

PHARMACOGNOSY

MICROSCOPY AND OTHER SOME IMPORTANT POINTS OF DRUGS

Volatile oil containing drugs

A. Eucalyptus oil:

1. Trichomes are absent
2. Presence of Sunken stomata
3. Epidermis is polygonal
4. Presence of schizogenous oil glands, both prismatic and spherules calcium oxalate

B. Cardamom (Elettaria cardamom):

1. Seeds are derived **anatropous ovules**. They are irregularly triangular shaped covered with transverse wrinkles known as **rugae**. **Korarima cardamom does not show presence of rugae**. Transverse section of seed shows the presence of **arillus**.
2. Epidermis of Pericarp made up of polygonal tubular cells.
3. Mesocarp contains partially lignified fibrovascular bundles.
4. Different variety of cardamom is distinguished by morphologically and **sclerenchymatous cells present per square mm**.
5. Cardamom can be distinguished from crude drug by its ash value.

C. Cassia cinnamon / Chinese cinnamon:

Chinese cinnamon	Indian cinnamon
<ol style="list-style-type: none"> 1. Stem bark is Single quill 2. Complete stem bark and cork contains polygonal tubular cells 3. Pericycle is made up of continuous band of stone cells and lignified pericyclic fibers are embedded in sheath of stone cells 4. Acicular calcium oxalate crystals and starch grains are abundant 5. It contains coumarin 6. Cinnamic aldehyde is main chemical constituent while very small amount of eugenol 	<ol style="list-style-type: none"> 1. Compound quill 2. It is inner bark so it lacks cork and primary cortex. 3. Pericycle is prominent with sclerenchymatous cells 4. Acicular calcium oxalate and starch grains 5. It does not contain coumarin 6. 5- 10 % eugenol

- Cassia oil only contains cinnamic aldehyde. So it only give brown colour
- Ferric chloride + **cinnamic aldehyde** \longrightarrow Brown colour

- Ferric chloride + **eugenol** $\xrightarrow{\hspace{1cm}}$ Blue color

Substituents and adulterants:

- Cinnamon chips: untrimmed bark** so it is distinguished from genuine drug by presence of abundant cork cells.
- Java cinnamon:** bark is **double quill and** medullary contains small tubular **calcium oxalate crystals** while genuine drug has acicular calcium oxalate crystals.

D. Clove:

- Hypanthium is surrounded by 4 thick acute divergent sepals surrounded by dome shaped corolla
 - Epidermis have large **anomocytic stomata, ellipsoidal schizolysigenous oil glands,**
 - Cluster of calcium oxalate crystals and no starch.
- **Mother cloves: contains starch** and very low content of volatile oils
 - **Clove stalks:** contain only 5 % oil and are detected by **prismatic crystals of calcium oxalate** and isodiametric sclerides. Authentic cloves should not contain more than 5 % of stalks to pass pharmacopeial unit.
 - **Exhausted cloves:** cloves from which **oil has been removed by distillation.** Exhausted cloves float on water while authentic clove is heavier than water.
 - **Blown cloves:** they are not bud but these are **expanded flowers of clove** of tree. Stamens are generally get detached.

E. Coriander:

- Coleospermic fruit, rich in vitamin A**
- Presence of 10 primary ridges and 8 secondary ridges. Primary ridges are wavy while the secondary are straight.
- Presence of calcium oxalate crystals.
- Epidermis shows polygonal cells.

F. European Dill (Anethum graveolens):

- Orthospermic fruit.** The fruits are in the form of mericarps usually separated and free from pedicel. While Indian dill contains whole cremocarps.
- European dill has main chemical constituent carvone and dihydrocarvone while **Indian dill has dilla-pole.**
- Mesocarp contains reticulated parenchyma.

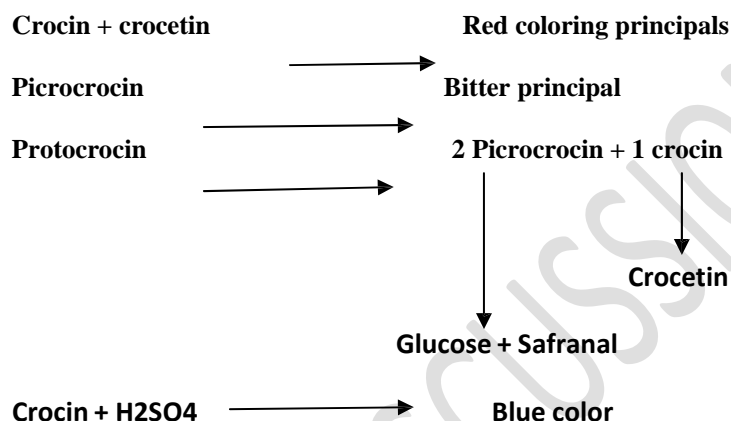
G. Fennel (Foeniculum vulgare)

1. **Orthospermic fruit**
2. **Anomocytic stomata**
3. **Trichomes and starch grains are absent.**
4. Rosette crystals of calcium oxalate
5. **Parquetry arrangement** of cells on the inner epidermis of Pericarp.

H. Anise (*Pimpinella anisum*):

- a. Epidermis is fruit covered with unicellular conical thick walled **warty trichomes**,
- b. Rosette calcium oxalate crystals

I. Crocus / Kesar / Saffron (Dried style and stigma of *crocus sativum*)



J. TAXUS (*Taxus Brevifolia*): give Taxol which is a **diterpenoid** that stimulate α and β tubulin which polymerise to give microtubules and for these process microtubules associated protein (MAP) and GTP is necessary. Taxol brings the polymerization in the absence of MAP and GTP. Due to enhanced microtubules can detrimental effects on dividing cells which leads to blockage of cell cycle.

10-deacetyl baccatin III is converted to Taxol by tissue culture.

K. FORSKOLIN: is a **diterpenoid** used as **vasodilator and cardiac stimulant (positive inotropic)**. It acts as vasodilator via activation of activation of adenylyl cyclase. It is also used to lower the intraocular pressure .

ALKALOIDS

True alkaloids: contain **heterocyclic Nitrogen which is derived from amino acid** and always basic in nature due to presence of lone pair of electrons on nitrogen.

Proto alkaloids: are simple amines in which **Nitrogen is not heterocyclic**. E.g. ephedrine, Colchicine, mescaline

Pseudo alkaloids: they are **not derived from amino acids** but they show positive test for alkaloids. E.g. purines (caffeine), steroidal and terpenoidal alkaloids Conessine, solanidine, protoveratrine, aconine.

Volatile alkaloids: coniine, nicotine, sparteine

Colored alkaloids: Berberine (yellow), Betanidin (Red)

- Some of proto and pseudo alkaloids show higher solubility in water e.g. Colchicine, caffeine, quinine HCl are freely soluble in water. So solubility of alkaloid is also employed for extraction procedures.

Alkaloids with Primary amine Nitrogen: Mescaline

Alkaloids with Secondary amine Nitrogen: Ephedrine

Alkaloids with Tertiary amine Nitrogen: Atropine

Alkaloids with **Quaternary Nitrogen:** Tubocurarine

Chemical test:

- Mayer's reagent test (K^+ mercuric iodide solution)** —————→ **Cream colored ppt**
- Dragendroff's reagent (K^+ bismuth iodide solution)** —————→ **Red brown ppt**
- Wagner's reagent (iodine K^+ iodide solution)** —————→ **Red brown ppt**
- Hager's reagent (Picric acid)** —————→ **Yellow colored ppt**
- Picrolonic acid** —————→ **Yellow colored ppt**

Classification:

- Pyrrole and Pyrrolidine ring: Hygrine, Cocoa
- Pyridine and piperidine : Coniine, Arecoline, Lobeline
- Quinoline : Camptothecin (Anticancer), Quinine, Cinchonine**
- Isoquinoline: D-Tubocuarine (Skeletal muscle relaxant), Morphine, Berberine, Emetine**
- Indole:** Ergot, Reserpine, Vinca, Strychnine, Physostigmine
- Imidazole:** Pilocarpine
- Quinazoline: Vasaka (antitussive & expectorant)
- Tropane: Datura

- i. **Steroidal** : Ashwagandha, Kurchi, Veratum
- j. **Amino alkaloids or protoalkaloids**: Ephedrine, Colchicum

A. Ergot:

Ovary of rye plant infected by **ascospores** (sexual spores) of the fungus **Claviceps Purpurea**. **Sclerotium** stage contains maximum amount of **pseudo parenchyma** used for production of **lysergic acid derivatives**. There are six pairs of alkaloids; **levo form is medicinally active while dextro is inert**.

- **Ergometrine and ergometrinine are water soluble** remaining are water insoluble.
- **Ergometrine gives blue florescence in water.**
- **Ergotamine used for treatment of migraine**
- **Ergometrine is used as oxytocic and** used to enhance labour pains in delivery cases and also to prevent post partum hemorrhage.
- **LSD (Lysergic acid diethylamide)**: Posses psycho mimetic action and used in psychiatry but its use is abuse.
- **Methyl sergide**: is lysergic acid which is used as prophylactic for migraine

Van-Urk's reagent: p-Dimethylaminobenzaldehyde gives blue color

B. Nux-Vomica:

1. Seeds are disc-shaped and have concavo-convex surface. Nux vomica contains glycoside loganin.
 2. Epidermis with collapsed cells
 3. lignified covering trichomes
 4. Calcium crystals and starch grains are absent
 5. Plasmodesmata
- **Manddin's reagent (ammonium vanadate + sulphuric acid)** endospermic cells give **purple color due to strychnine**.
 - Endospermic cells with concentrated **nitric acid** give **yellow color due to presence of Brucine**.

Brucine is 1/6 potency as compared to strychnine like increased in B.P, stimulation of respiratory and CVS. But Brucine is 4 times bitterer than strychnine.

C. Rauwolfia:

- a. **Cork is stratified**
- b. **Sclerenchyma**, stone cells, phloem fibers are absent.
- c. Prismatic calcium oxalate crystals.

R. Densiflora contains Sclerenchyma which is absent in R. serpentina

R. Tetraphylla has uniform cork.

Reserpine + conc. Nitric acid \longrightarrow **Red color**

Reserpine + vanillin in acetic acid \longrightarrow **Violet red color**

D. Vinca (Catharanthus roseus)

- a. Presence of Anisocytic stomata
- b. Calcium oxalate crystals are absent.

Vinblastine contains a indole alkaloid part called as **cathranthine** and dihydroindole alkaloid is called as **vindoline**.

Vinblastine is anti neoplastic drug and act by causing the mitosis arrest or by interfering with amino acid metabolism. It is mostly used in treatment of **Hodgkin's disease** and lymphomas.

E. Opium: Dried latex obtained by incision from **unripe capsules of Papaver somniferum**. **Largest production is in Afghanistan**. In India its cultivation is restricted to M.P, U.P and Rajasthan. Narcotine / Noscapine was the first alkaloid reported in opium. Capsules incised vertically with 'Nushtar' which is needle like apparatus penetrates up to 2 mm in afternoon. **Opium factor in India is at Ghazipur**. The best climate conditions for opium is soil pH 7, rich in organic matter, cool whether without freezing temp.

Indian opium	Cubical species
Parisian opium	Brick shaped
Turkish opium	Conical or rounded

Benzyl Isoquinoline derivatives: Noscapine, Papaverine, Narceine

Phenanthrene derivatives: Morphine, Codeine, Thebaine

- **Morphine, codeine, Narcotine are levorotatory while Papaverine is optically inactive.**
- **The opium alkaloids are present a strong monoacidic base as a salt of meconic acid.**

Chemical test:

1. **Opium extract + FeCl_3** \longrightarrow **Reddish purple color (Due to presence of meconic acid)**
2. **Morphine + HNO_3** \longrightarrow **Orange red color while codeine donot respond**
3. **Morphine + $\text{K}_3 \text{Fe} (\text{CN}_6)$** \longrightarrow **Bluish green while codeine do not respond**
4. **Papaverine + HCl + $\text{K}_3 \text{Fe} (\text{CN}_6)$** \longrightarrow **lemon yellow color**

Papaverine is used as **smooth muscle relaxant**

Narcotine / Noscapine and codeine are used as antitussive

Thebaine is convulsant

Morphine on removal of water molecule gives apomorphine which is a strong emetic and used to treat poisoning by giving subcutaneous route.

- The other varieties of opium / poppy that **does not contain morphine** are **P.bracteatum, P. argemone. These are rich in Thebaine.**

F. **Curare: (South American arrow root poison)** obtained from **chondrodendron tomentosum** and main chemical constituent is **benzylisoquinoline derivative (+) Tubocurarine** used as **neuromuscular blocker** or skeletal muscle relaxant and in myasthenia gravis.

G. **Ipecac (Cephaelis acuminata):**

- Characteristic feature is presence of **opalescent parenchymatous** cells
- Presence of **acicular raphides** and polyhedral parenchyma.
- Presence of mullar shaped starch grains
- Brazilian ipecac has annulated roots and pith is absent while Indian ipecac or panama does not have annulated roots but have transverse ridges.**

Emetine in smaller doses used as expectorant while in higher dose as emetic. Emetine is also used as antiprotozoal i.e. Entamoeba histolytica is sensitive in very low conc. 1 in 6 millions. **Cephaeline has more emetic and less expectorant action as compared to emetine.**

Chemical tests:

- ☐ Powdered drug + HCl + H₂O . Shake well and filter. To filtrate + KClO₄.
Yellow color is obtained changing to Red due to presence of emetine.
- ☐ Emetine + H₂SO₄ + Molybdic acid \longrightarrow Green color

H. **Tropane alkaloids (Pyrrolidine + Piperidine ring):**

They are biosynthesized in root and then migrate to leaves. Atropine is racemic form of hyoscyamine. L-Hyoscine or scopolamine which has an epoxide ring is used in preanesthetic medication in surgery and motion sickness. **Tropane alkaloids give + ve test to Vitali-Morin reaction.**

a. **Belladonna (Deadly night shade):**

Atropa belladonna is European belladonna

Atropa acuminata is Indian belladonna

- ☐ Leaves are ovate, lanceolate and petiolate.
- ☐ Epidermis with striated cuticle.
- ☐ **Both Anisocytic stomata and anomocytic with uniseriate multicellular covering trichomes 4-5 celled long and also contains glandular trichomes.**
- ☐ **Presence of microspheroidal crystals.**

b. *Datura stramonium* (Thorn apple):

- ☐ Epidermis is wavy with smooth cuticle
- ☐ Covering trichomes are **3 celled long.**
- ☐ It bears funnel shaped white/ purple colored flowers **with 5 stamens and superior ovary. The ovary is binocular.**

c. *Hyoscyamus* (Henbane):