

CHAPTER 5 (B)

Study of Crude Drugs - II

5.1. DRUGS ACTING ON NERVOUS SYSTEM

5.1.1. Introduction

Central Nervous System (CNS) and the Peripheral Nervous System (PNS) together make up the nervous system. The PNS further divides into the Somatic Nervous System (SNS, regulating sensation and motor control of skeletal muscle) and the Autonomic Nervous System (ANS, regulating involuntary functions such as heart rate and gut motility). The ANS further divides into the sympathetic nervous system (works when the body is active, thus increases heart and respiration rates) and the parasympathetic nervous system (works when the body is at rest, thus it decreases heart rate and increases gastrointestinal motility).

Central nervous system agents are medicines affecting the CNS made up of nerves in the brain and spinal cord. The CNS processes and controls most of the functions of body.

CNS is affected by various drugs like anaesthetics, anticonvulsants, antiemetic drugs, antiparkinson agents, CNS stimulants, muscle relaxants, narcotic analgesics (pain relievers), non-narcotic analgesics (acetaminophen and NSAIDs), and sedatives.

5.1.2. Hyoscyamus

Hyoscyamus is an annual or biennial plant of Solanaceae family and also of the nightshade family.

Synonyms

Henbane, Hyoscyamus herb, and Hyoscyamus leaves.

Biological Source

Hyoscyamus is the dried leaves and flowering tops of *Hyoscyamus niger*. It contains not less than 0.05% of hyoscyamus alkaloid, namely l-hyoscyamine.

Family

Solanaceae.

5.1.2.1. Occurrence and Distribution

Hyoscyamus has its origin in Western Asia, North Africa, Europe, and India. It is grown in Russia, Belgium, Hungary, and India.

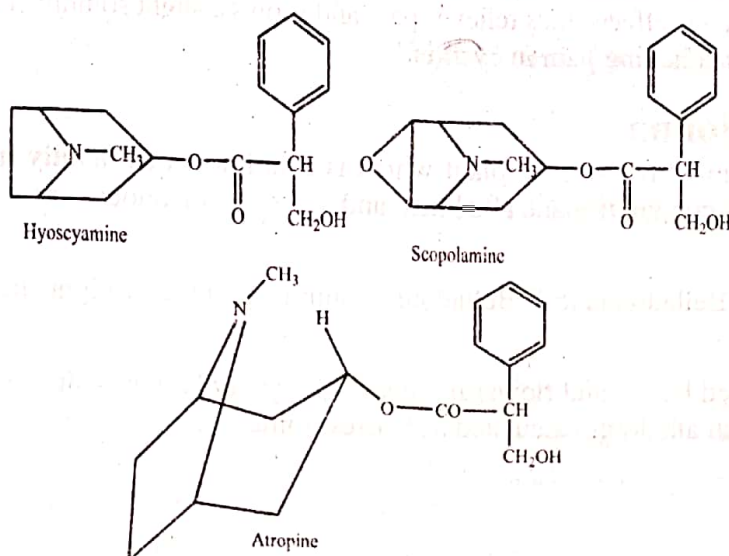
5.1.2.2. Organoleptic Evaluation

The organoleptic features of hyoscyamus are as follows:

- 1) **Fresh Drug:** Characteristic and strong odour, and a bitter and acrid taste.
- 2) **Leaves:** Pale greyish green coloured and ovate-oblong to triangular ovate shaped; leaves are sessile however in some cases they may have a short petiole; the margin has acute triangular lobes, which are irregularly dentate; they have an acute apex; the lamina is covered with glandular hair; they have a prominent midrib with pinnate venation.
- 3) **Flowers:** Funnel-shaped and yellow coloured with purplish veins.

5.1.2.3. Chemical Constituents

Hyoscyamus contains **hyoscyamine** (an alkaloid) as its chief constituent. **Atropine** and **hyoscyne** (or **scopolamine**) are also present in smaller quantities. Around 0.045-0.14% of alkaloid is present in the dried drug. Other constituents are hyoscytricin (a glucosidal bitter principle), choline, mucilage, albumin, calcium oxalate, and potassium nitrate. The leaves when incinerated give 12% of ash. The seeds contain 0.5-0.6% of alkaloid, including hyoscyamine and a small amount of hyoscyne. Around 20% of fixed oil is also present in the seeds.



5.1.2.4. Chemical Tests

Hyoscyamine gives the following chemical tests:

- 1) **Gerrard Reaction:** Hyoscyamine and atropine both respond to this test, in which 5-10mg of the drug on reaction with 2% w/v mercuric chloride solution in 50% ethanol instantly develops a red colour (without any requirement of warming the solution).
- 2) **Schaer's Reagent:** A small amount of hyoscyamine on reaction with a few drops of the Schaer's reagent (1 volume of 30% hydrogen peroxide mixed with 10 volumes of concentrated sulphuric acid) develops a green colour.
- 3) **Vitali-Morin Colour Reaction:** A small amount of hyoscyamine or atropine is treated with 0.2ml of fuming nitric acid and evaporated to dryness on the water bath. On adding 0.5ml of 3% w/v potassium hydroxide solution (in methanol) to the residue yields a bright purple colour which changes to red and finally becomes colourless.

Note:

- i) The 3% potassium hydroxide solution should be freshly prepared.
 - ii) The reaction being very sensitive requires a very few amount of drug (e.g., around 0.0001mg of the following alkaloids like strychnine, apomorphine, veratrine, physostigmine, etc., respond positively to this test).
- 4) **Para-Dimethylamino Benzaldehyde Reagent:** This reagent is prepared by dissolving 2gm of *p*-dimethylamino benzaldehyde in 6gm of sulphuric acid already added with 0.4ml of water. About 5-10mg of hyoscyamine is placed on an evaporating dish, added with 2-3 drops of the reagent, and heated for several minutes on a boiling water bath. A red colour develops which gradually changes to a permanent cherry red when the solution cools down.

5.1.2.5. Therapeutic Efficacy

Hyoscyamus has the following therapeutic properties:

- 1) It is used to counter the gripping action of purgatives.
- 2) It is used for relieving the spasms of urinary tract.
- 3) It is a sedative, hypnotic, expectorant, antispasmodic, anti-asthmatic, and a mild diuretic.
- 4) It is used to check salivary secretion.
- 5) The leaves are used as a narcotic medicine.
- 6) Hyoscyamine checks secretion and relaxes the spasms of involuntary muscles.
- 7) Hyoscine has narcotic effects, thus relieves pain and shows a slight somnifacient action.
- 8) It is also used for relieving pain in cystitis.

5.1.3. Belladonna

Belladonna is a perennial herbaceous plant which is also known as **deadly nightshade**. The foliage or berries contain tropane alkaloids, and are very poisonous.

Synonyms

Poison black cherry, Belladonna leaf, Belladonna folium, and Deadly night shade leaf.

Biological Source

Belladonna is the dried leaves and flowering tops of *Atropa belladonna*. It should contain 0.30% or more of total alkaloids calculated as hyoscyamine.

Family

Solanaceae

5.1.3.1. Occurrence and Distribution

Belladonna is native to Europe, North Africa, and Western Asia. In India, it is found in the western Himalayas from Shimla to Kashmir and also some neighbouring areas of Himachal Pradesh.

The main habitat of belladonna is the forests of Sindh, Chenab valley, and Jammu.

5.1.3.2. Organoleptic Evaluation

The organoleptic features of belladonna plant are (figure 5.1):

- 1) **Colour**
 - i) **Leaves:** Green to brownish-green.
 - ii) **Flowers:** Purple to yellowish-brown.
 - iii) **Fruits:** Green to brown.
- 2) **Odour:** Slight and characteristic.
- 3) **Taste:** Bitter and acrid.
- 4) **Size**
 - i) **Leaves:** 5-25cm long and 2.5-12cm wide.
 - ii) **Flowers:** Corolla 2.5cm long and 1.5cm wide.
 - iii) **Fruits:** About 10cm in diameter.
- 5) **Shape**
 - i) **Leaves:** Ovate, lanceolate to broadly ovate, with acuminate apex, decurrent lamina, entire margin, petiolate, brittle, and transversely broken.
 - ii) **Flowers:** Campanulate, 5, small reflexed lobes of corolla.
 - iii) **Fruits:** Berries, sub-globular in shape with numerous flat seeds.



Figure 5.1: Belladonna Herb

Extra Features

The whole plant looks wrinkled and twisted; dropping flowers are present with many pairs of leaves. Flowers have five stamens, a superior bilocular ovary having many seeds.

5.1.3.3. Chemical Constituents

Around 0.3-0.60% alkaloids are extracted from *Atropa belladonna* in which **hyoscyamine** is the main component. Volatile bases like **pyridine** and **N-methylpyrrolidine** are present in small quantities. If these are not removed during the assay of the drug by heating, on increasing the titration they appear in the result as hyoscyamine.

Leaves of belladonna also have a fluorescent substance, i.e., **β -methylnesculetin** (scopoletin) and calcium oxalate crystals. The leaves give 4% or less of acid-insoluble ash and about 14% of total ash.

About 0.28-0.32% of total alkaloids is present in finely powdered drug of a prepared belladonna herb.

5.1.3.4. Chemical Test

Belladonna alkaloids give violet colour with fuming HNO_3 and alcoholic KOH solution employed for their assay.

5.1.3.5. Therapeutic Efficacy

The therapeutic uses of belladonna herb are as follows:

- 1) It has anticholinergic and parasympathetic properties.
- 2) In case of poisoning of opium and chloral hydrate, belladonna is used as an antidote.
- 3) It is also used to decrease the secretion of sweat, gastric juice, and saliva.
- 4) It is used in breathing abnormalities in infants.
- 5) It is used for reducing sweat and other secretions.
- 6) It is effective against tonsillitis, meningitis, scarlet fever, whooping cough, and epilepsy.
- 7) Belladonna preparations are used against vesico-ureteral refluxes (a condition in which urine flows back towards the kidney from the bladder).
- 8) It is used as an analgesic in pain due to kidney stones, sore throat, etc.
- 9) It is useful in liver and gall bladder disorders.
- 10) Powdered preparations are used to treat asthma.
- 11) It can lessen headaches related to migraine.
- 12) It eases premenstrual syndrome.
- 13) It can reduce spasms in smooth muscles of digestive tract, but causes tremors or stiffness in other muscles.
- 14) Atropine, extracted from belladonna is used to dilate pupils.

5.1.4. Aconite

The roots of aconite plant have medicinal values as they contain chemicals which may improve circulation. However, chemicals which can adversely affect the heart, muscles, and nerves may also be present.

Synonyms

Aconite root, Bachnag, and Monkshood.

Biological Source

Aconite is the dried roots of *Aconitum napellus* Linn. It contains not less than 0.6% of aconite alkaloids of which aconitine should be not less than 30%.

Family

Ranunculaceae

5.1.4.1. Occurrence and Distribution

Aconite is native to Hungary, Germany, Spain, and Switzerland. It is grown in England. In India, it is collected from wild or cultivated plants, namely *A. chasmanthum* or *A. ferox*.

5.1.4.2. Organoleptic Evaluation

The organoleptic features of aconite roots are (figure 5.2):

- 1) **Colour:** Dark brown.
- 2) **Odour:** Slight odour.
- 3) **Taste:** Slight taste which causes tingling sensation and numbness of tongue.
- 4) **Size:** 4-10cm long and 1-35cm broad; they are broader towards the crown and tapering towards the distal end; the broader end has many rootlets and scars.
- 5) **Fracture:** Short and horny fracture.
- 6) **Surface:** Slightly twisted and deeply wrinkled. Daughter roots are the diagnostic characters of parent roots.

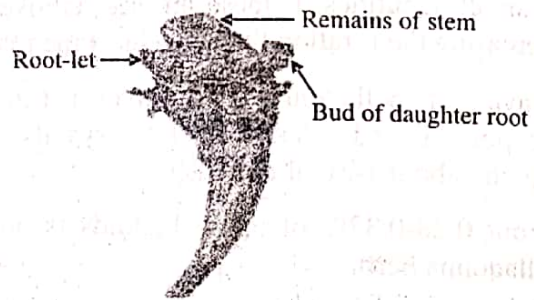
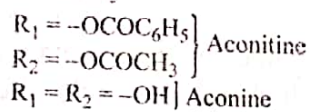
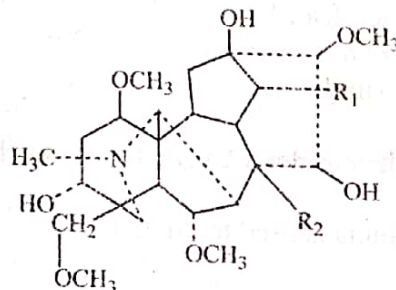
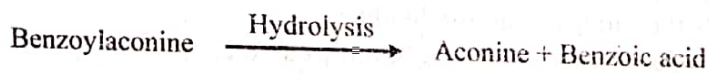
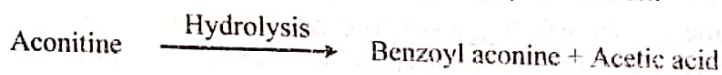


Figure 5.2: Aconite Root

5.1.4.3. Chemical Constituents

Aconite contains **aconitine**, **hypoaconitine**, **neopelline**, **nepelline**, **neoline**, and small amounts of sparteine and ephedrine; all these constituents are diterpene alkaloids, out of which only the ether-soluble aconitine is most important (and highly poisonous). Aconite also contains aconite acid, succinic acid, and starch.



The products of hydrolysis are less active.

5.1.4.4. Therapeutic Efficacy

Aconite has the following therapeutic properties:

- 1) It is externally used in the form of liniment for treating neuralgia, sciatica, rheumatism, and inflammation.
- 2) It is an analgesic and cardiac depressant.
- 3) Its use at the present time is restricted only to homoeopathic medicines.

5.1.5. Ashwagandha

The name Ashwagandha has been derived from the Sanskrit language and is a combination of the word *ashva* meaning **horse** and *gandha* meaning **smell**. Thus, the roots have a strong horse-like odour.

Synonyms

Withania root and Winter cherry.

Biological Source

Ashwagandha is the dried roots and rhizomes of *Withania somnifera*.

Family

Solanaceae

5.1.5.1. Occurrence and Distribution

The genus *Withania* is found to have 23 species, of which *Withania somnifera* (L.) Dunal. is medicinally essential. *Withania somnifera* is grown in the drier parts and sub-tropical regions. The plant grows wildily in India, Pakistan, Afghanistan, Philistine, Egypt, Jordan, Morocco, Sri Lanka, Spain, Canary Island, Eastern Africa, Congo, Madagascar, and South Africa.

5.1.5.2. Organoleptic Evaluation

The organoleptic features of ashwagandha are (figure 5.3):

1) **Colour:** Greyish yellow.

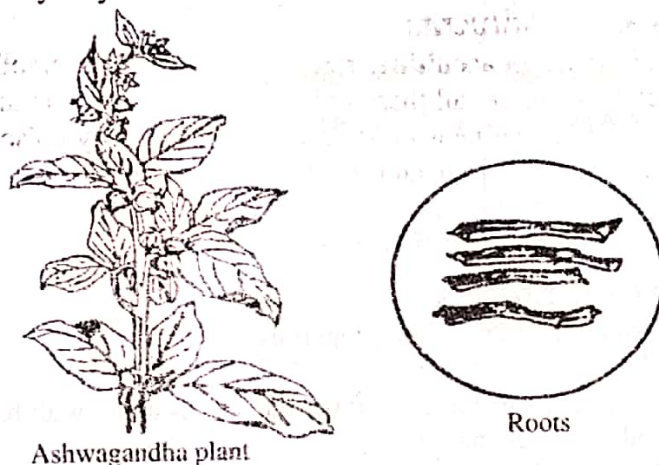


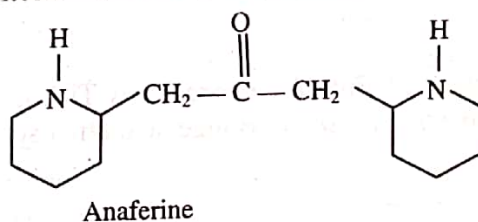
Figure 5.3: Ashwagandha Plant and Roots

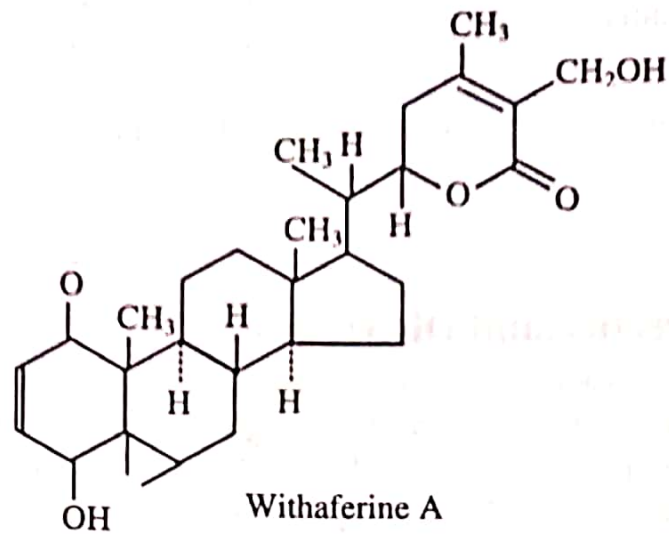
- 2) **Odour:** Characteristic.
- 3) **Taste:** Bitter and acrid.
- 4) **Size:** 20-30cm long and 6-12mm diameter.
- 5) **Shape:** Solid mass with scattered pores.
- 6) **Fracture:** Smooth and powdery.

5.1.5.3. Chemical Constituents

Ashwagandha comprises of the following constituents:

- 1) **Alkaloids:** Ashwagandhine, Withanine, Isopelletierine, and Anaferine.
- 2) **Steroidal Lactones:** Withanolides and Withaferins .
- 3) **Phytosterols:** Sitoindosides and B-sitosterol.





5.1.5.4. Chemical Tests

Given below are the two chemical tests for ashwagandha:

1) Dil. KMnO_4 + Drop of aqueous extract



Decolourisation of KMnO_4 solution

2) Aqueous extract + FeCl_3 (5%)



No darkening

5.1.5.5. Therapeutic Efficacy

Ashwagandha has the following therapeutic properties:

- 1) It is a sedative and hypnotic.
- 2) It is hypotensive, and shows respiratory stimulant actions along with bradycardia.
- 3) It is an immunomodulatory agent.
- 4) Sитоindosides (VII) and (VIII) possess antistress activity.
- 5) Conventionally, it has been used in rheumatism, gout, hypertension, nervine, and skin diseases.
- 6) It prevents bony degenerative changes in arthritic conditions.
- 7) It has been used as a sex stimulant and rejuvenator.
- 8) It provides strength and energy, especially to elderly.
- 9) Its leaf extracts are found to be active against *Staphylococcus aureus* and Ranikhet virus.