneous mutation ÷

Spontaneous mutation occurs naturally without any cause. The rate of spontaneous mutation is very low eg - Methylation followed by deamination of cytosine.

→ Rate of spontaneous mutations is higher in eukayotes than prokaryotes.

Ex ÷ UV light of sunlight causing mutation in bacteria.

(2) Induced Mutation ÷

Mutation produced due to treatment with either a chemical or physical agent are called induced mutation

→ The agents capable of inducing such mutations are k/a mutagen use of induced mutation for crop improvement program is k/a mutation breeding.

Ex. X-Rays causing mutation in cereals

Based on tissue of origin

(i) Somatic Mutation ÷

A mutation occuring in somatic cell is called somatic Mutation.

In asexually reproducing species somatic mutations transmit from one progeny to the next progeny.

(2) Germinal Mutation :-

When mutation occur in gametic cells or reproductive cells are k/a germinal mutation.

→ In sexually reproductive species only germinal mutation are transmitted to the next generation.

÷ Hybridization :-

→ Hybridization is the process of developing plants and animals having some desired qualities like a high yield disease resistance, tolerance to climate etc.

→ Offspring produced by hybridisation are called hybrids.

→ Through this technique high quality seeds are produced.

→ Cross breeding between the two varieties is done to develop one variety, which has to desired characteristic of both them. And the new variety produced is know as hybrid variety.

÷ Steps of hybridization :-

Selection of parent plant with different qualities.
↓
Removal of ~~stamens~~ from the female flower.
↓
collection of pollen grains from the male flower.
↓
pollinating the female flower using the collected pollen grains.
↓
- covers the mother plant with polythene bag
↓
collection of mature seeds from mother plants
↓
Select and grows better varieties of offsprings.

÷ Hybrid crops ÷

Rice – Aswathy, Jaya, IR-8, Jyothi Thrivveni, Harsha, Suvarna

pepper ÷ Panniyoor 1, panniyoor 2, Karimunda, Kalluvally

pea – Jwalamukhi, Ujjwala

Tomato – Sakthi, Mukthi, Anaka.

Bitterguard ÷ Priya, Priyanka, Preethi.

÷ Conservation of medicinal Plant ÷

(1) Introduction ÷ India has one of the richest plant medical cultures in the world.

→ Herbal plants that have been used by Ayurveda, Siddha Unani & Tibetan system of health care face an uncertain future due to over exploitation.

→ Conservation is about preventing damage and loss to our cultural heritage.

(2) Conservation Activities ÷

Preservation Restoration Examination Documentation

Research Advise Treatment Training and Education

(3) Need for Conservation (om swell)

→ Over one and a half million practitioners of the Indian systems of medicine in the oral and codified streams use medicinal plants in preventive, promotive and curative application

→ Medicinal plants are potential renewable natural resources.
→ Several medicinal plant have been assessed as endangered, vulnerable and threatened due to over harvesting in the wild.
→ While the demand for medicinal plant is increasing, their survival in their natural habitats in under growing threat.

(1) Endangered Species :-

(a) → Endangered species those which have already become extinct & the plant, which are on the verge of extinction.

(b) IUCN has classified endangered species as :-

Rare species :- Species with small population restricted geographically with localised habitats.
→ They are not in immediate danger of extinction
Ex :- Saraca Indica.

Endangered :- Species with low population number that are in considerable danger of becoming extinct.
Ex :- Dioscorea. deltoida.

Vulnerable :- Species are under threat of or actually declining in number. Ex - Embelia ribes burm.

Critically Endangered :- When a species is facing an extremely high risk of extinction in wild in the immediate future
Ex :- Conciniun, Fenestratum

Extinct :- Species which cannot be found in areas where they recently been inhabited. Ex - Drosera.

(c) Causes of Extinction :-

Forest depletion Due to :-

- Direct human pressure. Cattle ranching.
- Fuel wood consumption disturbances in the ecological system & diversity.
- Commercial logging in forests.

Indian Endangered Medicinal Plants :-

- Artocarpus hirsutus (Moraceae) → Ephedra gerardiana (Ephedraceae)
- Baliospermum montanum (Euphorbiaceae) → Garcinia (Clusiaceae)
- Calophyllum apetalum (Elusiaceae) → Rauwolfia Serpentina.
- Dipterocarpus indicus (Dipterocarpaceae) → Woodfordia fruticosa (Antibacterial)

Environmental factor :-

- Pollution.
- Acid rain, Illegal export & trade.
- Green house effect, Agricultural intensification.

:- Conservation biotechnology :-

- Conservation
  - In Situ
    - → Biosphere
    - → Reserves
    - → Sacred Groves.
    - → Sancturies.
    - → National Parks
    - → Protected areas
  - Ex Situ
    - → Field gene banks, Arboreta such as Pinetum, Bambusetum, Palmetum and orchidetum etc.
    - → Storage of plant parts / tissue viz. buds, seeds, Embryos, meristems callus ovule, pollen etc.
- propagation
  - Micropropagation
  - Macropropagation
  - Reintroduction into nature
- Molecular diversity. (Please refer table-2 for details)

÷ In situ conservation ÷

→ In situ or on site conservation involves maintaining genetic resources in their natural habitats that is within the ecosystem to which it is adapted, whether as wild or crop cultival in farmer's field as components of the traditional agricultural systems.

The key operation steps for establishing in situ gene banks for conservation of priaritized medicinal plants include.

1) Threat Assessment.
2) Establishment of a network of medicina plant.
3) Forest reserves.
4) Involving local.
5) Stakehalders, botanical, ecological,
6) Trade and ethno-medical surveys.
7) Assessing intraspecific variability of priaritized species.
8) Designing species recovery programmes.
(99) Establishment of a medicinal plant seed center etc.

÷ Ex-Situ Conservation ÷

Ex Situ conservation, involves conservation of biodiversity outside the native or natural habitat where the genetic variation is maintained away from its original location.

→ The Ex-Situ genetic conservation fulfills the requirement of present or future economic, social and environmental needs.

→

→ Conservation also includes propagation and assessment of molecular diversity conservation of medicinal plant include a combination of methods depending on factors such as geographic sites infrastructure, and network having an access to different geographical areas.