UNIT-I

INTRODUCTION TO PHARMACOGNOSY

Points to be covered in this topic

- ❑ DEFINITION
- ❑ HISTORY
- ❑ SCOPE AND DEVELOPMENT
- ❑ SOURCES OF DRUGS
- ❑ ORGANIZED DRUGS
- ❑ UNORGANIZED DRUGS

INTRODUCTION TO PHARMACOGNOSY

❑ DEFINITION

- Pharmacognosy is defined as the scientific **study of the structural, physical, chemical and biological characters of crude drugs** along with their **history, cultivation, collection, preparation for the market and preservation.**
- Thus Pharmacognosy literally means to **acquire knowledge about drugs.**

❑ HISTORY

3000 BC	**Pen-t-Sao**	• The oldest known herbal document of China i Pen Tsao written by Shen Nung. • It believed that Pen Tsao is the oldest document and contain 365 drugs in which 120 emperor, 120 minister and 125 servant drugs.
1500 BC	**Papyrus Ebers**	• It consists of ma of as many as 800 formulae and about 700 crude drugs of the plant and mineral origin. • Books were written in Egypt
460 - 360BC	**Hippocrates**	• The great Greek physician known as 'Father of Medicine' deals with the anatomy & physiology of human beings.
384 -322BC	**Aristotle**	• The renowned philosopher is well known for his studies on animal kingdom. (Recorded 500 plants)
372 - 287 BC	**Theophrastus**	The Greek philosopher known for his writings on the plant kingdom.

040 - 080 AD	Dioscorides	The Greek physician in 78 AD described several plants of medicinal importance in 'De Materia Medica'. (600 medicinal plants)
131 - 200 AD	Galen	The Greek pharmacist describes various methods of extraction & preparation containing active constituents of crude drugs.
1707- 1778	Swede Linnaeus	The great systematist classified the plants and introduced the system of naming the plants known as the binomial system which is still followed.

(b) Hippocrates (460 - 360 BC)

(c) Aristotle (384 - 322 BC)

(d) Dioscordies (040 - 080 AD)

(e) Galen (131 - 200 AD)

(f) Swede Linnaeus (1707 - 1778 AD)

❑ SCOPE AND DEVELOPMENT

- There is continuous increase in the demand of herbal products in many countries due to safe use.
- India's have introduced Herbal pharmacopoeia's which **contains regulatory requirement.**
- Pharmacognosy should posses the basic knowledge of **botany and zoology**.
- The knowledge of plant taxonomy, **plant breeding and plant genetics** is helpful in the development of cultivation technology for medicinal plants.
- Chemotaxonomy - Based on modern ideas of classification.
- Plant tissue culture, biogenetic pathway, biochemistry, biochemical engineering put new development in pharmacology.
- Pharmacognosy is an vital link between pharmacology and medicinal chemistry.

- Pharmacognosy is also an important link between **ayurvedic and allopathic medicine.**
- The use of herbal drugs is increasing day by day and new plant drugs are finding their way into medicine as **purified phytochemicals.**

❑ SOURCES OF DRUGS

Plants- Plant source is the **oldest source of drugs.** Most of the drugs in ancient times were derived from plants. Almost all parts of the plants are used i.e. **leaves, stem, bark, fruits and roots etc.**

For example leaves of Digitalis purpurea are the source of Digitoxin and Digoxin, which are cardiac glycosides.

S. NO.	SOURCES OF DRUG	EXAMPLE
1.	PLANT	• **Alkaloids :-** Nuxvomica, Opium, Cinchona, Ergot, Rauwolfia • **Glycosides :-** Digitalis, Senna, Liquorice • **Lipid :-**Castor oil, Kokum butter • **Volatile oil :-** Clove, Fennel • **Tannins :-** Myrobalan , Pale catechu • **Resins :-** Colophony, Jalap, Balsam of tolu • **Carbohydrate :-** Acacia, Guar gum, Pectin

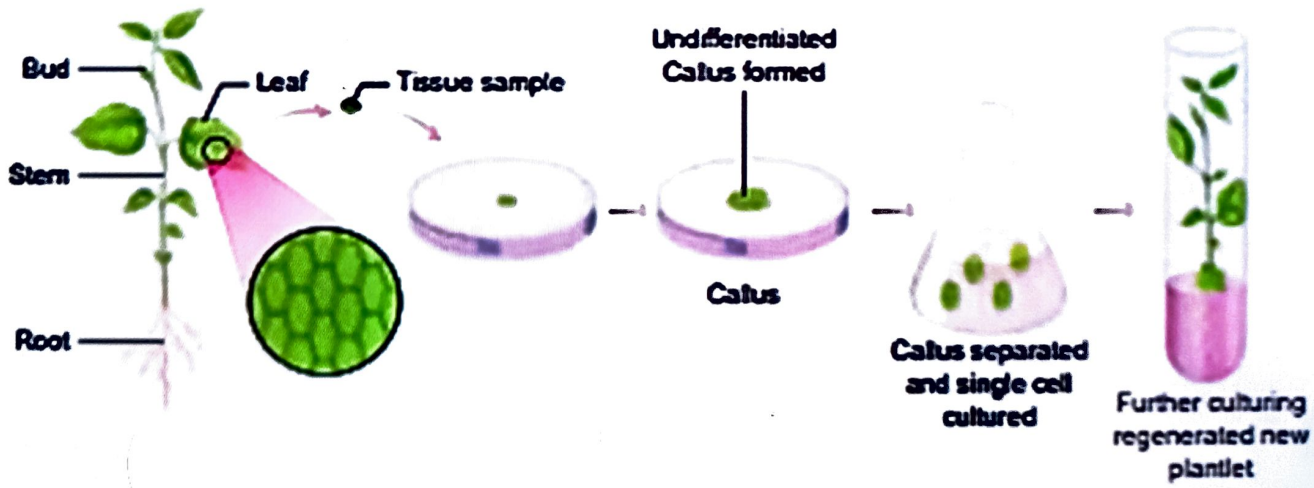
Animals- Pancreas is a source of **Insulin,** used in treatment of **Diabetes.** Sheep thyroid is a source of thyroxin, used in hypertension. **Cod liver** is used as a source of **vitamin A and D.** Cochineal (dried full grown female insects) consists of carminic acid used as colouring agent for foods, drugs and for cosmetic products.

S. NO.	SOURCES OF DRUG	EXAMPLE
2.	ANIMAL	• **Hormone :-** Thyroid, Conjugated Oestrogen, Insulin, Oxytocin, Vasopressin, Gonadotropins • **Enzymes :-** Pancreatin, Trypsin, Chymotrypsin, Fibrinolysin, Pepsin, Hyaluronidase • **Vitamins :-** Cod liver oil,Shark liver oil • **Carbohydrate :-** Honey

Marine Sources- The greater part of the earth surface is covered by seas and ocean, which contains about **5,00,000 species** of marine organisms. Many of these compounds have shown pronounced biological activity

S. NO.	SOURCES OF DRUG	EXAMPLE
3.	**Marine**	**Antimicrobial agents**:- Cephalosporins, Thelpin, Holotoxin, Variabilin **Antiviral Agents** :- Ara-a, Avarol, Eudostomin-a, Oppositol **Antiparasitic Agent** :- Domoic Acid, a-kainic Acid, Bengamide-f, **Anticancer agent** :- Sinularin, Crassin Acetate, Halitoxin, Asperidol **Anticoagulant** :- Carrageenan, Fucoidan **Cardiovascular Agent** :- Eledoisin, Octopamine, Tetramine Saxitoxin, Laminine **Anti-inflammatory agent** :- Manoalide ,Flexibility, Tetradoxin

Plant Tissue Culture- It is **in-vitro cultivation of plant cell or tissue** under aseptic and controlled environmental conditions, in liquid or on semisolid well defined **nutrient medium** for the production of primary and secondary metabolites or to regenerate plant. **Applications** are **Production of Phytopharmaceuticals**, Biochemical Conversions Clonal Propagation (Micro-propagation), **Production of Immobilized Plant Cell** and Sources of drugs of natural origin.



❑ Organized and unorganized drugs

Organized drugs	Unorganized drugs
They are the sources from plants and animals.	They are the sources of plants ,animals and minerals.
They procured directly from the above Sources.	They are products of plants and animals and obtained by extraction, distillation, incision methods.
They have proper cellular structures like, leaves, flowers, fruits, barks, roots, woods etc	They do not have well defined cellular structure like gum, mucilage, resin etc.
They are identified by morphological characters	They are identified by organoleptic properties.
They are solid in nature.	They are solid, semi-solid and liquid in nature.
To study their characters, transverse section is used for drugs under microscope.	To study their characters, physical parameters like density, optical rotation, viscosity, refractive index, chemical tests are important.

❖ EXAMPLES OF ORGANIZED DRUGS :-

Leaves - Digitalis, Eucalyptus, Mint, Senna, Spearmint, Squill, Tulsi, Vasaka, Coca, Buchu, Hyoscyamus, Belladonna, Tea.

Hyoscyamus

Belladonna

Fruits - Fennel, Coriander

Barks - Cascara, Cassia, Cinchona, Cinnamon,

Cascara

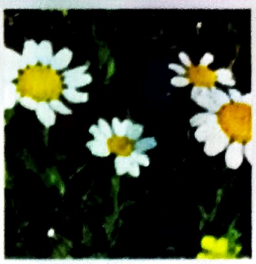
Cinnamon

Root - Aconite, Ipecac

Aconite

Seed - Isapghula, Nux-Vomica

Flowering parts - Clove, Pyrethrum, Chamomile



Pyrethrum

Nux-Vomica

❖ EXAMPLES OF UNORGANIZED DRUGS :-

➢ Dried latex

- Latex is the **milky sap** of many plants that coagulates on exposure to air. It is an emulsion or suspension in which the aqueous phase is composed of mineral salts, proteins, sugars, tannins & alkaloids. The oily phase is composed of oils, resins, etc.

✓ Latex is usually produced in **laticiferous tissues** which may be:

- Laticiferous cells
- Laticiferous tubes.
- Laticiferous vessels (originate from many cells); e.g. Opium

➢ Dried juices

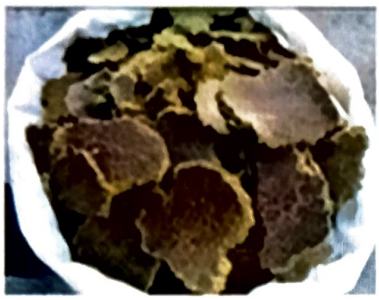
These juices are got from fresh fruit. **Mixing these juices with water, milk or soda** you'll have unforgettable refreshing drink.

➢ Dried extracts

- This group includes drugs which are prepared by evaporating the aqueous decoction from parts of certain plants or animals.

Examples of dried extracts are the following drugs:

1. Agar
2. Gelatin
3. Gambar or catechu



Flaxseed Oil Cake

Extraction

Flaxseed Oil Cake Extract (FOCE)

Emulsions

Flaxseed oil (10%/20%)+Maltodextrin + starch

Spray drying
180°C

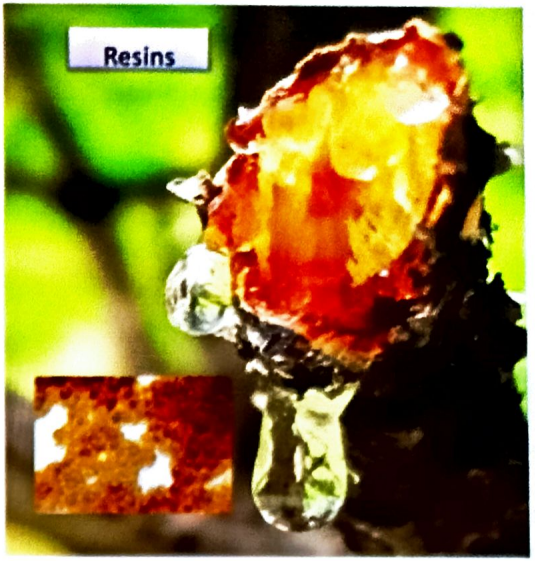
Storage time: 4 weeks

- Oil stability
- PV and TBARS
- Color
- ALA content
- Antioxidant activity: ABTS, DPPH
- Total Polyphenolics Content
- Total Free Amino Acids Content
- FTIR

➢ Gums and mucilage

- Gums and mucilage have similar constitutions and on **hydrolysis yield a mixture of sugars and uronic acids .**
- Gums are considered to be **pathological products,** while mucilage is formed by normal metabolism .

➢ Oleoresins



- These are found in abundance in the trunk of the trees in the resin ducts or in **rhizomes (ginger), fruits (capsicum) and other parts of the plants.**
- They are insoluble in water, may be semi-solid or solid.
- Many times they get associated with **gums or volatile oils.**

Example - Copaiba, ginger

➢ Oleo-gum-resins

- Oleogum resins are naturally occurring **mixtures of resin, volatile oil and gum.**
- The example includes gum **myrrh, asafoetida, gamboge, etc.**
- Oleogum resin ooze out from incisions made in a bark and harden.

UNIT-I

CLASSIFICATION OF DRUGS

Points to be covered in this topic

- ❑ ALPHABETICAL
- ❑ MORPHOLOGICAL
- ❑ TAXONOMICAL
- ❑ CHEMICAL
- ❑ PHARMACOLOGICAL
- ❑ CHEMO AND SEROTAXONOMICAL

CLASSIFICATION OF DRUGS

❑ ALPHABETICAL

- In Alphabetical classification, the crude drugs are arranged in the alphabetical order of their **English and Latin names.**
  - a. **Indian pharmacopeia IP 1955 (Latin)**
  - b. **Indian pharmacopeia IP 1966 (English)**
  - c. **British pharmacopeia BP (English)**
  - d. **United States of pharmacopeia USP (English)**
  - e. **European pharmacopeia (Latin)**

E.g. for alphabetical order of crude drugs-

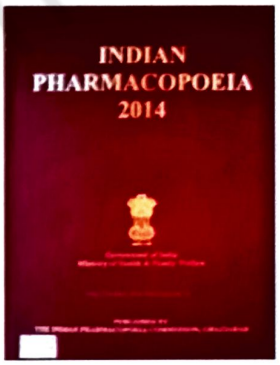
A - Acacia, Agar, Amla, Ashoka, Aconite. Arjuna.

B - Benzoin, Bahera, Bentonite, Beeswax.

C - Cinchona, Chirata, Cinnamon, Cumin.

D - Dill, Datura, Digitalis

E - Ergot, Ephedra, Eucalyptus.



❖ Advantage –

- A simple and useful method for books **and references like** I.P; B.P; U.S.P.
- Tracking of crude drugs in easy way.
- Any addition of crude drug is very easy.
- This system is handling by any person. No need for technical person.

❖ Disadvantage –

1. This system does not provide any information for the scientific nature of crude drugs.
2. In this classification original source is not clear.
3. Nature of drug is not clear either it is organized or un-organized.

❑ MORPHOLOGICAL

- Morphological classification is based on the **morphological or external** characters of the crude drugs.
- In this system the drugs are arranged according to the morphological or external characters of the parts of the plants, which is used as a drug like **leaves, barks, fruits, seeds, flowers, etc.**

In this system the crude drugs are further divide as-

1. Organised drug
2. Un-organized drug

➢ **Organised drug-** These drugs contains direct plant parts. These drugs represent any part of plant with cellular structure like **leaves, roots, bark, seeds etc.**

➢ **Un-organized drug -** These drugs are not direct parts of the plants but they are prepared from plants. These drugs does not represents any part of the plant without cellular structure like **gums, resins, fat, waxes etc.**

Example of Crude drugs under morphological classification:

- Seeds - Nux- vomica, Isabgol
- Leaves - Senna, Digitalis, Vasaka
- Barks - Cinchona, Kurchi, Cinnamon
- Roots - Rauwolfia, Aconite, Ipecac
- Rhizomes - Turmeric, Ginger
- Flowers - Clove, Saffron
- Fruits - coriander, fennel
- Gums - Acacia, Tragacanth
- Plant's exudates - Black catechu, Aloe.

❖ Advantage –

- This system is easy for the classification of crude drugs.
- Without knowing the chemical constituents, drugs are classified properly.
- This type of classification is useful in identifying the adulterants

❖ Disadvantage –

- 1. This system does not provide any information regarding chemical constituents and therapeutic use of crude drugs.
- 2. It is difficult to recognize the organized or un-organized nature of crude drugs.

❑ Taxonomical

- Taxonomical classification is purely a botanical classification and is based on the principles of natural relationship among organisms.
- The drugs are grouped in Kingdom, phylum, order, family, genus and species.

Example :

Phylum - Spermatophyta
Class - Dicotyledons
Sub-class - Sympetalae
Order - Tubiflorae
Family - Solanaceae
Genus - Atropa, Hyoscyamus

❖ Advantage

- This system provide information about scientific nature of drugs.
- Majority of characters are easily studied.

❖ Disadvantage

- Drugs obtained from non living origin are not classified in this system

❑ Chemical Classification

- In this system of classification, drugs are arranged according to the chemical nature of active constituents of the drugs.
- This classification is based on the chemical nature of the active constituents or chemical constituents of drugs.

CHEMICAL CONSTITUENTS	DRUG
Alkaloids	Vinca, Datura, Lobelia
Resins	Colophony , Benzoin
Tannins	Catechu, Ashoka
Volatile oils	Clove, Eucalyptus
Lipids	Castor Oil, Beeswax
Proteins and enzymes	Gelatin, Papain

❖ Advantage

- This type of classification is very easy for the study of chemical constituents.
- On behalf of chemical constituents, medicinal use also studied.

❖ Disadvantage

- In this type of classification there is no proper placement for drugs containing two different types of chemical constituents.
- The drugs of different origin are placed under similar chemical titles.

❑ Pharmacological

- This type of classification is based on the therapeutic effect or pharmacological action of crude drugs.
- This system of classification can be used for suggesting substitutes of drugs if they are not available at a particular place or point of time.

PHARMACOLOGICAL ACTION	DRUGS
Anti-inflammatory	Turmeric, Mint, Aloe
Anti-amoebic	Kurchi Bark, Ipecac
Anti-asthmatic	Ephedra, Vasaka, Lobelia
Astringent	Ashoka, Myrobalan
Anti-cancer	Vinca, Taxus
DRUG ACTING ON G.I.T	
Carminative	Fennel, Cardamom, Mentha
Emetic	Ipecac
Laxative	Agar, Isabgol, Banana
Purgative	Senna, Castor oil
RESPIRATORY SYSTEM	
Expectorant	Vasaka, Liquorice, Ipecac
Antitussive	codeine

❖ Advantage

- In this classification if the chemical constituents of the drugs are not known they can be classified properly on the basis of therapeutic effects or pharmacological uses.
- Drugs with differ in mechanism of action but similar in pharmacological action fall in same group.

❖ Disadvantage

- This classification is not provide information regarding morphology, taxonomical status, chemical constituents of drugs.
- Does not provide any information regarding sources of drugs.

❑ Chemotaxonomic

- This system of classification applies Chemistry to systematics.
- It includes systematic study of the chemical variation between different plant taxa.
- It helps to understand the relationship between constituents in various plants and the taxon they belong to. Certain plant families are even characterized by the presence of certain chemical compounds.

Example - Tropane alkaloids are found in Solanaceae, rutin in Rutaceae etc.

❖ Advantages:

- It is simple method, in this system location, tracing and addition of the drug is easy.
- No technical person is required for handling the system.

❖ Disadvantages:

- Scientific nature of the drug cannot be identified by this method, whether they are organized or unorganized drug.
- This system does not help in distinguishing the drugs of plant, animal and mineral source. (Original source is not clear)

❑ Serotaxonomical classification

- Serology is defined as that portion of biology, which is concerned with the nature and interactions of **antigenic material and antibodies**.
- Smith (1976) defined it as "the study of the origins and properties of antisera." When foreign cells or particles (antigens) are introduced into an organism, antibodies are produced in the blood (antiserum).

❖ Advantages:

- It is simple method, in this system location, tracing and addition of the drug is easy
- No technical person is required for handling the system.

❖ Disadvantages:

- Scientific nature of the drug cannot be identified by this method, whether they are organised or unorganised drug.
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UNIT-I

QUALITY CONTROL OF DRUGS OF NATURAL ORIGIN

Points to be covered in this topic

- ADULTERATION OF DRUG
- EVALUATION
  - Organoleptic method
  - Microscopic method
  - Physical method
  - Chemical method
  - Biological method
- QUANTITATIVE MICROSCOPY
- LYCOPODIUM SPORE METHOD
- LEAFCONSTANTS
- CAMERA LUCIDA

QUALITY CONTROL OF DRUGS OF NATURAL ORIGIN

❑ ADULTERATION OF DRUGS

- Adulteration is broadly defined as admixing or substitution of original or genuine drugs with inferior, defective or otherwise useless, worthless or harmful substance.
- It is a practice of substituting original crude drug in part or whole with other similar looking substances.
- It also occurs due to **spoilage and deterioration** of drugs.
- The drug is said to be adulterated if it fails to confirm to the compendial standards of **quality, purity and strength.**

- Adulteration means **deterioration, admixture, sophistication, substitution, inferiority and spoilage.**

❖ **Deterioration :** It refers to the change caused in drug quality.

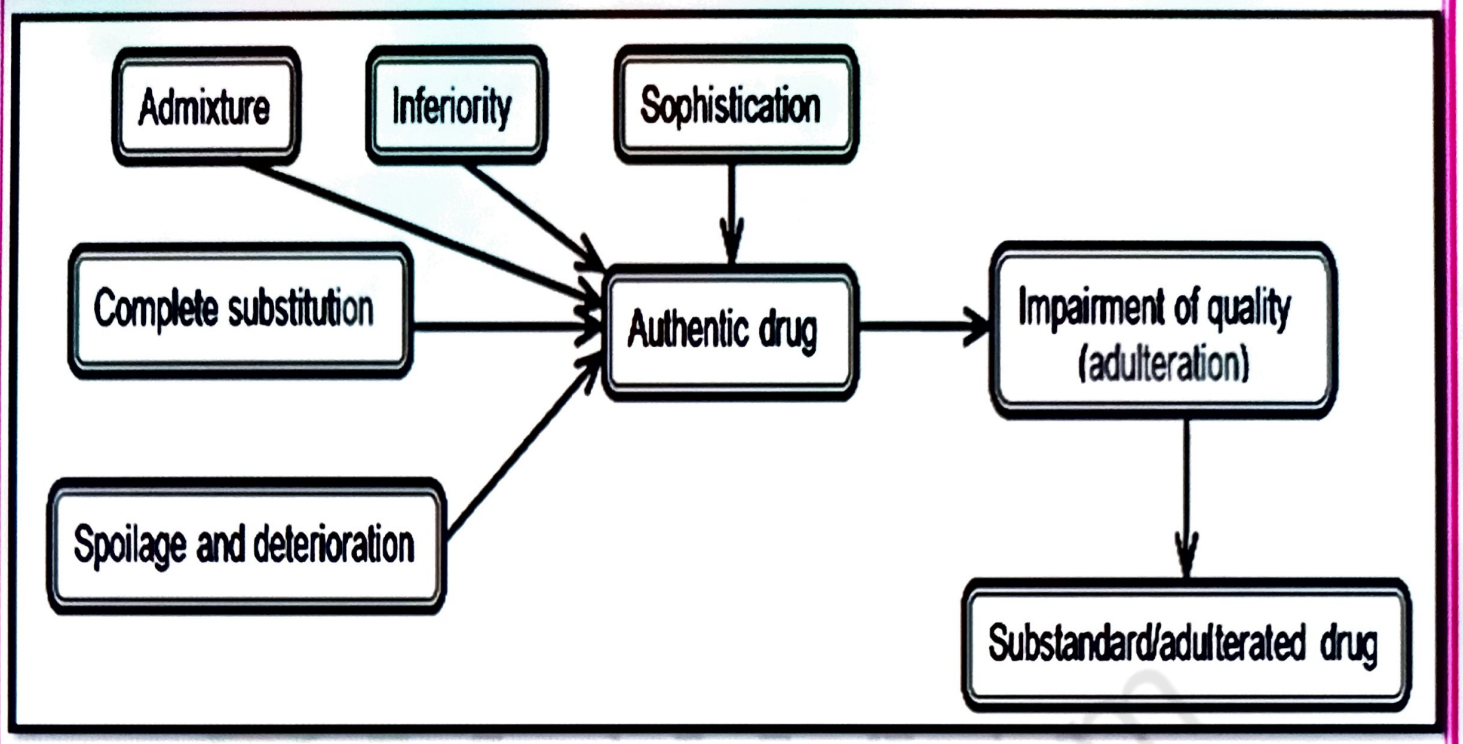
❖ **Admixture :** It refers to addition of one or more items to the drug either due to ignorance or carelessness.

❖ **Sophistication :** Intentional adulteration meant for material gains e.g Crocus sativus is adulterated with Carthamus tinctorius.

❖ **Substitution :** Some other drug is presented as the original drugs e.g **Strychnos nux blanda and S. potatorum instead of S. nux vomica.**

❖ **Inferiority :** It Refers to any substandard **drug and spoilage** is due to the attack of microorganisms.

Deterioration



➢ TYPE OF ADULTERATION

✓ **Substitution with substandard commercial varieties:** The adulterants used here may resemble original crude drug by morphological, chemical or therapeutic characters, but are substandard in nature and hence cheaper in cost.

✓ **Substitution with superficially similar inferior drugs:**

- These inferior drugs used may or may not have any chemical or therapeutic value as that of original natural drug.
- Due to their morphological resemblance to authentic drug, they are marketed as adulterants.

✓ **Substitution with artificially manufactured substances:**

- It has been also observed that substances artificially prepared to resemble original drug are used as substitutes.
- Generally, this practice is followed for much costlier drugs.

✓ **Substitution with exhausted drugs:**

- In this type, the same drug is admixed but is devoid of any medicinally active constituents as they are already extracted out.

- This practice is more common in case of volatile oil containing drugs like fennel, clove, coriander, caraway etc.
- Sometimes, natural characters of exhausted drugs like colour and taste are manipulated by adding other additives and then it is substituted.

✓ **Besides these common practices:**

- sometimes other methods are employed like use of synthetic chemicals to enhance the natural character

✓ **Presence of vegetative matter from the same plant:**

- Sometimes, the other miniature plants growing along with medicinal plant are mixed with drug due to their resembling **colour, odour and in some cases constituents.**

✓ **Harmful adulterants:**

- Several times, the wastes from market are collected and admixed with authentic drugs.
- This is particularly noticed for liquids or unorganized drugs.

✓ **Adulteration of powders:**

- Besides the entire drugs, the powdered forms are frequently found to be adulterated.

❑ DRUG EVALUATION

- Drug evaluation means confirmation of its identity, **determination of its purity and quality and detection of nature of adulteration.**
- It has been established that chemical constituents of a plant species vary with respect to climatic and seasonal changes.

Different methods used are –

1. Organoleptic evaluation
2. Microscopic evaluation
3. Physical evaluation
4. Chemical evaluation
5. Biological evaluation

❖ Organoleptic evaluation

- It refers to the evaluation of drug through gross morphology like **size and shape of leaves, flower, bark, seed, fruits, woods etc** and sensory profile like **colour, odour, taste, touch and texture of plant.**
- Organoleptic evaluation means conclusions drawn from impressions on organs of senses.

➢ leaves

Type of leaves	Simple and compound leave
Shape of leaves	Oval, Oblong, Round, Cordate, Linear, Lanceolate, Ovate, Obovate.
Type of leaf apex	Acute, Acuminate, Obtuse, Recurred
Type of leaf margin	Entire, Serrate, Crenate, Sinuate, Dentate
Type of leaf base	Symmetrical, Asymmetrical, Cordate, Decurrent
Type of venation of leaf base	Parallel, Reticulate, Palmate, Reticulate pinnate

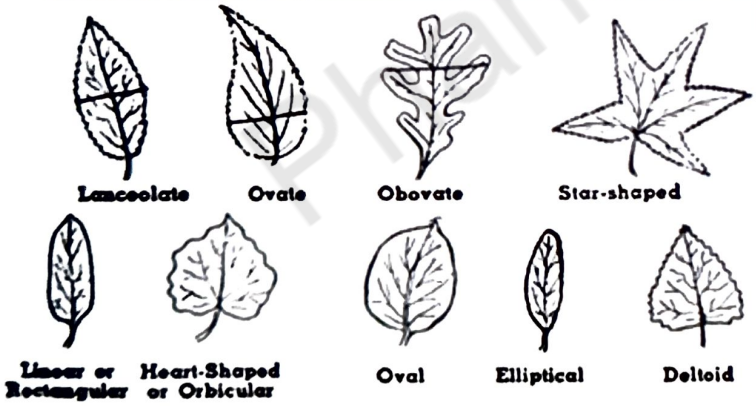
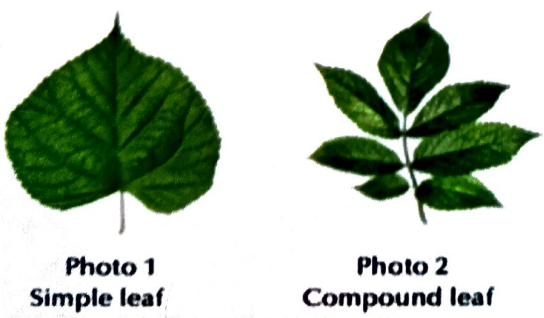


Fig. Shape of leaves



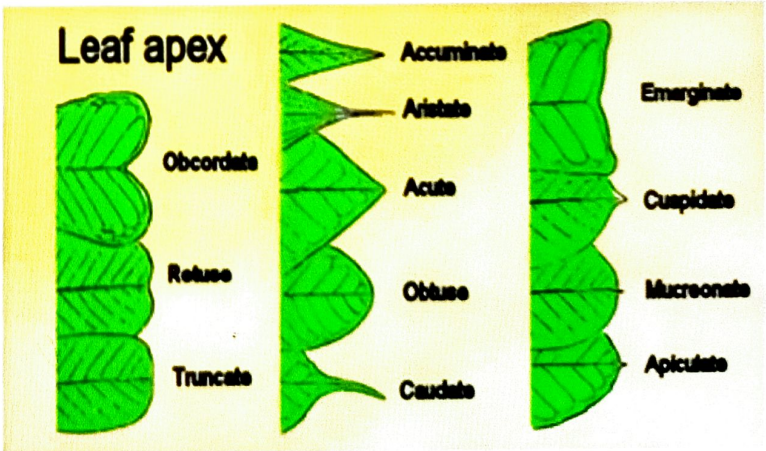
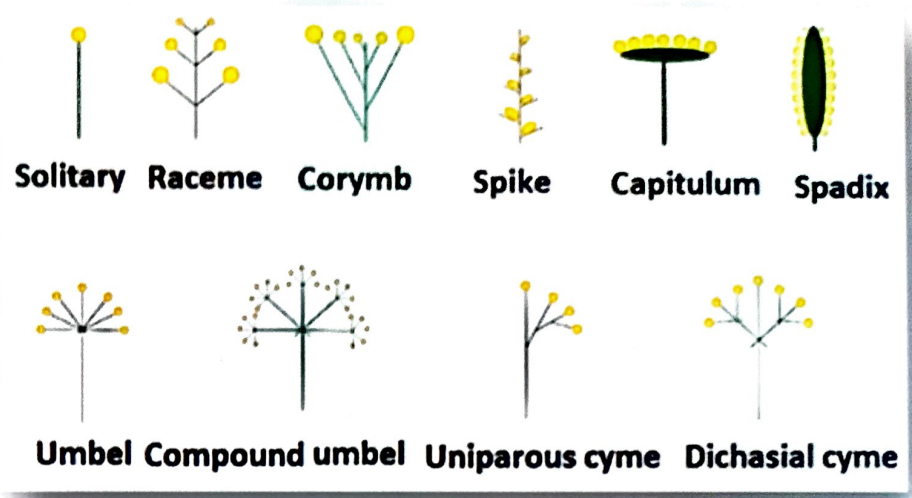


Fig. Type of leaves

➢ Flowers

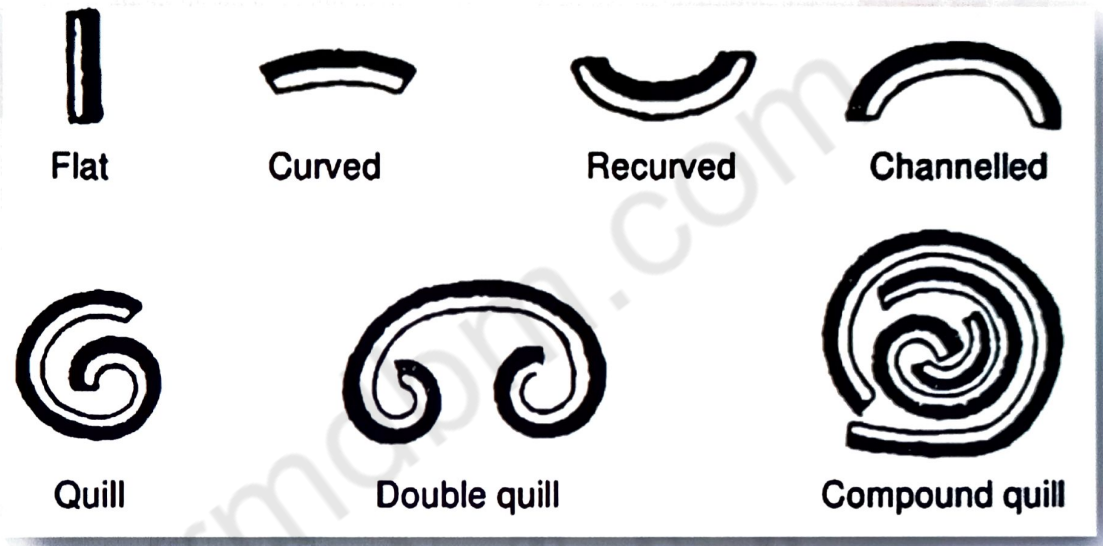
Type of inflorescence :-

Solitary, Cymose, Raceme, Spike, Corymb, Capitulum



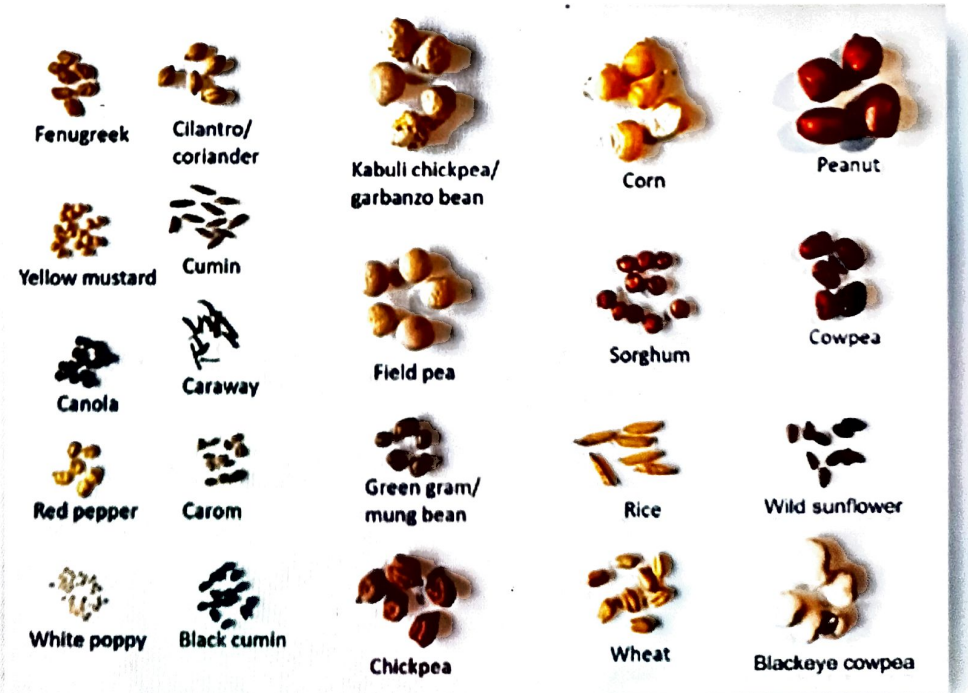
➢ Bark

Shape of bark :- Flat, Curved, Recurred, Channeled quill, Double quill, Compound quill



➢ Seed

Type of seed :- Globular, Spherical, Oval, Planoconvex, Reniform



➢ Odour and taste of somedrugs

- Camphor-aromatic odour,
- Ginger, capsicum-pungent odour
- Cardamom- green colour fruit
- Cinnamon- brown color bark
- Fractured surface- cinchona
- Lemon-sour taste
- Honey-sweet

❖ Microscopic evaluation

- This evaluation is also known as **anatomical evaluation or histological evaluation of crude drugs.**

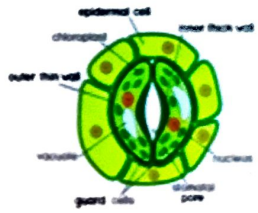
- This method can be used to identify the organized drug in powdered form by their histological characters or anatomical cell or tissue arrangements.
- This evaluation also covers study of the constituents by application of chemical method to small quantities of powdered drug.

Microscopic evaluation include

- ✓ **Leaf constants**
- ✓ **Types of stomata**
- ✓ **Calcium oxalate crystals**
- ✓ **Trichome**

✓ **Stomata:**

- Stomata are the minute epidermal opening present in the aerial part of the leaves.
- Mainly it helps in **gaseous exchange.**
- It consists of two kidney shaped cells with middle tiny pore.
- Broadly four types of stomata viz.
- Moss type, Gymnospermous, Gramineous type and Dicotyledonous type.



stoma open

e.g. – Paracytic- Senna, Coca

Diacytic- Spearmint, Peppermint

Anomocytic - Buchu, Clove, Opium

Anisocytic - Vinca, Belladonna

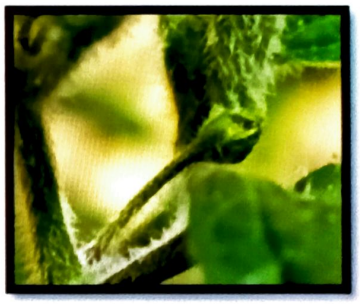
Actinocytic – Blue berry, **Sunken** -ephedra

✓ **Trichome:**

- Trichomes are hair-like components, found on the epidermis of several types of plant stems and leaves.
- Sometimes in seeds also observed (Nux vomica).
- Generally they are colorless under microscope but **lignified in case of Nux vomica.**
- **Covering trichomes** (Unicellular and multicellular), glandular and hydathodes.
- **Multicellular covering** trichomes are two types namely branched and unbranched .
- **Glandular trichomes:** They are two types namely Unicellular and multicellular

Examples:

- **Unicellular covering trichomes:** Senna, Nuxvomica, Cannabis, Lobelia
- **Multicellular unbranched trichomes:** Datura, Digitalis, Belladonna
- **Multicellular Branched trichomes:** Artemisia, Pyrethrum
- **Unicellular glandular trichomes:** Betel, Vasaka, Piper
- **Multicellular glandular trichomes:** Digitalis
- **Hydathodes:** Present in Piper betal



❖ Chemical evaluation

- It involves both qualitative and quantitative determinations of their **active principles.**
- In this method characteristic qualitative chemical tests are employed to identify crude drugs and **their constituents.**
- Quantitative chemical assays are used to determine their **quality and purity**
- This method of evaluation is now widely used in the examination of crude drugs for its **accuracy and reliability**

Generally it is completed in two parts -

1. Preliminary **phyto-chemical screening**
2. Particular **chemical test for different phyto-constituen**

Examples

- **For alkaloids-** Dragendroff's test, Mayer's test, Wagner's test
- **For cardiac glycosides-** Legal test, Baljet test, Killer Killiani test
- **For steroids-** Liebermann- Burchard reaction
- **For carbohydrates-** Molish test, Fehling solution test etc.

❖ Biological evaluation

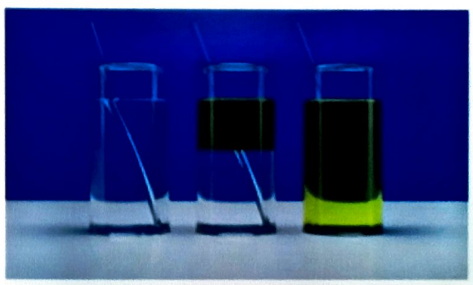
This Biological evaluation of crude drugs is very **useful in determining the potency of drug sample.** In this type of evaluation the extent of pharmacological activity of the drug or its constituents is taken as the basis of quality. Since living organisms or their isolated living tissues are used, this method is also called the biological method or bioassay. Many drugs, particularly the antibiotics, toxins and toxoids and also vitamins are assayed by this method.

Examples

1. **Analgesic activity** is evaluated by Hot plate method, Tail flick method
2. **Antipyretic activity** is evaluated by Yeast induced pyrexia method
3. **Anti-inflammatory activity** is evaluated by Carageenan induced rat paw edema

❖ Physical Evaluation

The Physical evaluation of crude drugs is accomplished by the determination of various **physical constants** using various physicochemical techniques. The common physical constants used to evaluate crude drugs and their extracted chemical principles include **specific gravity** (particularly of the **fats and volatile oils and some crude drugs as Nutgalls**), **optical rotation** (of some alkaloids in solution and of volatile oils), **refractive index** (particularly of the volatile and fixed oils), **melting points** (of isolated alkaloids and their derivatives), **ash values** (of most crude drugs) and **extractive values** (of most crude drugs).



Moisture content

Limit for moisture content:

DRUG	MOISTURE CONTENT (%)
ALOES	Not more than 10%
DIGITALIS	Not more than 05%
ERGOT	Not more than 08%
ACACIA	Not more than 15%
STARCH	Not more than 15%

Ash content

- **Physiological ash** : Derived from plant tissue itself
- **Non physiological ash** : Consist of residue of extraneous matter sand , soil etc. adhering to the herb itself
- **Total ash : Physiological Ash + Non physiological Ash**

Fluorescence analysis

HERBAL DRUG	NATURE OF FLUORESCENCE
CINCHONA	Purple blue
GENTIAN ROOT	Whitish blue
IPOMOEA	Deep purple-violet
QUASSIA	Whitish blue
RHUBARB	Violet

❑ QANTITATIVE MICROSCOPY OF CRUDE DRUGS

➢ Lycopodium spore method:

- This method is use to identify the crude drugs when the chemical and physical methods are inapplicable.
- This method is also useful to detect the adulteration present in the crude drugs containing starch grains.

Examples:

- The percentage purity of an authentic powdered ginger is calculated using the following equation:

$$\% \text{ purity} = N \times W \times 94000 \times 100 \ / \ S \times M \times P$$

Where,

N = Number of characteristic structures (starch grain) in 25 fields.

W = Weight in mg of lycopodium taken.

S = Number of lycopodium spores in the same 25 fields.

M = Weight in mg of the sample, calculated on the basis of sample dried at 105°C.

P = 2,86,000 in case of ginger starch grains powder.

Significance:

- Determination of foreign organic matter.
- Determination of percentage purity of drugs.
- Detection of adulterant

➢ Leaf constants:

1. Stomal Index:

- It is the percentage proportion of the number of stomata to the total number of epidermal cells.
- Stomatal number varies considerably with the age of the leaf but stomatal index is relatively constant for a given species.

Example: Atropa - 20.0-23.0 (lower epidermis)

2. Stomata number

Stomatal number is defined as **the average number of stomata per sq mm of epidermis of the leaf.**

3. Palisade ratio

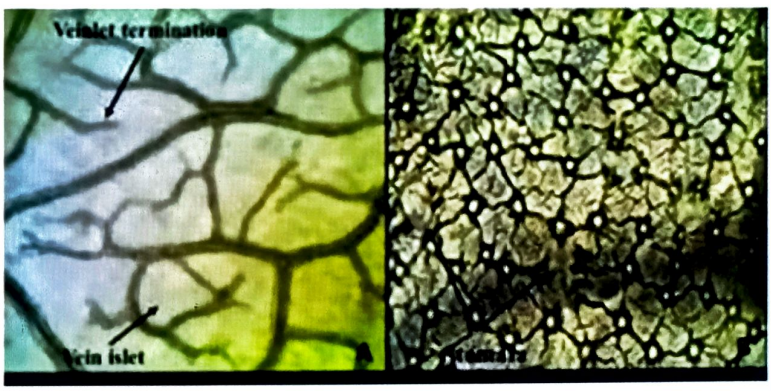
Numbers of palisade cell under each epidermal cell

4. Vein islet number

Number of vein islet per sq. mm of the leaf surface between midrib and margin

5. Vein-termination

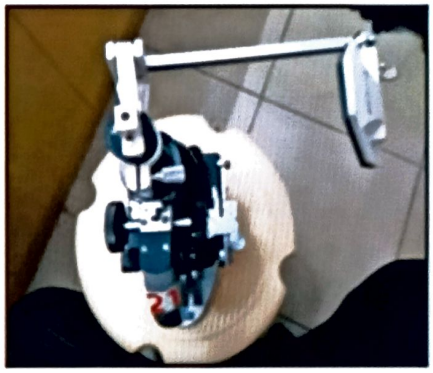
Number of veinlet termination per sq. mm of the leaf between midrib and margin



➢ Camera Lucida:

- It is an optical device or instrument in which rays of light are reflected by a prism to produce an image on a sheet of paper, from which a drawing is made.
- It works on simple optical principle reflecting beam of light through a prism and a plane mirror.
- There **are two types of camera lucida namely Swift Ives and Abbe model camera lucida.**
- The Abbe camera lucida consists of a prism fitted over the eyepiece of the microscope.
- A **side arm is carrying a mirror** that supported vertical over the tracing paper
- In Swift Ives Camera lucida the plane mirror is replaced by a small right angled prism.
- It is a small size and fitted over the eyepiece of the microscope with a screw.





Principle:

During use, the light from the drawing board is **reflected by the plane mirror into the prism and further reflected into the observer's eye that is seeing the drawing paper and the pencil in the direction of the stage of the microscope**. The prism has a small opening through which the observer is seeing the image of the object. As a result, the superimposed image then conveniently traces the microscopic object