



Shree H.N.Shukla Institute of Pharmaceutical Education & Research Rajkot

B.Pharm Semester V

Subject Name: Pharmacognosy and Phytochemistry II

Subject code: BP503TP

UNIT II:

**General introduction, composition, chemistry & chemical classes,
biosources, therapeutic uses and commercial secondary metabolites .**

TOPIC –UNIT -II

General introduction, composition, chemistry & chemical classes, biosources, therapeutic uses and commercial applications of following secondary metabolites:

Alkaloids: Vinca, Rauwolfia, Belladonna, Opium,

Phenylpropanoids and Flavonoids: Lignans, Tea, Ruta

Steroids, Cardiac Glycosides & Triterpenoids: Liquorice, Dioscorea, Digitalis

Volatile oils: Mentha, Clove, Cinnamon, Fennel, Coriander,

Tannins: Catechu, Pterocarpus

Resins: Benzoin, Guggul, Ginger, Asafoetida, Myrrh, Colophony

Glycosides: Senna, Aloes, Bitter Almond

Iridoids, Other terpenoids & Naphthaquinones: Gentian, Artemisia, taxus, carotenoids

ALKALOIDS

- Alkaloids are basic nitrogen containing compound obtained from plant, animal and microorganism having marked physiological action.
- Term alkaloids was coined by Meissner in 1819.
- Term alkaloids are derived from “alkali like” they are basic in nature, they contain one or more nitrogen atom (usually in heterocyclic ring).

PROPERTIES

- Most of alkaloids are basic in reaction due to the availability of lone pair of electron on nitrogen.
- The alkaloid contain one or more number of nitrogen and it may exist in the form as
 - Primary amine – Mescaline
 - Secondary amine – Ephedrine
 - Tertiary amine – Atropine
 - Quarternary amine – Tubocurarine Chloride
- Alkaloids are colorless, crystalline, non-volatile, solid and bitter in taste.
- Alkaloids are generally optically active, among the leavo isomers are more active. Optically inactive are – Papavarine, Atropine

CHEMICAL TEST FOR ALKALOIDS :

Table-1

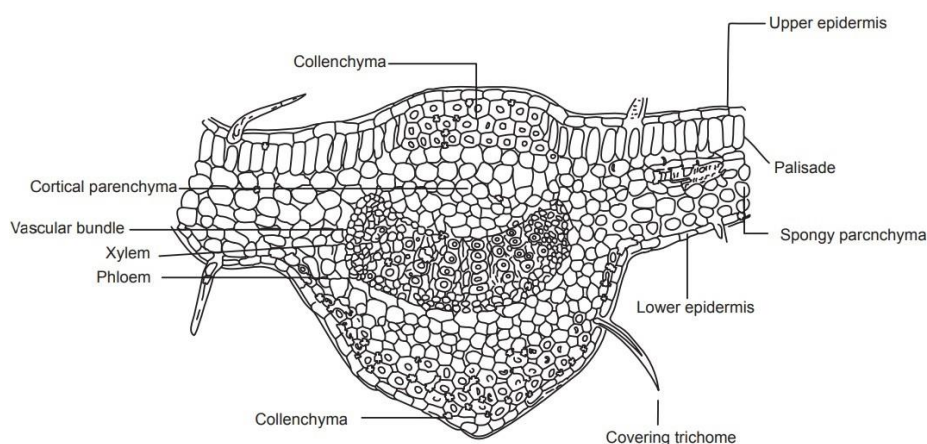
S.NO.	Reagent	Observation
1	Mayer's Reagent (Potassium mercuric iodide solution)	Creamy precipitate
2	Wagner's reagent (Potassium triiodide solution)	Reddish brown precipitate
3	Dragendroff's reagent (Potassium bismuth iodide solution)	Reddish brown precipitate
4	Hager's reagent (Picric acid)	Yellow precipitate
5	Sonnenschein's reagent (Phosphomolybdic acid)	Precipitate
6	Scheibler's reagent (Phosphotungstic acid)	Precipitate
7	Tannic acid test	Precipitated the alkaloid
8	Ammonia reineckae test (Saturated solution of ammonia reineckete)	Pink precipitate
9	Murexide test (Caffeine + HCl + KCl ₃)	Purple color and when added alkali color loss
10	Colchicine + Mineral acid	Yellow color

11	Van Urk's test (Ehrlich Reagent) (Ergot powder + p-dimethyl aminobenzaldehyde)	Blue color
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VINCA

- Synonym** : Periwinkle, Sadabahar
Biological source : Vinca is obtained from dried whole plant of *Cataranthus roseus*. It is also known as *Vinca rosea*.
Family : Apocynaceae
Microscopy :

Figure-1



- Upper surface shows presence of single layer of rectangular celled epidermis with unicellular covering trichomes.
- Spongy parenchyma.
- Cruciferous stomata / Anisocytic stomata present.

Chemical Constituents –

- Vincristine
- Vinblastine

Uses :

- Used as a antineoplastic agent.
- Used in Hodgkin's lymphomas.
- Used in acute lymphocytic leukemia in child.
- Antidiabetic action.

RAUWOLFIA

- Synonym** : Chhotachand, Sarpagandha
Biological source : Rauwolfia is obtained from dried roots and rhizomes of plant *Rauwolfia serpentina*.
Family : Apocynaceae
Microscopy :
 T.S section of root shows externally by stratified cork with 2-7 layers of small cells that is followed by phelloderm.

- Both bark and wood contains abundant starch.
- Xylem is entirely lignified.
- Sclerenchyma is absent
- Tetrastichious arrangement present.

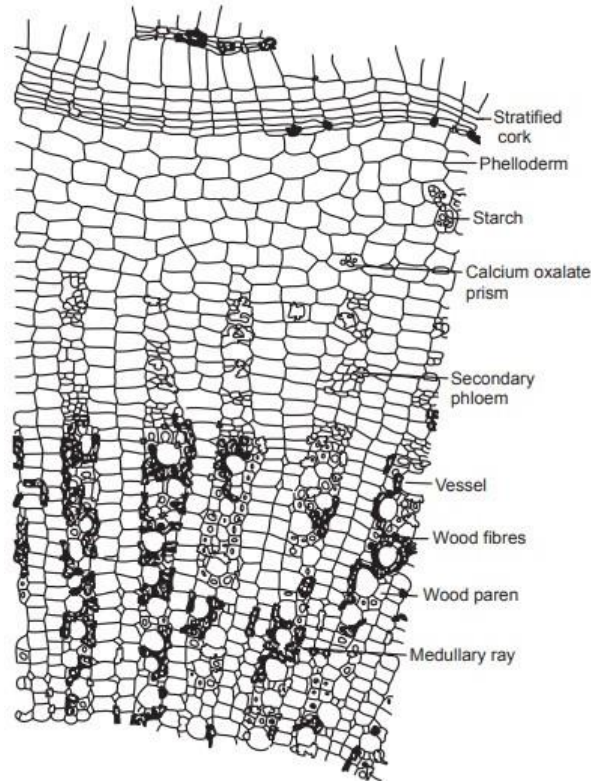


Figure-2

Chemical Constituents –

Contains more than 30 alkaloids –

- Ajmaline (Rauwolfine), Ajmaliline, Ajmalacine, Serpentine, Serpentinine.
- Chief important therapeutically active alkaloids – Reserpine, Rescinnamine.

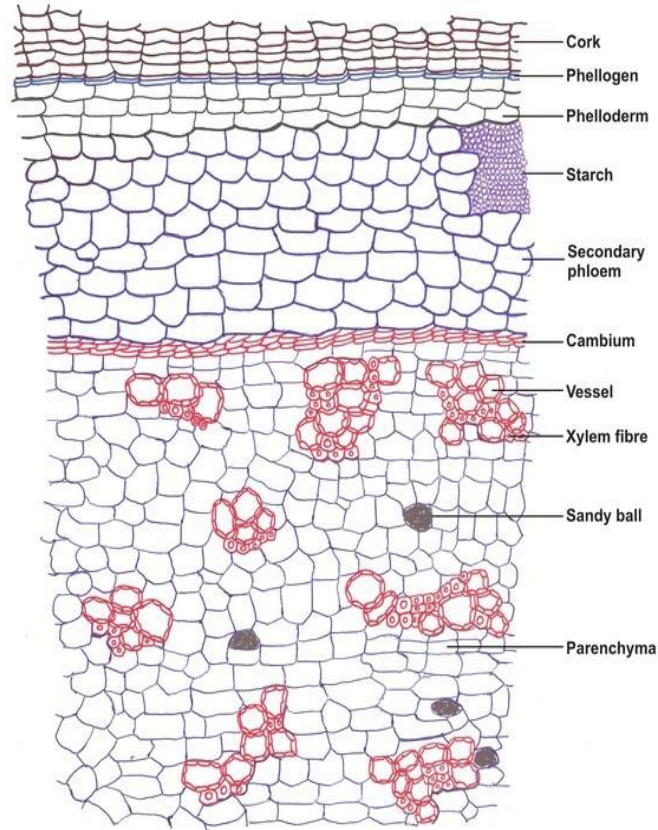
Uses :

- Therapeutically Rauwolfia is antihypersensitive in nature.
- Used in neuropsychiatric disorder.
- Ajmaline is used in the treatment of arrhythmia.
- Ajmalacine used in the relief of obstruction of normal cerebral blood flow.

BELLADONNA

- Synonym** : Deadly night shade leaf.
- Biological source** : Belladonna is obtained from dried leaves and other aerial parts of *Atropa acuminata* (Indian belladonna), *Atropa belladonna* (European belladonna).
- Family** : Solanaceae
- Microscopy** : Epidermal cell with slightly sinuous anticlinal wall and striated cuticle with anisocytic type of stomata.

- Have less non-glandular and more glandular trichome → Uniseriate and with unicellular heads.
- Occasionally covering trichomes → Uniseriate and multicellular heads.
- Cells of spongy mesophyll filled with microsphenoidal crystals of Ca oxalate.
- The palisade ratio is 5 to 7.



T. S. of Belladonna root

Figure-3

Chemical constituents

- It contain about 0.3-1.0% of alkaloids
- Main alkaloids are l-hyoscyamine and its racemic form is atropine.
- The leaves also contain afluroscent substance scopoletin.

ADULTANTS AND SUBSTITUTE:

- *Phytolacca Americana*- Idioblast present and anomocytic stomata.
- *Solanum nigrum*-Palisade ratio.
- *Alianthus glandulosa*-Lignified trichome present.

Uses: It is a Parasympathetic drug with anticholinergic property.

OPIUM

Synonym : Afim.

Biological source : Opium is obtained from dried latex obtained by incision of the unripe capsule of *Papaver somniferum*.

Variety : *Papaver somniferum album* (Indian)
Papaver somniferum glabrum (Turkey)
Papaver somniferum nigrum (European)

Family : Papaveraceae.

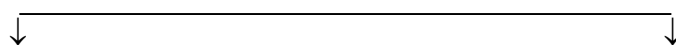
Microscopy :

- Microscope shows agglomerated latex granules in irregular mass.
- Stomata – Anomocytic
- Pointed trichomes, few starch granules present.

Chemical constituents

The present alkaloids has combined with organic acid i.e. Meconic acid.

OPIUM ALKALOIDS



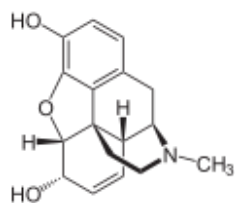
Benzylisoquinoline

- Noscapine
- Narceine
- Narcotine
- Papaverine (optically inactive)

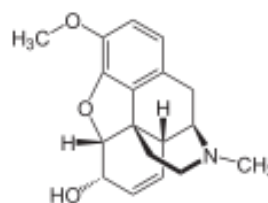
Phenanthrene ring

- Morphine
- Codeine
- Thebaine

- Morphine is monoacidic, phenolic alkaloids.
- Morphine is laevorotatory in nature.
- Opium alkaloids are present as salt of meconic acid.
- Opium also contains sugar, wax, mucilage and salt of calcium, potassium and magnesium.



Morphine



Codeine

Figure-4

Other Species (Allied plants) :

Papaver bracteum contains no morphine, they contains high percentage of thebaine so causes no addiction.

Chemical Constituents :

- 1) **Marquis test** – Morphine + Conc. H₂SO₄ + HCHO → Dark violet color
- 2) Meconic acid + FeCl₃ → Deep reddish purple color
- 3) Morphine + SiO₂ → Blue color
- 4) Papaverine solution in HCl and potassium ferricyanide develops a lemon yellow color.
- 5) Morphine, when sprinkled with concentrated HNO₃, shows an orange red color, this is not allowed by codeine.

- 6) Morphine solution when treated with ferric chloride and potassium ferricyanide gives a bluish-green color.

Uses :

- Morphine is used as a Analgesic.
- Sedatives and hypnotics
- Morphine also produces respiratory depression and constipation.
- Codeine – Cough syrup preparation.
- Papaverine – smooth muscle relaxants.
- Apomorphine – Emetic (for treating poisoning cases).

PHENYLPROPANOIDS AND FLAVONOIDS

PHENYLPROPANOIDS :

- The phenylpropanoids are diverse family of organic compounds that are synthesized by plants from the amino acids phenylalanine and tyrosine.
- The name is derived from the six-carbon, aromatic phenyl group and the three-carbon propene tail of coumaric acid, which is the central in phenylpropanoid biosynthesis.

FLAVONOIDS :

- Flavonoids are synthesized through the phenylpropanoid pathway transforming phenylalanine into 4 coumaroyl-CoA, which finally enters the flavonoids synthesis pathway.

LIGNANS

Biological source : The lignans are a large group of polyphenols found in plants. Lignans are macromolecules, polymers of basic units of C6-C3 n-propylbenzenes which are linked by the β carbon by their side chains.

Uses :

- Lignans have been found to exhibit antiviral, antibacterial, antifungal, antimitotic and antitumor properties.
- Lignans have been used as preservatives in the food, agriculture, rubber and pharmaceutical industries.
- These are used as stabilizing agents for lubricants and polymers such as adhesives and plastics.

TEA

Synonym : *Camelia thea*

Biological source : Tea is obtained from the prepared leaves and leaf buds of *Thea sinensis*.

Family : Theaceae

Chemical Constituents –

- Contains caffeine, theobromine, theophylline. Color of leaves is due to gallotannic acid.
- Also contain an enzymatic mixture called thease.

Chemical test :

Murexide Test-

- Caffeine + HCl + $KCl_3 \rightarrow$ Purple color $\xrightarrow{\text{Alkali}}$ Colorless

Uses :

- Stimulant effect on nervous system.

RUTA

Synonym :Rue

Biological source : It is native to Mediterranean region and distributed throughout the world.

Family : Rutaceae

Uses :

- Extracts from rue have been used to treat eyestrain, sore eyes and as insect repellent.
- Rue has been used internally as an antispasmodic, as a treatment for menstrual problem, as an abortifacient and as a sedative.

CARDIAC GLYCOSIDES

- The aglycan part of cardiac glycoside is a steroidal moiety so also called as steroidal glycoside.
- Two types---Cardenolides,Bufadienolides.
- Occurance of Cardenolides in nature is high as compared to bufadienolides.

Cardenolide

- It has C₂₃ steroids having α,β unsaturated five membered lactone ring attached at 17 β position.
- Eg-Digitalis,stropanthus

Bufadienolide

- It has C₂₄ steroids having unsaturated six membered lactone ring at 17 β position.
- Eg-Squill.

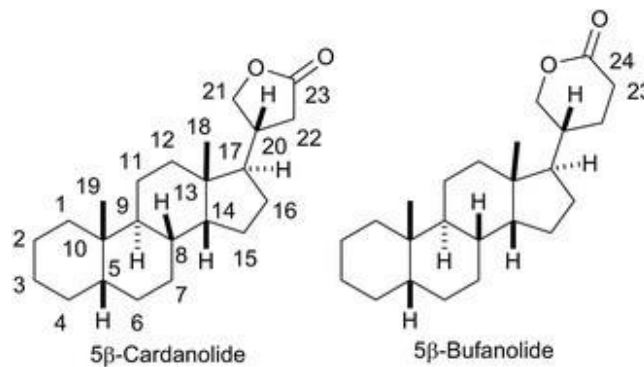


Figure-5

For maximum cardiac activity-

1. Lactone is attached to $\rightarrow 17\beta$ position.
2. Sugar part is attached to $\rightarrow 3\beta$ position.
3. Sugar part helps in absorption and distribution in body.
4. When number of hydroxyl group increased on the molecule the more rapid action in the body.

TRITERPENOIDS

- Triterpenoids have been found in both free states and in combination with sugars forming glycosides and esters.
- Triterpenoids are composed of 30 carbon atoms, polymerized to form six isoprene units.
- These are grouped into linear, monocyclic, dicyclic etc., up through pentacyclic compounds.
- These are widely distributed in nature; they may be found in fungi, fern, higher plants, animals and marine organisms.
- These are compounds with a carbon skeleton based on six isoprene units which are derived biosynthetically from the acyclic C₃₀ hydrocarbon, squalene. They have relatively complex cyclic structures, most being either alcohols, aldehydes or carboxylic acids.

LIQUORICE

Synonym : Mulethi

Biological source : Liquorice is obtained from dried peeled or unpeeled root and stolon of *Glycyrrhiza glabra var. typica* (Spanish liquorice)
Glycyrrhiza glabra var. glandulifera (Russian liquorice)
Glycyrrhiza glabra var. violacea (Persian liquorice)

Family : Leguminaceae

Macroscopy : The color of unpeeled liquorice is yellowish brown externally and yellowish internally while the peeled liquorice is pale yellow in color.

Microscopy : **Table-2**

T.S of Liquorice root	T.S of Liquorice stolon
Shows presence of polyhedral tubular brownish cork cells.	Also shows presence of polyhedral tubular brownish cork.
Absence of pith, shows tetrarch xylem.	Presence of pith.
Presence of medullary rays	Absence of medullary rays
Presence of cortex	Presence of cortex

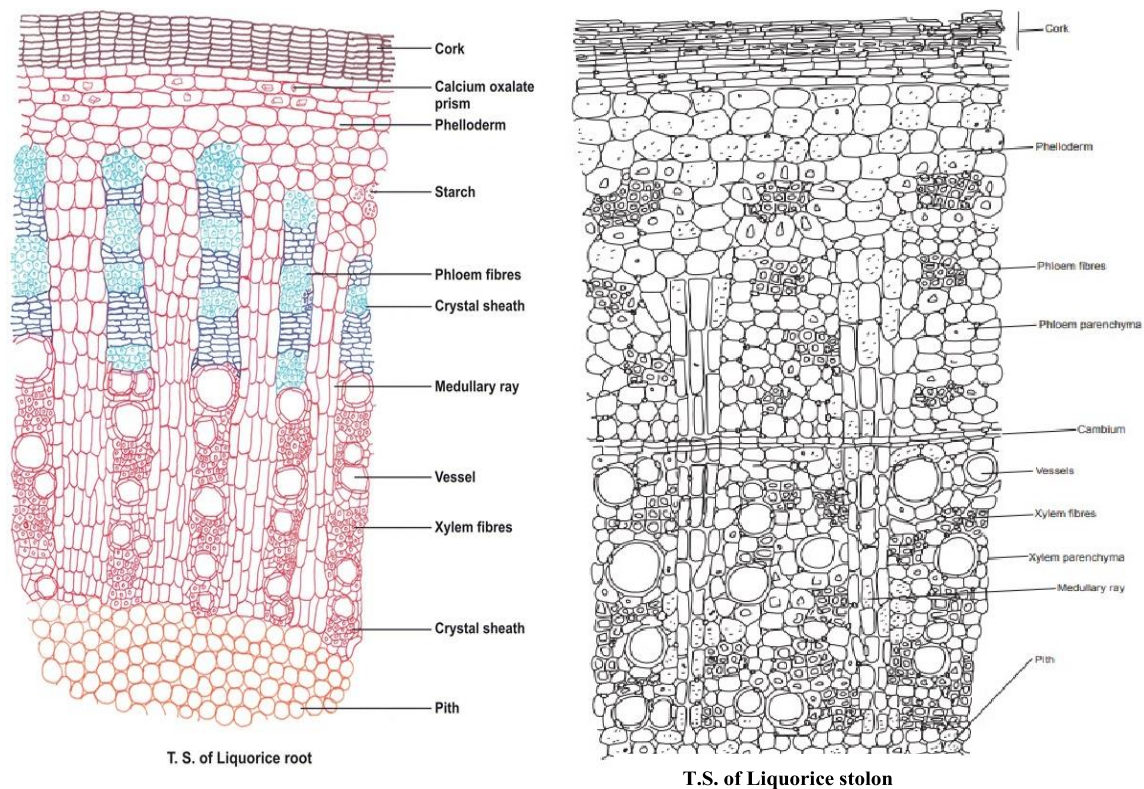


Figure-6

- ❑ Unpeeled drug shows presence of polyhedral tubular brownish cork cells.
- ❑ Thick, lignified fibres in phloem and xylem.
- ❑ Calcium oxalate are present in parenchyma.
- ❑ In stolons pith is present and it is parenchymatous.
- ❑ Root is characterized by presence of tetrarch xylem and absence of pith.

Chemical Constituents :

- ❑ Chief constituent is pentacyclic triterpenoid saponin known as glycyrrhizin (glycyrrizic acid) which is a potassium and calcium salts of glycyrrhizic acid.
- ❑ Presence of flavonoid (liquiritin and isoliquiritin) cause antigastric effect and it is useful in peptic ulcers.
- ❑ Carbenoxolone (used as anti ulcer drug) is an oleandane derivative prepared from glycyrrhiza.

Chemical Test :

Section of drug + 80% H₂SO₄ → Show Yellow Color

Uses :

- 1) Used as expectorant, demulcent.
- 2) It is used in peptic ulcer in the form of deglycyrrhized liquorice (DGL).
- 3) It is having minerocorticoid activity (due to glycyrrhetic acid). It is employed in place of corticoids for the treatment of rheumatoid arthritis, inflammation and addison's disease.
- 4) Flavouring agent.

Adulterants and Substitute :

- Manchurian liquorice (*Glycyrrhiza uralensis*)
- Russian liquorice (*Glycyrrhiza glandulifera*)

DIOSCOREA

Synonym : Yam plant

Biological source : Dioscorea is obtained from dried tubers of plant *Dioscorea deltoidea*.

Family : Dioscoreaceae

Chemical Constituents :

- Rhizomes contain 75% starch in rhizome.
- Chief active constituents is diosgenin (Sapogenin) and its glycosides smilagenin and yammogenin.
- Diosgenin is the hydrolytic product of saponin-dioscin.

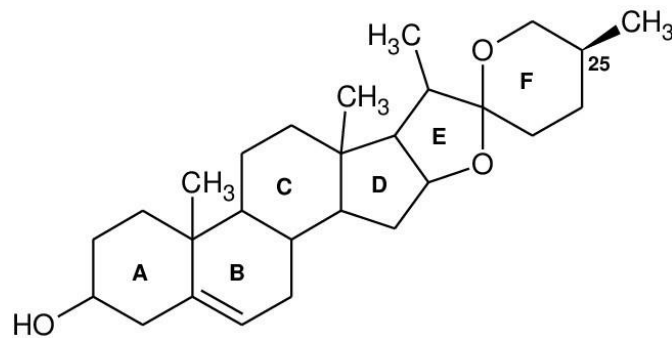


Figure-7

Uses:

- As a precursor for the synthesis of corticosteroids, sex hormones and oral contraceptives.
- Used in the treatment of rheumatic arthritis.

DIGITALIS

Synonym : Foxglove leaves

Biological source : Digitalis is obtained from dried leaves of plant *Digitalis purpurea* and *Digitalis lanata*.

Family : Scrophulariaceae

Description :

- Contains not less than 0.3% of total cardenolides calculated as digitoxin.
- Dried at temperature below 60°C, immediately after collecting the leaves.
- In leaves should contain not more than 5% of moisture.

Microscopy :

- Dorsiventral leaf.
- Anomocytic stomata in upper epidermis.
- Numerous covering trichomes and few glandular trichomes present.
- Covering trichomes are uniseriate and multicellulars.
- Glandular trichomes are unicellular stalk and bicellular head.
- Collapsed cell trichomes are important characteristic of digitalis leaf.

- Free of Calcium Oxalate crystals and sclerenchyma (stone cells).
- Colenchyma at 3 different places: (characteristic of digitalis leaf).
 1. Upper epidermis
 2. Lower epidermis
 3. Ppericyclic part

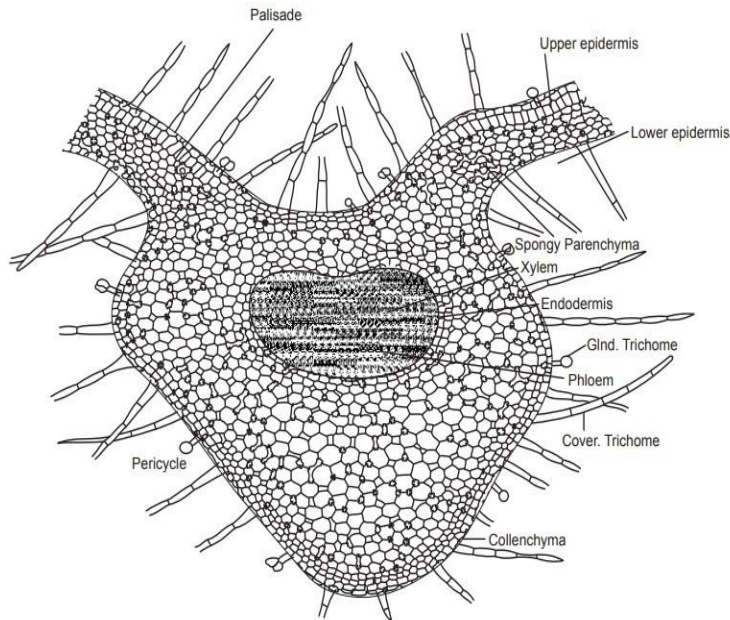


Figure-8

Chemical Constituents :

- Contains – 0.2 to 0.45% mixture of both primary and secondary glycosides.
- Primary glycoside : Purpurea glycoside A and B.
Contain linear chain of 3 digitoxose sugar terminated by glucose.
- Secondary glycoside (less absorbable) : digitoxin, gitoxin and gitaloxin.

Uses :

- Digitalis increase the force of systolic contraction, cardiac stimulant and cardiotonic.
- Used in congestive heart failure.
- Arterial flutter and arterial fibrillation.

VOLATILE OILS

- Volatile oils are defined as the odorous and volatile constituent of plant and animal species.
- Volatile oils are also termed as ethereal oil because they evaporate when exposed to air at an ordinary temperature.
- They are also called as essential oil as they are the essences or active constituent of the plant.
- They are composed of terpenes, monoterpene, sesquiterpenes, diterpenes, polyterpenes and their derivatives.

MENTHA OIL

Synonym : Peppermint oil

Biological source : Mentha oil is obtained by steam distillation of the fresh flowering tops of the plant *Mentha Piperita officinalis* –white mint
Mentha Piperita vulgaris – black mint

Family : Labiatae

Chemical Constituents :

- ☐ The main constituent is *l* – menthol 70%.
- ☐ Other constituents are *l* – limonene, Pinene, camphene.

Uses :

- ☐ Carminative, stimulant and flavouring agent.
- ☐ Used in the preparation of chewing gums, candies, toothpaste, shaving creams.

CLOVE

Biological source : It is the dried flowers obtained from the plant *Eugenea caryophyllus*

Family :Myrtaceae.

Macroscopic character:

Table-3

Color	Dark brown
Odour	Strongly aromatic
Taste	Pungent aromatic
Size	12-17 mm length
Shape	Spherical head sub-cylindrical shape tapering at lower end

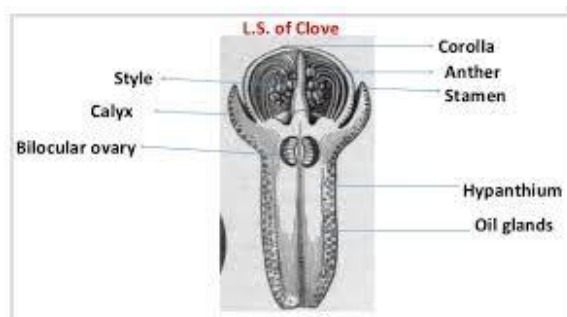


Figure-9

Chemical Constituents:

- ☐ 15-20% of volatile oil, proteins, fixed oil, active constituents of volatile oil of tannin, resin, eugenin.
- ☐ The volatile oil, the drug contains eugenol, eugenol acetate, caryophyllenes and small quantities of esters, ketones and alcohols.

Uses:

- Used as antiseptic, stimulant and aromatic.
- Clove is used as a dental analgesic, stimulant, flavouring agent, an aromatic and antiseptic.
- It is also used in the preparation of cigarettes.
- The oils are used in the perfumes and also in vanillin.

CINNAMON

Biological source : It consists of dried inner bark of *Cinnamomum zeylanicum*.

Family : Lauraceae

Macroscopic Characters:

- The outer surface is dull yellowish brown while the inner surface is dark yellowish brown.
- Found in the form of compound quills.
- About 1 m length and 1cm in diameter. The thickness of the bark is approximately 0.5 mm.
- Aromatic and sweet followed by warm sensation.

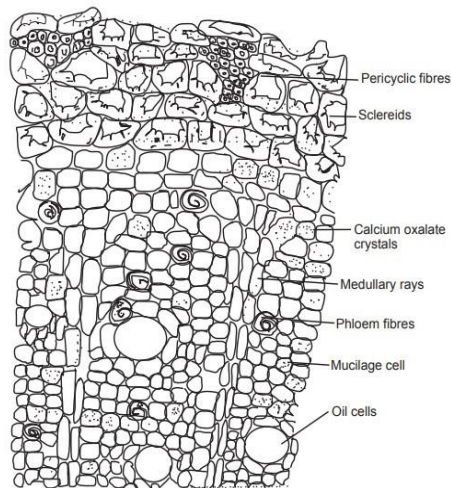


Figure-10

Chemical Constituents :

- Cinnamon bark contains about 0.5%-1% of volatile oil, 0.2% of tannin, phlobatannin, mucilage, Ca.oxalate, starch & sweet substance known as mannitol.

Chemical Test:

- On addition of a drop of ferric chloride solution to a drop of volatile oil a green color is produced with ferric chloride.

Uses:

- Bark is used as carminative, stomachic and mild astringent.
- It is also used as flavouring agent, stimulant, aromatic and antiseptic.

FENNEL

Biological source : It is the dried fruit obtained from the plant *Foeniculum vulgare*.

Family : Umbeliferae

Macroscopic character: **Table-4**

Color	Yellowish Green to yellowish brown
Odour	Aromatic
Taste	Strongly aromatic, sweet
Size	5-4 mm length, 4-10mm in diameter
Shape	Oval with bifid stiploid

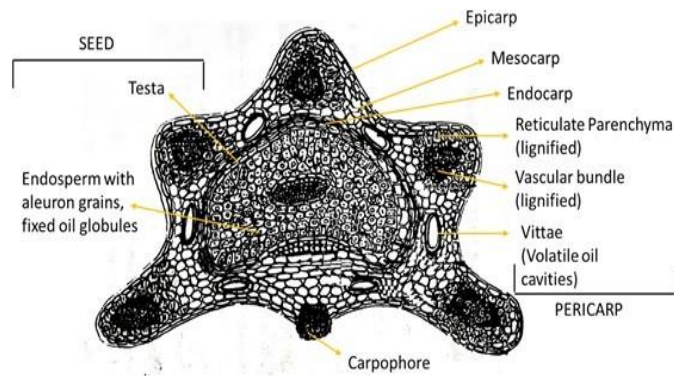


Figure-11

Chemical Constituents:

- 3-7% of volatile oil, proteins, fixed oil, active constituents of volatile oil are fenchone and anethole, anisic aldehyde, phellandrene and cimonene or some other are present.

Uses:

- It is used as carminative, aromatic, stimulant and also an expectorant.
- Pharmaceutically used as flavouring agent.

CORIANDER

Biological source : It is the dried fruit obtained from the plant *Coriandrum sativum*

Family : Umbeliferae

Macroscopic character: **Table-5**

Color	Yellowish brown
Odour	Aromatic
Taste	Spicy
Size	2-4 mm length, 4-30 mm in diameter
Shape	Globular and cremocarp

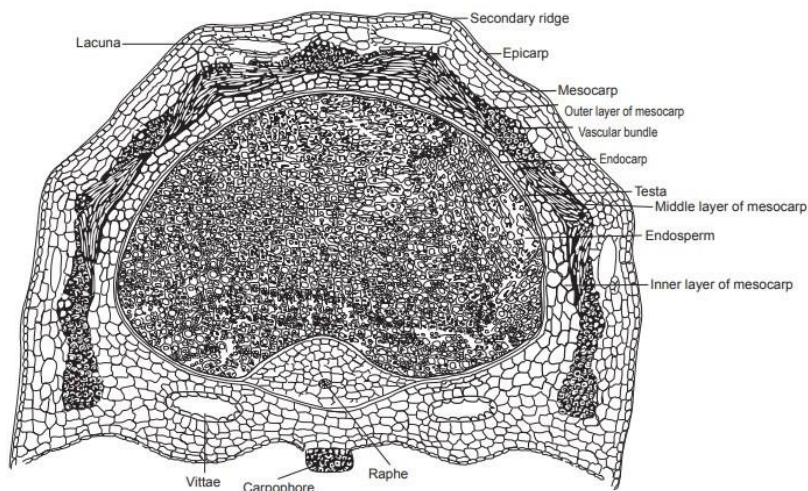


Figure-12

Chemical Constituents:

- ☐ Coriander yields 0.3% to 1% of volatile oil. D-Linalol and coriandryl acetate and small quantities of 1-borneol, geraniol and pinene.

Uses:

- ☐ The fruit and volatile oil are used as an aromatic,carminative,stimulant and flavouring agent.

TANNINS

- As the name indicates they posses the property to tan.
- Tannins are secondary metabolite of plant, non-nitrogenous and phenolic in nature and are present in cell sap and vacuoles.

PROPERTIES

- Tannins are freely soluble in alcohol, water, glycerol and dilute alkaloids.
- They precipitate proteins and alkaloids(astringent action)
- Tannins are precipitated by metallic salts of copper, tin and lead.
- Tannins shows color reactions with iron.

CATECHU

Synonym : Gambir
Biological source : Dried aqueous extract of the leaves of young shoots of Uncaria gambier
Family : Rubiaceae
Description :

- ☐ Pale catechu occurs as reddish-brown colored cubodial mass quite friable in nature.
- ☐ When broken, it shows cinnamon brown color and porous nature.
- ☐ The drug has no odour, but highly astringent taste which first appears bitter and then sweet.
- ☐ When mounted in water, it shows minute acicular crystals.

Chemical Constituents –

- The drug contains condensed tannins in the form of catechin, catechutannic acid and catechu red.
- The drug also contains quercetin and gambier fluorescein.

Uses :

- It is used as astringent in treatment of diarrhea and also as a local astringent in the form of lozenges.
- Pale catechu is mainly used in dyeing and tanning industries and also for protecting the fishing nets.

PTEROCARPUS

Synonym	: Malbar kino
Biological source	: It consists of the dried juice of the plant pterocarpus marsupium.
Family	: Leguminaceae
Macroscopy	:
	Color- ruby-red
	Odour- odour less
	Taste - astringent
	Shape - angular granules

Chemical Constituents –

- It contains kinnotannic acid, kino-red, resin and gallic acid. kinnotannic acid is a glucosidal tannin, while kinnored is anhydride of kinoin.
- Kinoin is an insoluble phlobaphene and is produced by the action of oxydase enzyme.
- It is darker in color than kinnotannic acid.

Identification :

1. When the solution of drug is treated with ferrous sulphate, green color is produced.
2. With alkali like potassium hydroxide violet color is produced.
3. With mineral acid, a precipitate is obtained.

Uses :

- It is used as powerful astringent and also in the treatment of diarrhea and dysentery, passive haemorrhage toothache and in diabetes.
- It is used dyeing, tanning and printing.

RESINS

- Resins are mixture of essential oils, oxygenated product of terpenes and carboxylic acid.
- Resin is a solid or highly viscous organic substance of plants or synthetic origin.
- Many plants, particularly woody plants, produce resin in response to injury.

Properties :

- Resins are transparent, amorphous solids, semisolids or liquid substances.
- They are insoluble in water, but soluble in alcohol, ether and chloroform.
- They are electrically non conductive.

BENZOIN

Synonym : Sumatra Benzoin, Loban
Biological source : Benzoin is a balsamic resin obtained from *Styrax benzoin* Dryand or *Styrax paralleloneurus* Perkins and other species of *Styrax* known in the market as **Sumatra Benzoin**.

Family : Styraceae

Macroscopy :

Sumatra Benzoin

Color – It is greyish brown or grey.

Odour – Aromatic and characteristic

Taste – Sweetish and slightly acrid

- It occurs in the form of lumps of varying sizes or tears. Tears are externally yellowish, milky white.
- The surface is uneven. When heated, fumes of benzoic and cinnamic acids are produced.

Chemical Constituents –

- Sumatra benzoin contains contains free balsamic acids (benzoic and cinnamic acids) and esters derived from them.

Identification :

1. Alcoholic solution of benzoin with water gives milky white solution.
2. Heat small quantity of benzoin in a test tube covering opening of test tube with a glass plate. Cool the contents of the test tube. Examine the glass plate under microscope. The crystals of cinnamic acid shall be observed.
3. To 2.5 g benzoin, add 10 ml ether, shake it well and pour 2 to 3 ml of this extract in a porcelain dish, add 2 to drops sulphuric acid. A deep brown color is produced in case of Sumatra benzoin and a deep purplish red color is obtained in case of Siam benzoin.
4. Add 4 ml solution of potassium permanganate to 1 g benzoin and warm odour of benzaldehyde is produced in case of Sumatra benzoin.

Uses :

- It is used in the form of compound tincture of benzoin, and as an inhalation, specifically in the treatment of upper respiratory tract infection.
- It is also used externally as an antiseptic and a protective.

GUGGUL

Synonym : Commiphora

Biological source : Guggul is the oleo-gum-resin obtained by making deep incisions at the basal part of stem bark of *Commiphora weightii*.

Family : Burseraceae

Macroscopy :

Color - Brown to pale yellow or dull green.

Odour-Agreable, aromatic and balsmatic.

Taste-Characteristic bitter.

Solubility-When triturated with water, it forms white emulsion. It is partly soluble in alcohol.

Chemical Constituents –

- The gum-resin portion of guggul contains steroids, diterpenoids, carbohydrates and aliphatic esters.
- They are present in a complex mixture form but the resin does not contain cinnamic acid. Guggul contain z-guggulosterone, E-guggulosterone and three new sterols guggulosterol I, II, III.

Uses :

- It is used as anti-inflammatory, anti-rheumatic, hypolipemic and hypo-cholesteremic drug.

GINGER

Synonym : Zingiber, Sunthi, Zingiberis

Biological source : Ginger consists of whole or cut, dried scrapped or unscrapped rhizomes of *Zingiber officinale* Roscoe.

Family : Zingiberaceae

Macroscopy :

Color – Externally, it is buff color.

Odour - Agreeable, aromatic.

Taste – Agreeable and pungent.

Size – Rhizomes of ginger are about 5 to 15 x 1.5 to 6.5 cm.

Shape – The rhizomes are laterally compressed, bearing short flat, ovate and oblique branches on the upper side, with bud at the apex.

Microscopy :

- Cork consists of irregularly arranged cells, followed by cortex.
- Cortex is made up of thin walled parenchymatous tissue. Well marked endodermis distinguishes the stele and the cortex.
- Vascular bundles just inside the endodermis are free of fibres.

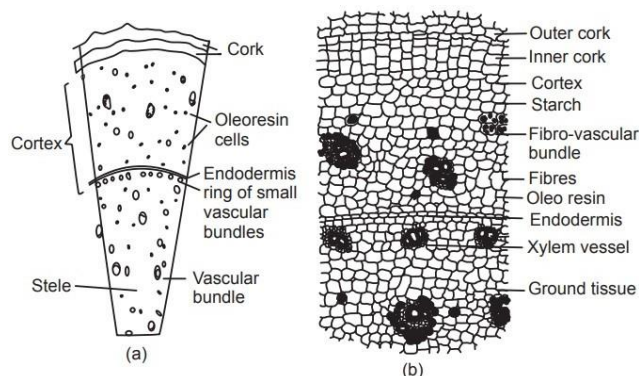


Figure - 13

Chemical Constituents –

- Ginger consists of volatile oil (1 – 4%), starch (40 – 60%), fibre (5%), inorganic material (6%), residual moisture (10%) and acrid resinous matter (5 – 8%).
- Ginger oil is constituted of monoterpene hydrocarbons, sesquiterpene hydrocarbons, oxygenated mono and sesquiterpenes and phenyl propanoids.

Uses :

- Ginger is used as a stomachic, an aromatic, a carminative, stimulant and flavouring agent.
- Ginger oil is used in mouth washes, ginger beverages and liquors.
- Ginger powder has been reported to be effective in motion sickness.

ASAFOETIDA

- Synonym** : Gum Asafoetida, Devil's dung
Biological source : Asafoetida is the oleo-gum resin obtained by incision from the rhizomes and roots of *Ferula foetida* Regel, *Ferula rubricaulis* Regel and other species of *Ferula*.
Family : Umbelliferae
Macroscopy :
Color – Yellowish-white changing to reddish brown.
Odour – Intense, persistent, penetrating and alliaceous.
Taste – Bitter, alliaceous and acid.
Size – The tears are 0.5 to 3 cm in diameter.
Shape – It occurs in 2 different forms i.e. tears and masses.

Chemical Constituents –

- Asafoetida contains resin (40 to 65%), gum (20 to 25%) and volatile oil (4 to 20%).

Identification :

1. Fractured surface of the drug, if treated with sulphuric acid forms red or reddish brown color.
2. When treated with 50% nitric acid, the drug gives green color.
3. When triturated with water, it forms the yellowish-orange color.

Uses :

- It is used as carminative, nervine stimulant or in intestinal flatulence.
- It is also used as flavouring agent for curries, sauces and pickles.
- It is used in veterinary medicine.

MYRRH

- Synonym** : Gum myrrh
Biological source : Myrrh is an oleo-gum-resin obtained from *Commiphora molmol*
Family : Burseraceae
Macroscopy : Color-Externally, it is reddish-brown, internally, brown.
Odour and Taste-Aromatic and agreeable.
Shape-It is found in the form of rounded or irregular tear.

Chemical Constituents –

- Myrrh contains about 10% of yellowish thick volatile oil, 60% of gum, 25 to 40% resin and about 3 to 4% bitter principle.
- Resin contain ether-soluble resin acids, α , β and γ commiphoric acids.
- The volatile oil contains terpenes, cumminic aldehyde, eugenol etc.

Uses :

- It is used as a stimulant and antiseptic .
- It is also protective.
- Myrrh is astringent to the mucous membrane and hence its tincture is used in the mouth washes and gargles.

COLOPHONY

- Synonym** : Pine-resin
Biological source : Colophony is the residue left after the distillation of the oil of turpentine from the crude-oleo-resin obtained from the various species of pinus plant.
Family : Pinaceae.
Macroscopy :Color-Pale yellow to yellowish brown to amber color.
Odour-Faint and terebinthinate.
Taste-It occurs in the form of angular,transluscent masses of various size.

Chemical Constituents –

- Colophony contains mainly resin acids which are unsaturated and hence reactive.
- About 90% of this is abetic acid.
- The drug contains esters of oleic acid and resin acids.
- It also contains 0.5% volatile oil, 5-6% resenes.
- Other acid in the colophony are sapinic acid and pimaric acid.

Uses :

- Colophony is a stimulant and diuretic.
- It is ingredient of certain plaster masses and collodions.
- It is also used in the preparations of ointments .Industrially, it is used in the preparations of varnishes, soaps, printing inks etc.

GLYCOSIDES

- Glycosides are organic compound from plant or animal sources.
- On enzymatic or acid hydrolysis yields one or more sugar moieties known as glycone and non sugar moiety aglycone.
- Aglycone part-Responsible for chemical and therapeutic property.
- Glycone part—Responsible for facilitates absorption of glycosides and helps in transportation of aglycone portion at the site of action.
- Chemically they are acetals or sugar ethers, formed by the interaction of hydroxyl group each of sugar and non sugar moiety with loss of water molecule.
- Sugar is mostly β -D-glucose others are galactose, mannose, rhamnose, digitoxose, cymarose etc.
- Linkage between aglycone and glycone is called as glycosidic linkage and on the basis of this linkage α and β stereoisomer is assigned.

Properties

- Most glycosides are Colorless, Crystalline.
- Anthraquinone- Red or Orange in color.
- Flavone glycoside-Yellow in color.
- Glycosides are solubule in water, alcohol but insolubule in chloform and ether.
- The glycosides are extracted by using stas-otto method.

SENNA

Synonym : Indian Senna, European Senna
Biological source : Senna is obtained from leaflets and pods of *Cassia angustifolia* and *Cassia acutifolia*.
Family : Leguminaceae
Macroscopy :

- Isobilateral leaf-typical histological character of senna.
- In Indian variety less hair is present as compared to European senna.
- Active constituents are present in epicarp of leaf and pericarp of pods.
- It is a leguminous plant so add nitrogen soil at regular interval.

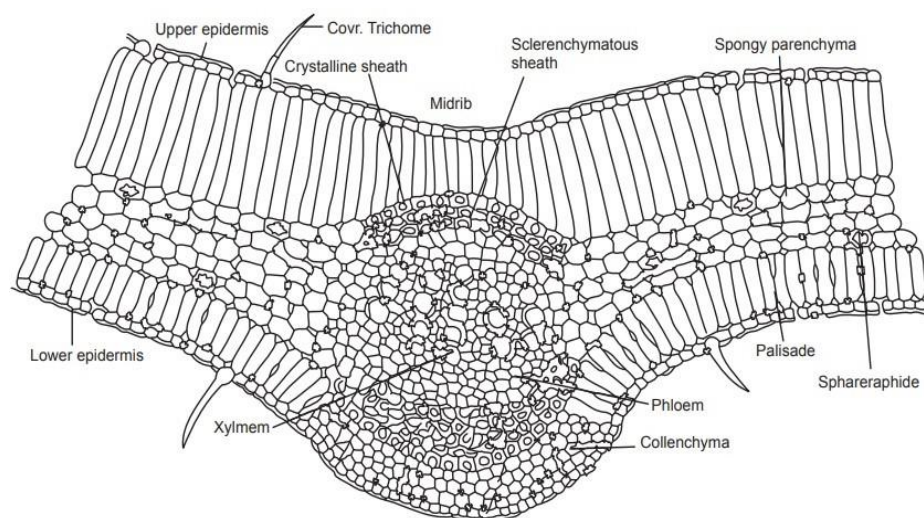


Figure -14

Microscopy :

- Epidermis shows presence of unicellular, conical thick-walled trichomes.
- Microscopically two varieties of senna are distinguished by Vein-islet number and stomatal indices.
- Stomata type - Paracytic.
- Presence of cluster sheath and collenchyma are characteristic features of senna leaves.

Chemical Constituents –

1. Anthraquinone glycoside
 - a. Sennosides A, Sennosides B, Sennosides C, Sennosides D
 - b. Emodin, Chrysophenol, Aloe emodin, Rhein
 2. Two naphthalene glycosides – 6-hydroxymusizin glycoside (Alexandrian senna); and tinnevellin glycoside (Tinnevely senna)
 3. It also contains – flavanol, kaempferol
 4. Phytosterol and its glycoside – Mucilage, Resin, Calcium oxalate
- Sennoside A and Sennoside B are the active constituents of drug and stereoisomers of each other and are dimeric glycosides.

Sennidin : Only dimer aglycone moiety, sugar is absent.

Sennosides : Are dianthrone derivative of aglycone with glycone part of two identical compounds.

- In sennoside A it is decorative and in sennoside B, the aglycone is in meso form.

Adulterants and Substitute :

- **Dog senna** (*cassia obovata*) – Leaves are obovate in shape, Consists Pappiloses cells in lower epidermis.
- **Palthe senna** (*cassia auriculata*) – Characterized by absence of anthraquinone glucoside.
- **Arabian senna** – wild plant of cassia angustifolia.

Uses : Acting as a purgative by increasing peristalsis movement of intestine.

ALOES

Synonym : Ghritkumari

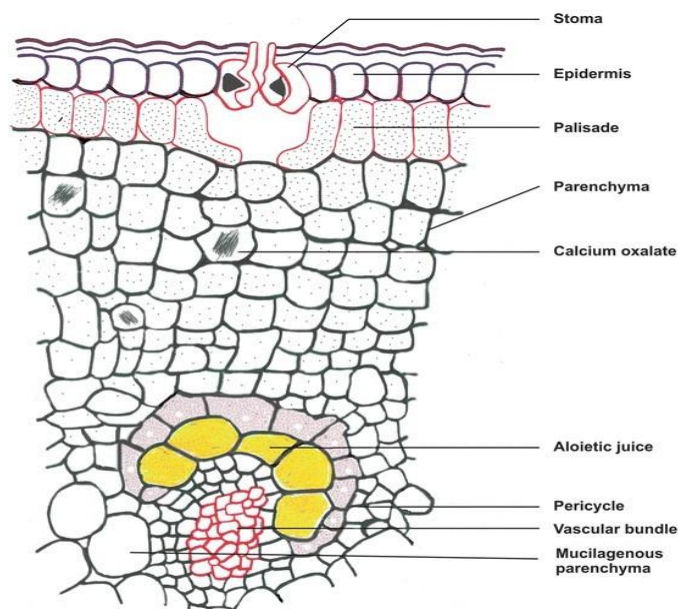
Biological source : Aloe is obtained from the dried juice of leaves of aloe species. Aloe barbendis (Curaco aloe), Aloe ferox (Cape aloe), Aloe perryi (Scortine aloe), Aloe vera (Indian aloe).

Family : Liliaceae

Macroscopy :

Table-6

	Form	Color	Fracture
Curacao	Opaque masses	Yellow brown to chocolate brown	Waxy like
Cape	Transparent and glassy	Dark brown or greenish brown	Smooth and glassy
Scortine	Opaque	Reddish-black to brownish black	Conchoidal
Zanzibar	Opaque	Liver brown color	Smooth and even fracture



T. S. of Aloe leaf

Figure - 15

Microscopy :

- T.S of leaf shows outermost cuticle followed by epidermis, palisade cells, mucilaginous parenchyma.
- Aloe juice present in pericycle fibre.
- Aloe gel present in Mucilaginous cell.
- Calcium oxalate crystals are present in parenchyma.

Chemical Constituents –

- Principle active constituents of aloe is aloin and aloin is a mixture of three isomer- Barbaloin, β -barbaloin, and iso-barbaloin.
- Among all barbaloin is the main constituents.
- Proportion of barbaloin varies in different variety of aloe.
- Aloe barbedis (Curaco aloe)-22% of barbolin present.
- Aloe vera (Indian aloe)-3.5-4% barbolin is present.
- It also contains
Aloesin-Resin present which also gives purgative action.
Aloctine-Increase removal of dead cells from skin.

Adulterants and Substitute :

1. **Natalaloes**-It resembles to cape aloes in microscopic character therefore it is used as substitute. It is a weak purgative.
2. **Mocha aloes**-It is brittle, black and glassy aloe with strong odour.

BITTER ALMOND

Synonym : Amygdala amara, Badam

Biological source : Bitter almond is obtained from dried ripe seeds of plant *Prunus amygdalus* and *Prunus communis* (sweet almond tree)

Family : Rosaceae

Chemical Constituents – Contains colorless, crystalline glycoside amygdalin (2.5 to 4%)

Uses :

- Sedative and demulcent in skin lotion.
- Flavouring agent.

IRIDOIDS

- Iridoids are a type of monoterpenoids in the general form of cyclopentanopyran, found in a wide variety of plants and some animals.
- They are biosynthetically derived from 8 – oxogeraniol.
- Iridoids are typically found in plants as glycosides, most often bound to glucose.
- The chemical structure is exemplified by iridomyrmecin, a defensive chemical produced by the genus *Iridomyrmex*, for which iridoids are named.
- The iridoids produced by plants act primarily as a defense against herbivores or against infection by microorganisms.

NAPHTHOQUINONES

- ☐ Naphthoquinone is a class of organic compounds structurally related to naphthalene.
- ☐ Two isomers are common for the parent naphthoquinones :
 - 1,2 – Naphthoquinone
 - 1,4 – Naphthoquinone
- ☐ Naphthoquinones usually do not occur as glycosides in higher plants.
- ☐ Naphthoquinones represent the group of plant secondary metabolites with cytotoxic properties based on their ability to generate reactive oxygen species and interfere with the processes of cell respiration.
- ☐ The most important naphthoquinones containing plants belong to the group of phylogenetically heterogenous plant families.

GENTIAN

Synonym : Gentian root, Gentiana, Radix Gentianae.

Biological source : Gentian is the dried partially fermented rhizome and root of yellow gentian i.e. *Gentiana lutea*.

Family : Gentianaceae

Macroscopy :

- ☐ The rhizome is yellowish – brown and has transverse annulations and shows conical buds at the top.
- ☐ The root is narrower but continuous with rhizome.
- ☐ It is longitudinally wrinkled and has circular scars of rootlets.
- ☐ The drug has a peculiar odour.
- ☐ The drug first gives a sweet taste, followed by an intensely bitter taste.

Microscopy :

- ☐ The transverse section of rhizome shows bark, cambium, wood and pith.
- ☐ The root shows these parts but no pith, in place of which a triarch primary xylem is present.
- ☐ The cork cells are thin walled.
- ☐ Cortex has parenchyma with oil globules and calcium oxalate.
- ☐ Phloem is present in small groups and phloem fibres are absent.
- ☐ The xylem contains spiral and annular vessels and also shows presence of interxylary phloem.

Chemical Constituents –

- ☐ The drug contains bitter glycosides mainly gentiopicrin, which is also called gentiopicroside.
- ☐ It is a water soluble, crystalline compound with a bitter value of 12,000. During fermentation and drying, it breaks down to gentiogenin and glucose.

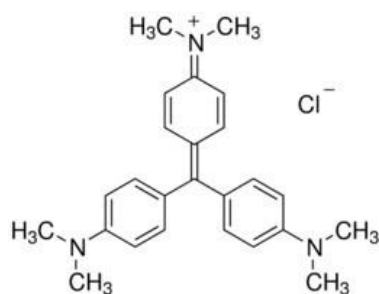


Figure - 16

Chemical Test:

- Under UV radiation gentian extract shows light blue fluorescence.

Uses :

- It is used as a bitter tonic to stimulate the gastric secretion and hence improving the appetite.

ARTEMISIA

Synonym : Santonica; Worm seeds

Biological source : These are the unexpanded flower – heads of *Artemisia cina* Berg, *Artemisia brevifolia* Wall, *Artemisia maritime* Linn. and other species of Artemisia.

Family : Compositae

Macroscopy :

Color – Flowers are yellow in color, while other parts are whitish grey.

Odour – Aromatic and sweet

Taste – Bitter and camphoraceous

- The drug consists of yellowish or brownish flower – heads, which are oval in shape.
- Flowers are fertile with tubular corolla and cylindrical tube and narrow limb.
- Calyx is absent.

Chemical Constituents –

- Santonica contains essential oil and two crystalline substances i.e. santonin and artemisin.
- The volatile oil content varies from 1.0 to 2%, while the percentage of santonin is about 2.0%.
- The volatile oil contains cineole, pinene and resin.

Identification :

- Boil 1g finely powdered drug with 10 ml alcohol and filter.
- To the filtrate, add sodium hydroxide and heat again.
- The liquid develops red color.

Uses :

- Santonica is used as a strong anthelmintic, especially for round worms.
- It has less or no effect on hook worms and tape worms.

TAXUS

Synonym : Yew, Talispatra, Himalayan Yew

Biological source : This consists of dried leaves, bark and roots of various species of Taxus. The four important species with parts used are as under.

1. *Taxus baccata* (English or European yew) mainly leaves
2. *Taxus brevifolia* (Pacific yew) mainly stem bark.
3. *Taxus Canadensis* (Canadian or American yew) leaves and roots.
4. *Taxus cuspidate* (Japanese yew) leaves.

Family : Taxaceae

Chemical Constituents –

- The main constituent taxol is present in all parts of the plant especially in leaves, roots and bark of the plant.
- Three most important member of taxol, cephalomannine and 10-deacetyl baccatin.
- A derivative of taxol , called taxotere has been reported to have better bio-availability and pharmacological properties and has been claimed as a promising anticancer agent.

Uses :

- Taxol brings out the polymerization to microtubule in absence of MAP and GTP.
- Due to this, microtubule formation is much enhanced which causes effects on dividing cells which leads to blockade of cell cycle.
- Taxol also inhibits cell migration thus, preventing spread of metastatic cancer cells.
- Taxol has been approved by USFDA for treatment of refractory ovarian cancer.

TETRATERPENOIDS AND CAROTENOIDS

- They are C₄₀ compounds of terpenoid groups and biosynthetically prepared by tail-to-tail condensation of geranyl geraniol.
- They contain long sequence of conjugated double bonds.
- Carotenoids are a prominent group of natural coloring matters exhibiting purple, red, yellow or orange colors.
- They are present both in plants and animals.
- In plants, they act as photosynthetic accessory pigments and in animals as a source of vitamin A and also as antioxidants.

REFERENCES :

1. Kokate, C.K, 1994. Practical Pharmacognosy. Vallabh Prakashan. New Delhi, India.
2. Krishnakumar, P.R and Suresh Kumar, D., 1995. Conservation of plants from Siddha system. Industry meet-cum-seminar on Bio-diversity and information on medicine and Aromatic plants,15-17, Nov., 1995, New Delhi, India.
3. Warriar, PK, Nambiar, VPK and Rarnankutty, C., 1994. Indian medicinal plants, Vol. 1-4. Orient Longman, Hyderabad, India.
4. Tyler, V.E., Brady, L.R. and Robbers, I.E., 1981. Pharmacognosy, Lea and Febiger, Philadelphia, U.S.A.
5. Srivastava, G.N. and Srivastava, AK., 1988. Pharmacognosyof *Cataranthus roseus* (L.) G. Don (Sadabahar) root and its adulterants. International Journal of Crude Drug Research, 26(1): 33-44.
6. Mallavarapu, G.R., Ramesh, S., Chandrasekaran, R.S., Rao, R.B.R., Kaul, P.N.,and Bhattacharya, A.K., 1995. Investigation of the essential oil of Cinnamomum leaf grown at Bangalore and Hyderabad.
7. Jain, S.K, 1996. Medicinal plants. National Book Trust, New Delhi, India.
8. Jain, S.P., 1989. Tribal Remedies from Saranda forest, Biliar, India. International Journal of Crude Drug Research.
9. Gopalan, C., Ramasastri, S.V. and Balasubramanian, S.C.,1984. Nutritive value of Indian food. National Institute of Nutrition, Hyderabad, ICMR, New Delhi, India.
10. Chopra, R.N., Nayar, S.L. and Chopra, I.C., 1956. Glossary of Indian Medicinal Plants, CSIR, New Delhi, India.