Unit-II (BOP-474)

Imidazole Alkaloid

The amino acid *L-histidine*, containing the heterocyclic imidazole ring, is considered to be the right precursor of alkaloids that essentially comprise of this ring-system.

A good number of *Pilocarpus species*, belonging to family *Rutaceae*, found to contain plethora of alkaloids with an *imidazole ring*, namely: **pilocarpine, isopilocarpine,** and **pilosene.** It has been observed that the alkaloids in these species invariably reside in the leaves. **Pilocarpine** constitutes 0.5-1.0% of the dried leaf material. **Isopilocarpine** appears to vary significantly within a range from 5 to 7.5% of the total alkaloids. Further, the alkaloids are located mostly in the upper epidermal leaves of the cells of the leaves, and also in the cells of the mesophyll bordering upon the lower epidermis.

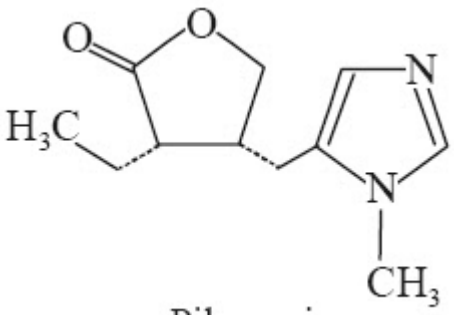
The *three* major alkaloids derived from histidine shall be described in the sections that follows.

Pilocarpus

Biological Source : Pilocarpine is obtained from the leaves of closely related plants of the genus*Pilocarpus*, belonging to the natural order *Rutaceae*. However, the genus comprised of a variety of species commonly known by various names, such as: *Pilocarpus jaborandi* (*PernambucoJaborandi*),(*Pilocarpuspennatifolius* (**Paraguay Jaborandi**); *Pilocarpus microphyllus*

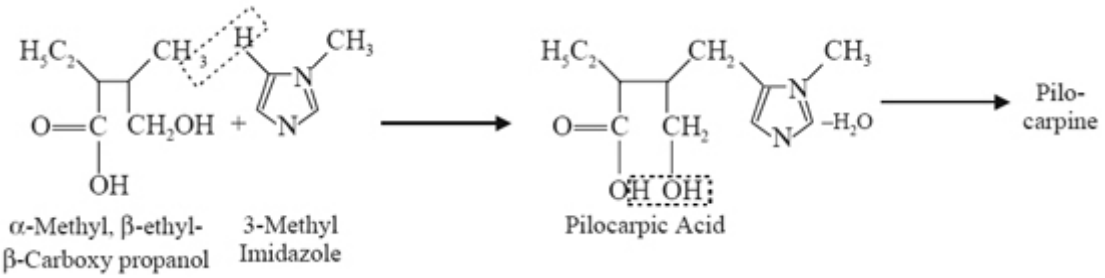
Pilocarpus

Chemical Structure



Pilocarpine

Pilocarpine is a monoacidic tertiary base comprising of a lactone ring and an imidazole nucleus. It is the lactone of **pilocarpic acid,** an acid with a **glyoxaline** nucleus, as given below:



α-Methyl, β-ethyl-β-Carboxy propanol

3-Methyl Imidazole

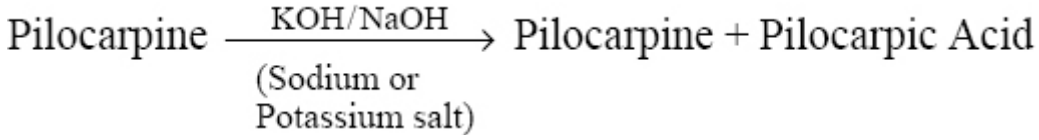
Pilocarpic Acid

Pilo-carpine

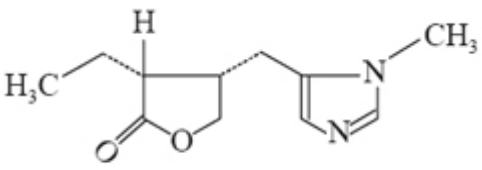
Characteristic Features

1. It is found as oil or crystals having mp 34°C.
2. It is soluble in water, alcohol, chloroform, sparingly soluble in ether and benzene; and practically insoluble in petroleum ether.
5. It exhibits an absorption maximum at 263 nm.
6. It behaves as a monoacidic base.

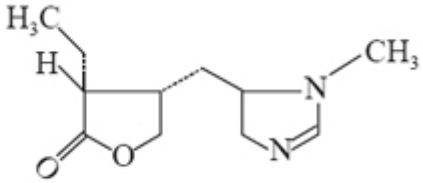
Cessation of Lactone-Ring: The lactone ring is opened-up (undergoes cessation) by treatment with strong alkalies like NaOH, KOH, which ultimately form salts with the formation of **pilocarpic acid** as given below:



Isomerism Pilocarpine and **isopilocarpine** are stereoisomers, that essentially exhibit the stereochemical difference in the **lactone moiety** of the molecule as shown below:



Pilocarpine



Isopilocarpine

However, the above observation is based on the experimental evidence, which specifically depicts that the isomerism of the above two alkaloids still persists, even when the **imidazole moiety** undergoes destruction under mild experimental conditions.

Identification Tests

1. **Helch's Violet-Colour Test:** Pilocarpine readily forms a violet coloured compound when a solution of either the base or its salt is first treated with hydrogen peroxide (H2O2) and then with potassium dichromate ($K_2Cr_2O_7$) in the presence of few drops of dilute sulphuric acid (Helch, 1902).

2. **Ekkert's Colour Tests:** Add to 1 ml of 1% (w/v) solution of pilocarpine hydrochloride ($C_{11}H_{16}N_2O_2$.HCl) 1 ml of sodium nitroprusside solution (2% w/v) and 1 ml of NaOH solution (1N). Allow the reaction mixture to stand for 6-8 minutes and then acidify with dilute HCl when a wine or red colour develops.

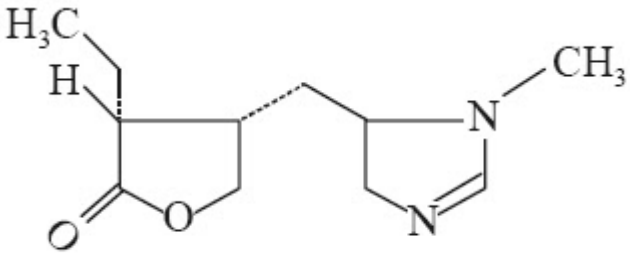
Uses

1. Pilocarpine possesses miotic and diaphoretic actions.
2. Pilocarpine nitrate is used extensively as an ophthalmic drug having cholinergic action.
3. It is also employed to reduce the intra-ocular pressure in glaucoma patients.

Isopilocarpine

Synonym β-Pilocarpine.

Chemical Structure



Isopilocarpine

Characteristic Features

1. It is a hygroscopic oily liquid or prisms.

2 It is miscible with water and alcohol; very soluble in chloroform; less soluble in ether and benzene; and almost insoluble in petroleum-ether.

Uses

1. It is used as an antiglaucoma agent.
2. It is also employed as miotic.

Steroidal Alkaloids

In general, the **steroidal alkaloids** represent an important class of alkaloids that essentially afford a close structural relationship to sterols *i.e.,* they contain a perhydro-1, 2-cyclopentanophenanthrene nucleus. Interestingly, these group of alkaloids invariably occur in the plant kingdom as glycosidal combination with carbohydrate moieties.

The **steroidal alkaloids** may be broadly classified into *two* major groups, namely:

(*a*) Solanum Alkaloids, and
(*b*) Veratrum Alkaloids.
These two class of alkaloids shall now be discussed in an elaborated fashion hereunder:

A. Solanum Alkaloids

A good number of plants belonging to the natural order *Solanaceae* have been found to accumulate favourably several **steroidal alkaloids** based on a *C27 cholestane skeleton*, such as: **solasodine, tomatidine, solanidine.** These alkaloids usually occur in a wide variety of the genus *Solanum, Solanum xanthocarpum, Solanum khasianum ,Solanum laciniatum; S. dulcamara* Linn etc. The three above mentioned alkaloids normally occur naturally in the plant as their co *Solanum laciniatum* responding glycosides.

However, the two species of *Solanum,* namely: *S. laciniatum* and *S. aviculare* are considered to be a rich source of alkaloids (*i.e.*, the aglycone moieties) that are employed exclusively as the starting materials for the synthesis of several hormones and adreno-cortical steroids.

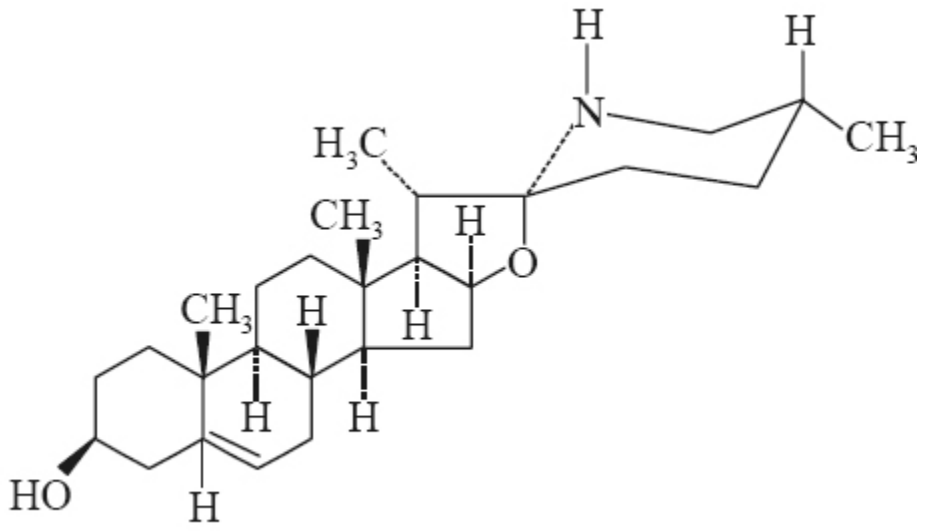
The **solanum alkaloids**, stated above are essentially the nitrogen-analogues of steroidal saponins.

Solasodine

Biological Sources It is obtained from the fruits of *Capsicum annuum* L. (*Solanaceae*) (**Chili, Paprika, Sweet Peppers**); shoots and berries of *S. dulcamara* L. (*Solanaceae*) .

It has sharp and prickly branches that are densely covered with rather minute star shaped hair. The herb has yellow colored shining prickles that are of 1.5 cm in size. The sparsely hairy egg shaped leaves, purple colored flowers and round fruits. The Solanum Xanthocarpum is native to India. This herbal plant is usually found in wastelands of India and on the roadside as well as open scrublands.

Chemical Structure

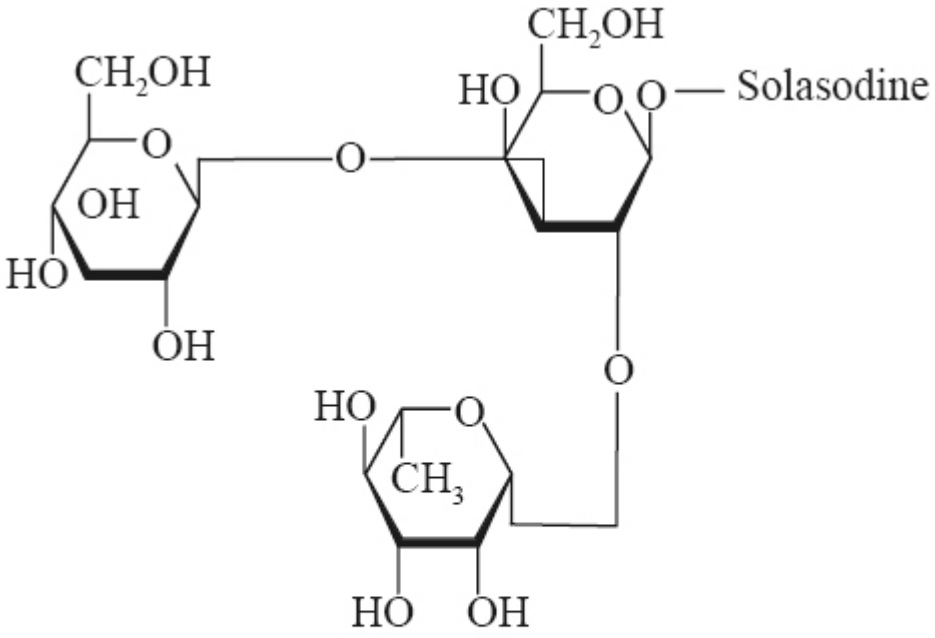


Solasodine

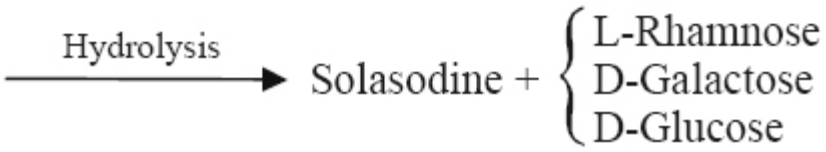
Isolation It is obtained by the hydrolysis of **solasonine** which yields **solasodine**, L-rhamnose, Dgalactose and D-glucose respectively. It is the dehydrated product.

Characteristic Features

(*i*) It is obtained as hexagonal plates from methanol or by sublimation under high vacuum.



Solasonine



(*iii*) It is freely soluble in benzene, pyridine, and chloroform; moderately soluble in ethanol, methanol, and acetone; slightly soluble in water and practically insoluble in ether.

Identification Tests (for Solanum Alkaloids)

1. Dissolve 5-10 mg of the alkaloid in a few drops of hot amyl alcohol or ethanol and allow it cool gradually. The appearance of jelly-like product gives the characteristic test of the solanum alkaloids.

2. When a few mg of the alkaloids is treated with antimony trichloride solution in dry chloroform, it gives rise to a distinct red colouration.

3. The **solanum alkaloids**, in general, produces an instant red-violet colour with formaldehyde (HCHO) and sulphuric acid (H_2SO_4). This particular test is so distinct and sensitive that it is used for the quantitative estimation of these alkaloids colorimetrically.

THE HERB IS KNOWN TO RELIEVE THE FOLLOWING HEALTH PROBLEMS:-

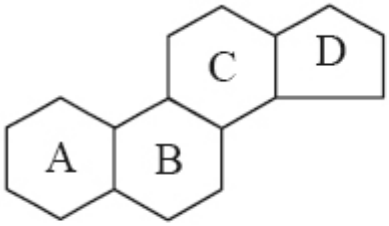
- **Respiratory disorders:** the Solanum Xanthocarpum is used for clearing catarrh as well as phlegm in the bronchial tubes. This makes it a management for respiratory problems like bronchitis, cough and asthma.
- **Stomach disorders:** the herb is used to relieve problems of flatulence and constipation. It is used to strengthen and promote the action of the stomach. It is known to correct the disordered process of nutrition absorption in the body. The herb possesses an anthelminitic or worm destroying property that helps in relieving the problem of intestinal infection.
- **Dropsy:** the Solanum Xanthocarpum is used to relieve dropsy which is the excessive collection of fluids in tissues as well as the cavities of the body.
- **Throat disorders:** the Solanum Xanthocarpum is used to relieve problems like sore throat and tonsillitis. The extract of the plant is used in gargles for this purpose.
- **Gum diseases:** the Solanum Xanthocarpum is used with black mustard for relieving gum problems.
- **Snake bites:** the herb root can relieve problems of snake and scorpion bites. A paste made from it can be added to lemon juice for application on the affected area.
- The Solanum Xanthocarpum is also used to relieve problems of gonorrhea, enlargement of liver, dysuria, fever, worm infestations, epilepsy, flatulence, colic, rheumatoid arthritis, dental issues, amenorrhea, kidney stone as well as enlargement of spleen.

B. Veratrum Alkaloids

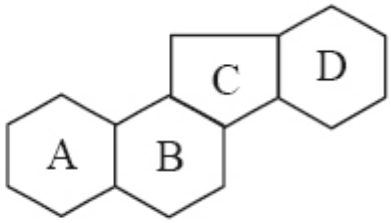
The **Veratrum alkaloids** represent the most important and medicinally significant class of steroidal alkaloids. It is, however, pertinent to mention here that the *basic ring systems* present in the Veratrum alkaloids are not quite the same as seen in the usual steroidal nucleus, as present either in the cholesterol or in the aglycone residues of the cardiac glycosides.

Veretrum

(A). Interestingly, one may observe in the structures of Veratrum alkaloids that the ring 'C' is a five membered ring while ring 'D' is a six-membered ring (B) which apparently is just the reverse of the pattern in the regular steroidal nucleus as depicted in next page.



(A)



(B)

Examples

(*a*) Alkamine portion of the **ester alkaloids of Veratrum,** *viz.,* **Protoverine, Veracevine, Germine.**

(*b*) **Alkamine aglycones of glycosidic veratrum alkaloids,** *viz.,* **Veratramine.**

In general, the majority of **Veratrum alkaloids** may be classified into *two* categories solely based on their characteristic structural features, namely:

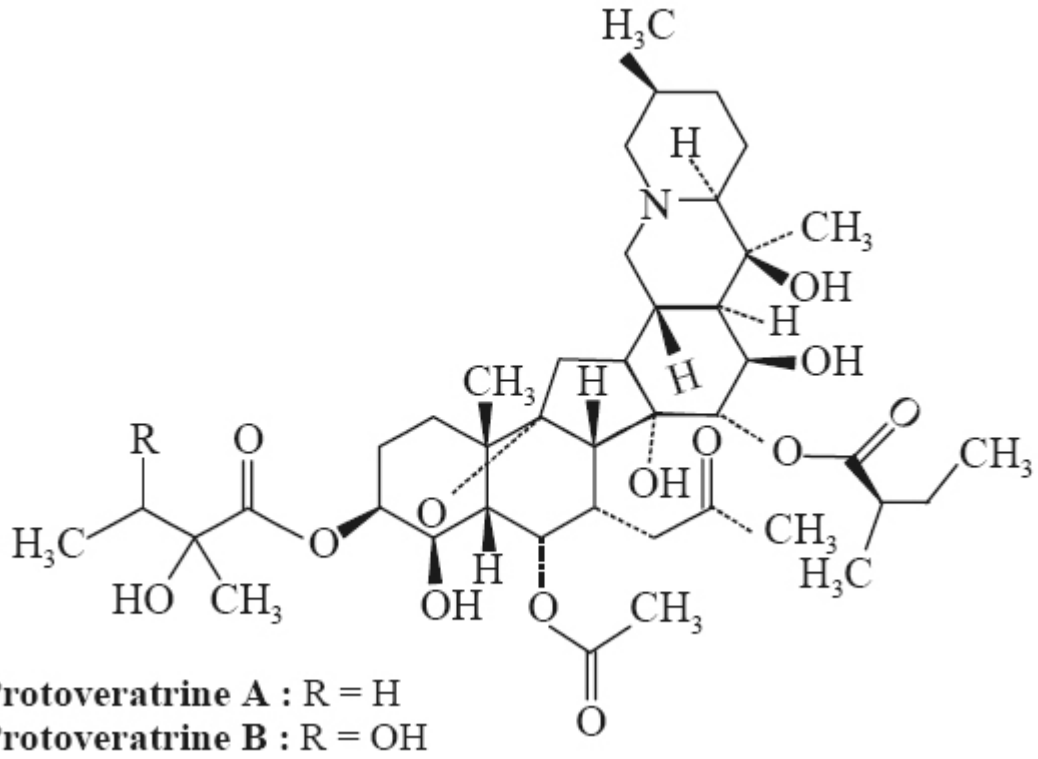
(*i*) Cevaratrum alkaloids, and

(*ii*) Jeveratrum alkaloids

These *two* categories of **Veratrum alkaloids** shall now be discussed individually in the sections that follows:

Ceveratrum Alkaloids The important alkaloids belonging to this group of alkaloids are, namely: **Protoveratrines; Veratridine, Cevadine, Germine** etc., which shall be treated separately hereunder:

Chemical Structure



Protoveratrine A : R = H
Protoveratrine B : R = OH

Characteristic Features The characteristic features of the **protoveratrines** are as follows:

(*i*) The sternutative crystals obtained from ethanol have a slightly bitter taste.

(ii) It is soluble in chloroform, dilute aqueous acidic solutions and slightly soluble in ether. It is practically insoluble in water and petroleum ether.

However, the characteristic features of **protoveratrine A and B** are as stated below:

S. No.	Characteristic Features	Protoveratrine-A (Protalba)	Protoveratrine-B (Veratetrine; Neoprotoveratrine)
1.	Nature	Crystals obtained from acetone	Crystals obtained from acetone
2.	Decomposition temperature/mp	267-269° (dec.)	268-270° (dec.)
3.	Specific rotation	$[\alpha]_D^{25}$ – 40.5° (pyridine); $[\alpha]_D^{25}$ – 10.5° (chloroform);	$[\alpha]_D^{25}$ – 37° (dec.); $[\alpha]_D^{25}$ – 3.5° (chloroform);
4.	Solubility	Soluble in chloroform, hot ethanol and pyridine	Soluble in hot ethanol, pyridine and chloroform
5.	Stability in alkaline medium	Decomposes	Decomposes

Uses

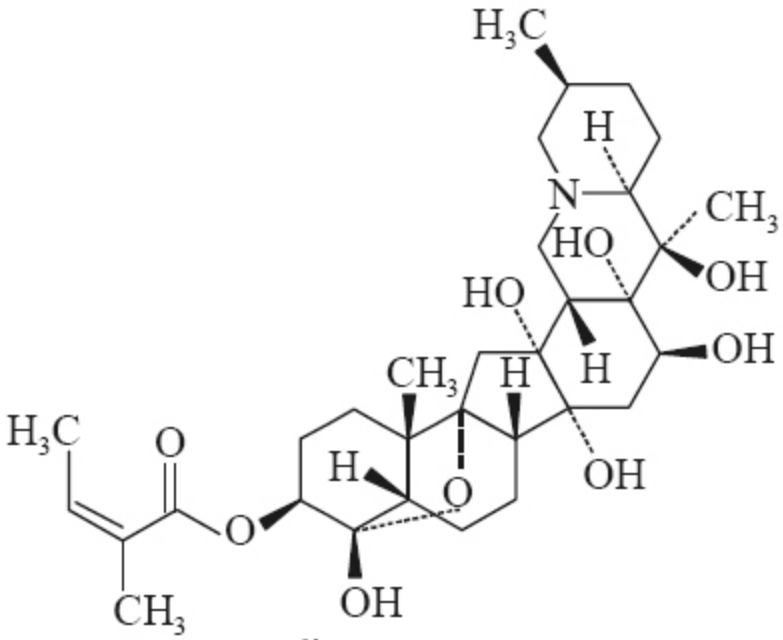
1. It is used as an antihypertensive agent which exerts its action through reflex inhibition of pressor

receptors in the heart and carotid sinus.

2. It also possesses emetic action.

3. It is used in the treatment of toxemia of pregnancy.

.



Cevadine

Characteristic Features

1. It is yellowish-white amorphous powder.
2. It tenaciously retains water.
3. It is insoluble in water but slightly soluble in ether.

Identification Tests

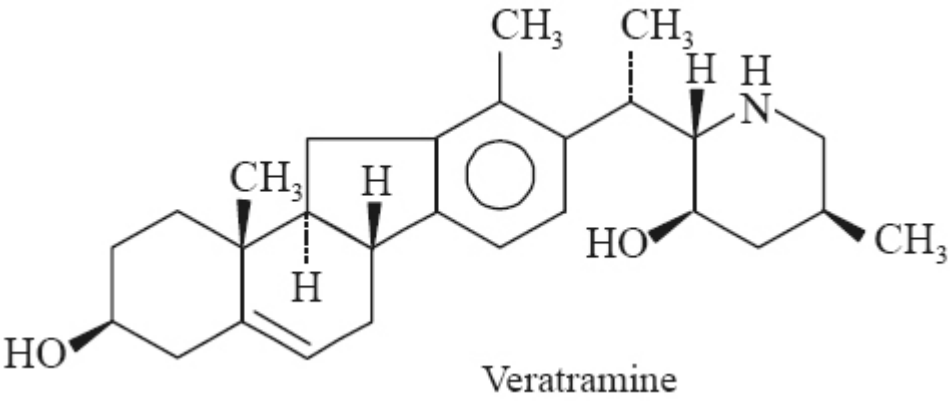
1. It readily forms its nitrate derivative which is an amorphous powder and sparingly soluble in water.
2. Its sulphate salt is formed as its needles which happens to be very hygroscopic.
3. It readily forms its perchlorate derivative as long needles from water having mp 259-260°C

.

Veratramine

Biological Sources It is obtained in the rhizomes of *Viratrum viride* Ait. (*Liliaceae*) (**American Hellebore**); and also from *Veratrum grandiflorum* (Maxim.) Loes. F. (*Liliaceae*).

Chemical Structure The chemical structure of **veratramine** has also been referred to as **azasteroid**, wherein the N-atom is present is in one or more side chains.



Veratramine

Characteristic Features

1. It is obtained as crystals having mp 206-207°C.
2. It is slightly soluble in water, but soluble in ethanol and methanol.

Kurchi

Synonyms:

Holarrhena – Eng.; Kura Kurchi- Hindi; Kutaha- Sans; Kada chhal- Guj; Kuchla seed.

Botanical source:

Kurchi consists of the dried stem bark of Holarrhena antidysenterica Wall.

Family: Apocynaceae.

Geographical source:

Indigenous to tropical Himalayas at 3500 ft. and found throughout forests of India at higher altitude.

Collection:

The plant is a small tree and besides the bark, seeds known as Indrajav, are also used in medicine. Bark is collected from 8 to 12 years old trees by making suitable transverse and longitudinal incisions. It is found that from July to September, the bark contains maximum percentage of alkaloids and should preferably be collected during the above period.

Macroscopical characters:

(i) Size and shape: Small re-curved pieces of varying sizes and thickness.

(ii) Outer surface: Buff to brownish, rough, wood sometimes attached to inner bark.

(iii) Fracture: Short and granular.

(iv) Taste: Bitter.

(v) Odour: None

(vi) Smoothed Transverse Surface:

Shows outer cork, wide Phelloderm containing stone cells and wide phloem with medullary ray and tangentially arranged stone cells.

Microscopical characters:

Cork: They are 5-9 layers, thin walled rectangular cells, some with yellowish matter.

Phellogen: Two layers of colourless rectangular cells.

Phelloderm: They are 5-10 layers, thin walled somewhat rectangular cells, at times arranged in radial rows. The parenchymatous cells contain rhomboidal crystals and a few starch grains.

Cortex:

a. They are wide, interspersed with groups of lignified, pitted, stone cells of large lumen and of various shapes (rectangular to elongate) and sizes.

b. The cortical parenchyma surrounding the stone cells and as well the stone cells themselves contain rhomboidal crystals.

c. Starch grains are present in cortical parenchyma.

d. One or two groups of non-lignified pericyclic fibres are seen in the cortex.

Secondary phloem:

e. It consists of phloem parenchyma, medullary rays and groups of stone cells arranged in tangential rows separated by medullary rays.

f. The stone cells in the secondary phloem are encircled by a sheath of parenchyma containing rhomboidal crystals of calcium oxalate.

Medullary rays:

g. They are 1-3 seriate, wide towards the outside and consist of thin walled radially elongated parenchymatous cells.

h. Phloem parenchyma and medullary ray cells contain starch grains.

i. Phloem fibres are absent.

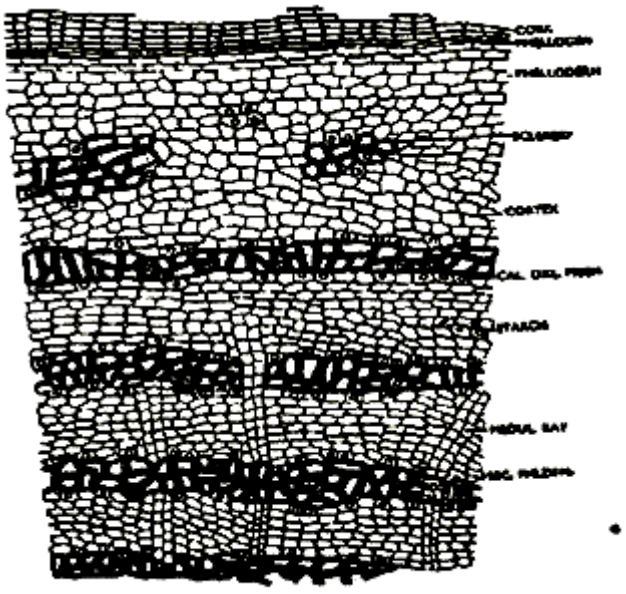


Fig. 19: T. S. of Kurchi bark

Chemical constituents:

Steroidal alkaloids (2 to 45)

(i) Conessine (30%),

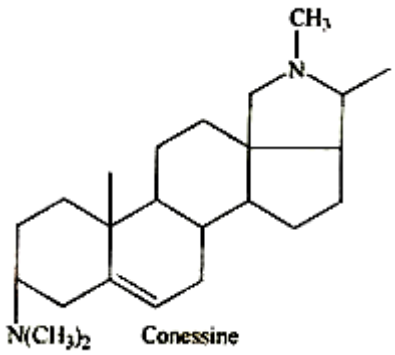
(ii) Norconessine

(iii) Isoconessine

(iv) Kurchicine

(v) Holarrhimine and

(vi) Holarrhenine.



Conessine

Uses:

1. In the treatment of dysentery (Used both in acute and chronic dysentery).

2. Astringent and Tonic.

3. As an antiperiodic (Used in periodic recurrence like Malaria)

4. In the synthesis of steroid hormones.

5. It is used as anthelmintic against oxyuris.

Allied Drugs:

Bark Hollarhena Floribunda obtained from Tropical Africa contains 1.5 to 2.5 steroid alkaloids from which conessine is 50% or more and is a rich source of Conessine. It is used in the same way as Kurchi bark.

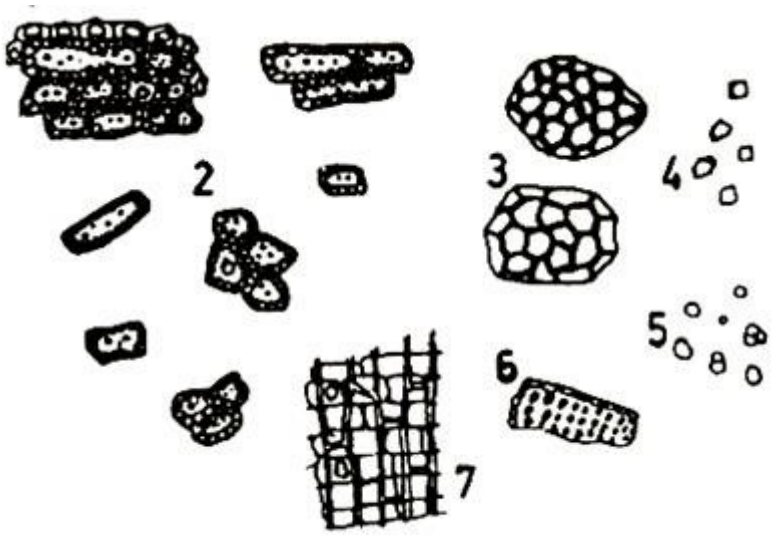


Fig. 20: Identifying characters of Kurchi bark powder

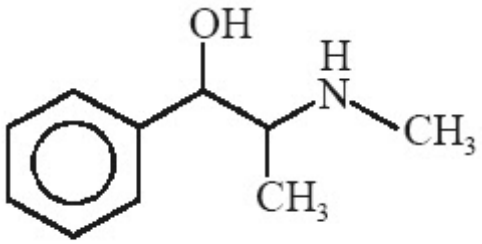
Alkaloidal Amine

It has been observed that the aromatic amino acid **L-tyrosine** is not only a common but also an extremely vital precursor of **alkaloids;** whereas, **L-phenylalanine** is found to be much less frequently employed. The various typical examples of phenylalanine-derived alkaloids are: **ephedrine, norpseudoephedrine** (**cathine**) and **capsaicin**.

Ephedra

Biological Source It occurs in the dried young stems of the Chinese wonder drug **Ma Huang**, *Emhedra vulgaris*, *Ephedra sinica* Stapf., *Ephedra equisetina* Bunge belonging to family *Ginetaceae*, and also in several other Ephedra species.

Chemical Structure



Ephedrine

Special Features

(*i*) **Ephedrine** does not yield a precipitate with Mayer's Reagent except in concentrated solution.

(*ii*) Ephedrine in chloroform solution after long standing or on evaporation usually forms ephedrine hydrochloride and phosgene.

(*iii*) Both **ephedrine** and **pseudoephedrine** are fairly stable to heat and when heated at 100°C for several hours does not undergo any decomposition.

(*iv*) **Ephedrine** hydrochloride on being heated with 25% HCl gets partially converted to **pseudoephedrine**; and this conversion is reversible and soon attains on equilibrium.

Identification Tests

(*i*) **Colour Test:** Dissolve 0.1 g ephedrine in 1 ml water with the addition of a few drops of dilute HCl. Add to it two drops of $CuSO_4$ solution (5% w/v) followed by a few-drops of NaOH (1N) solution when a reddish colour is obtained. Add to it 2-3 ml of ether and shake vigorously, the ethereal layer becomes purple and the aqueous layer turns blue.

(*ii*) **Formation of Ephedrine Hydrochloride:** Dissolve 0.2-0.3g of ephedrine in 35 ml of chloroform in a stoppered test tube and shake vigorously. Allow it to stand for 12 hours and evaporate the chloroform, when crystals of ephedrine HCl are obtained, and

NUTRIENT COMPOSITION

The herb contains ephedrine which is a phenylethylamine alkaloid, flavonoids, lignans, catechols and polysaccharides. The root of the plant contains spermine alkaloids, procyanidins and tyrosine derivatives.

THIS HERB ACTS AS A RELIEVE FOR MANY AILMENTS. SOME OF THESE ARE:

- **Asthma:** One of the prominent uses of Ephedra is in the management of bronchial asthma. Powder of the herb in the range of 0.5 to 2 grams should be consumed along with water. It gives immediate relief by clearing the air passage.
- **Rheumatism:** The powder of Ephedra is used in acute rheumatism. It relieves inflamed and painful joints. When allopathic medicines like aspirin, antipyrin and salicylate of soda fail to show visible results, Ephedra acts as an infallible remedy. It does not produce any side effects.
- **Heart disorders:** It is an effective heart stimulant. It works efficiently when heart is affected by diphtheria and pneumonia infections.
- **Urinary disorders:** Ephedra influences urinary bladder. It is effective in relieving night wetting condition in children.
- **Other ailments**: Ephedra is useful in relieving disorders like rashes and hay fever. It is used in several nasal sprays useful in relieving asthmatic attacks and sinusitis and inflammation of the mucous membrane.

Colchicum

COLCHICUM LUTEUM

Colchicum Luteum is known by the name of colchicum in English, Suranjan in Sanskrit and Hirantutiya in Hindi. It belongs to the family of ***Liliaceae.*** The common names of the plant are autumn crocus and meadow saffron.

The corms of the plant are usually used to make natural medicines. It is known to be Kapha and Vata suppressant. These are the principle stabilizing energies that govern the body as well as the mind. It is connected with the structure, lubrication, fluid balance and stability of the entire human body.

CHARACTERISTICS OF COLCHICUM LUTEUM

It is found at the height of 2000- 9000 feet. It has tuberous roots which are oval in shape and brown in color. The leaves of the tree are 6-12 inches in length and are roundish in shape with small flowers. The flowers of this herb are 1-2 inches in length and around half an inch in width. The flowers of the plant are hermaphrodites. The plant leafs in the summer season only. The seeds are oval in share and are light brown color.

Colchicum is a perennial flowering plant that has around 160 species which grows in to bulb like corms. It is a member of the Colchicaeceae family and is native to Europe, West Asia, parts of the Mediterranean coast, East Africa, South Africa and the region of Western Cape.

THERAPEUTIC USE OF COLCHICUM LUTEUM

Colchicum Luteum is known for its pain relieving properties that also help in relieving wounds. Colchicum helps in preventing indigestion and work as a laxative that relieves constipation. This medicinal herb is helpful for all kinds of liver and spleen related problems. It purifies the blood and acts as diuretic. This plant is also advised by naturalists for patients who suffer from any condition related to the urination.

- **Laxative:** The herb is known to stimulate the bowel movement in the body naturally and solve the problem of constipation.
- **Anodyne:** Colchicum Luteum is known for its pain relieving properties. It is also a very beneficial pain relieving agent.

THE COLCHICUM LUTEUM THE PLANT IS AN:

- **Alterative:** The Colchicum Luteum causes a gradual change in the body which is usually because of improved nutritive absorption as well as the elimination of toxins from the body.
- **Aphrodisiac:** The herb works as an aphrodisiac that increases the sexual desires in a person.
- Carminative: The Colchicum Luteum plant reduces flatulence and helps in expelling excessive gas from the intestines.

PLANT IS AN EXCELLENT RELIEVE FOR THE FOLLOWING AILMENTS:

- **Joint pains:** This plant has been used for relieving the problem of joint pain for centuries.
- **Skin related problems:** Application of Colchicum Luteum on the skin can relieve ailments of the skin.
- **Rheumatoid arthritis:** This plant is beneficial for people suffering from swelling due to rheumatism. It is advised to use a paste of this herb with saffron and egg for relieving rheumatic pain.
- **Gouty arthritis**: The presence of colchicines in the corms is very beneficial for relieving pain and for inflammation caused due to gout.
- **Wounds:** The dried root of the plant is beneficial for relieving injuries.
- Osteoarthritis
- Liver and spleen related problems
- Dysurea
- Sciatica
- Blood infection

Purine Alkaloids

COFFEE

BIOLOGICAL SOURCE: dried seeds of coffee Arabica
Family: rubiaceae
GEOGRAPHICAL SOURCE: southern part of India, Indonesia.

- **Collection:**
  The unripe coffee fruit is dark green & is collected when it turns red .Each fruit has two locules containing one seed each .
- The seeds are separated, roasted because of which they develop a dark brown colour & a typical odour.

Chemistry:
Contains caffeine which is a salt of chlorogenic acid, volatile oil known as caffeol, enzymes & other phenolic compounds.

Chemical Test:
1. Murexide test: caffeine when heated with HCl & potassium chlorate gives a residue which turns purple when exposed to ammonia vapours .

2. Caffeine forms a white precipitate with tannin solution .

Uses:
Stimulant, diuretic (due to theophylline), & source of caffeine

.

TEA

Scientific name: Thea sinensis
Family: Theaceae.

Tea is a shrub that grows up to four meters high, evergreen, alternate leaves, elliptic, pointed, toothed andcoriaceous leaves, six to eight inches long and three inches wide. It has white flowers, axillary and with peduncle, capsular fruit, globose habit, with three blackish seeds. The parts used are leaves which take different names according to the treatment they experience: **Green Tea** or **Black Tea**.

Tea was originally grown in China over 1000 years ago. Today it is cultivated in India, China, Sri Lanka, Japan, Indonesia, Kenya, Turkey, Pakistan, Malawi and Argentina.

Collection:

The tea plant is a small green shrub wherein younger leaves are picked & allowed to undergo fermentation .
Polyphenol oxidase carries out oxidation to produce furfural & other phenolic compounds
The process imparts a dark brown or black colour & a typical odour of tea powder

Active ingredients and content of tea:

The major active ingredient of the **tea plant** are the xanthic bases: caffeine, theophylline, theobromine (whose content depends on the development stage of leaves), adenine and xanthine, caffeine predominates with 3 to 4%.

It also contains catechic tannins that may be combined with the xanthic bases.

Tea also contains abundant flavonoids, phenolcarboxylic acids, mineral salts (high amounts of fluorides 130-160 mg / kg), vitamins and small amounts of terpenes (theafolia saponins).

Chemical Test:

1. Murexide test: caffeine when heated with HCl & potassium chlorate gives a residue which turns purple when exposed to ammonia vapours .

Use:

Stimulant, diuretic, source of caffeine.

Quinazoline Alkaloids

Vasaka

Biological Sources It is obtained from the leaves of *Adhatoda vasica* (L.) Nees (*Acanthaceae*) (**Malabar Nut, Adotodai, Paveltia**); and the seeds of *Peganum harmala* L. (*Rutaceae*) (**Harmel, Syrian Rue, African Rue**).

ADHATODA VASICA

Adhatoda Vasica is a herb, also popularly known as Malabar Nut in English, Adosa in Hindi and Vasaka in Sanskrit. It has been used in preparation of herbal medicines for the past 2000 years. Yogic practitioners often use this herb to clear their respiratory tracts during the course of breathing exercises.

CHARACTERISTICS OF ADHATODA VASICA:

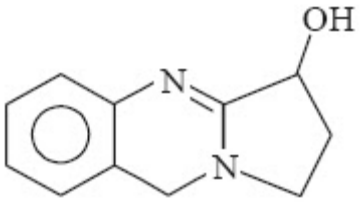
The herb reaches 1300 meters in height and is grown throughout India on wastelands in different habitats and different types of soil. It is grown in other countries like Sri Lanka and Malaysia as well.

This evergreen perennial shrub has leathery leaves. The flowers are dense and large having large bracts and whitish pink/purple colored.

The herb is often grown as a hedge and its leaves and twigs are utilized as green-manure. The whole plant or its roots, leaves, bark and flowers are used in various herbal preparations.

CHEMICAL COMPOSITION:

Chemical Structure



Vasicine

Characteristic Features

1. It is obtained as needles from ethanol having mp 210°C.
2. It sublimes on being subjected to high vacuum.
3. It is soluble in acetone, alcohol, chloroform; and slightly soluble in water, ether and benzene.

Identification Tests

1. Hydrochloride dihydrate derivative is obtained as needles having mp 208°C (dry).

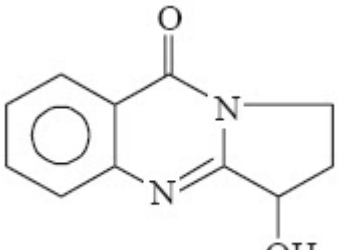
Uses

1. It is mostly used as an expectorant and bronchodilator.
2. It also shows oxytocic properties very similar to those exhibited by **oxytocin** and **methyl ergometrine.**
3. **Vasicine** also shows abortifacient action which is due to the release of prostaglandins.

B. Vasicinone

Biological Source The plant source remain the same as described under **vasicine**.

Chemical Structure



Vasicinone

- **Alkaloids:** Vasicine is the major alkaloid available in different parts of the herb. The leaves contain alkaloids like vasicinone, vasicinol, adhatonine, adhatodine and so on. The roots contain vasicinol, vasicinolone, vasicol and so on.
- **Triterpenes and phytosterols:** These include a-amyrin, epitaraxerol and oaucosterol.
- **Flavonoids:** The flowers and leaves contain flavonoids like apigenin, kaempferol, astragalin, quercetin, isovitexin, vitexin and so on.
- **Essential oils:** The flower has volatile oil which contains 'ketone' apart from 36 other components.
- **Hydrocarbons and fatty acids**: The oil extracted from the leaves contains almost 50 compounds. The major component is 'decane' along with hydroxyalkanes, hydroxyhexatetracont, and methyltriacontan. It also contains lilolenic, arachidonic, palmitic and oleic acids.

Use:-

- **Antiasthmatic and bronchodilatory activity:** Vascine which is a major component of the herb's alkaloids displayed bronchodilatory activity in-vivo and in-vitro.
- **Anti-bacterial activity:** The methanolic extract from the leaves showed strong activity of the alkaloid against certain bacteria. Another study proved the ability of the extract in inhibiting bacterial population in unrelieved water which suggested its use in improving quality of drinking water.
- **Anti-tubercular activity:** Certain derivatives of vasicie are used as mucolytics. This along with other direct and indirect effects makes Ahatoda vasica useful in relieving tuberculosis.
- **Cholagouge activity:** In experiments conducted on cats and dogs, the amount of excretion of bile increased with an additional effect of diluting the bile and increasing bilirubin excretion.
- **Anti-dyspepsia activity:** Ahatoda vasica syrup improved symptoms related to dyspepsia.
- **Uterotonic and abortifacient activity:** Vasicine displayed both these effects due to priming effect of oestrogen hormone.
- **Wound-relieving activity:** On relieving buffalo calves with powdered, chloroform or alcoholic extracts of Ahatoda vasica, marked improvement in the process of relieving was observed.