STUDY OF THE PLANT FAMILIES YIELDING CRUDE DRUGS

RANUNCULACEAE:

Botanical Characters, Chemical Constituents & Therapeutic Uses

Aconite, Hydrastis, Larkspur, Pulsatilla

PAPAVERACEAE

Botanical Characters, Chemical Constituents & Therapeutic Uses

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ZINGIBERACEAE

Botanical Characters, Chemical Constituents & Therapeutic Uses

Ginger, Curcuma.

**MEDICINAL PLANT FAMILIES**

**RANUNCULACEAE**

**Introduction: -**

This family is also called as “buttercup” family (as flowers are bowl shaped) or “crow foot” family. According to Royal Botanic garden, the family consists of 51-88 genera and 2500 species. –

Following are the important genera of the family: - Ranunculus (600 Species), Aconitum (300 Species), Delphinium (365 Species), Clematis (325 Specie), Thalictrum (150 Species), Adonis (20 Species), Hellebore (20 species), Hydrastis (1 species).

**Distribution:**

The plants included in this family can be found worldwide but are most common in temperate and cold areas of northern hemisphere. The family consists of many ornamental flowering plants, common to Himalayan area, some of which are of medicinal importance.

**Biological Characters**: - The plants are mostly perennial herb with a rhizome or rootstock; but there are some woody climbers (such as clematis). - Leaves: The leaves are typically alternate or compound. - Flowers: The flowers are bisexual and regular and are medium to large in size, to attract pollinators; e.g.; aconite flowers are helmet shaped and grown in raceme (clusters)and are dark purple to bluish purple in colour; similarly, pulsatilla flowers are bell-shaped and are purple coloured. They are actinomorphic (radially symmetrical) or zygomorphic (bilaterally symmetrically). - Fruit: The fruit is most commonly a follicle or berry as aconite follicle, and hydrastis fruit has superficial appearance with raspberry with fleshy, small red berries.

**Chemical Components**: - The family has diverse chemical constituents and is of considerable phytochemical and chemotaxonomic interest. Following are the chemical constituents belonging to different groups of secondary metabolites, present in Ranunculaceae family. o Glycosides: The glycoside “ranunculin” has been found in the member (plants) of this family. This glycoside hydrolyses to protoanemonin, which is vesicant and accounts for this properly in many species. Similarly, saponins (glycosides), mainly triterpenoids occur in Ranunculus, clematis and thalictrum. Cardenolides (glycosides) occur in Adonis, and Black hellebore rhizome (from Helleborus niger) contain very powerful cardiac glycosides but is now little used in medicine. Black cohosh of B.H.P is the dried rhizome of Cimicifuga racemosa; it contains triterpenoid glycosides, and also isoflavones including formononetin. Cyanogenetic glycosides occur in ranunculus and clematis. o Alkaloids: Isoquinoline derived alkaloids occur in hydrastis, Thalictrum; diterpenederived alkaloids in delphinium and Aconitum. However, aconite roots contain very toxic alkaloids which have lost much of their former popularity; Aconitum napellus contains aconitine, while A. heterophyllum contains heterophylline etc. o Volatile Constituents: From 12-different Ranunculaceae species, Anther volatiles have been isolated. These species belong to Ranunculus, pulsatilla and Anemone. These compounds are aromatic, and mono- and sesquiterpenoids, e.g. protoanemonin, octanal, pentadecane α-murolene and linalool-oxide etc. Many members of the family contain protoanemonin and other toxic compounds, alkaloids and glycosides, which are toxic to human and animals.

**Uses of Ranunculaceae**: -

Many member of the family are poisonous. Certain species e.g. Helleborus niger contains powerful cardiac glycosides but is now little used in medicine.; Aconite was used for the preparation of **antineuralgic liniment** and it was included in the BPC (1973); but as Aconite is a potent quick-acting poison, that is why it is now rarely used in the U.K - However, Aconite possess anti-inflammatory and analgesic activity and it is therefore, used in rheumatic and gouty inflammation. - Similarly, hydrastis possesses **astringent properties** and is effective in inflammatory conditions of mucous membranes e.g. catarrhal (inflammation) conditions of the genitorurinary tract and various other inflammatory and ulcerative conditions of mouth, upper respiratory tract etc. and also in nasal inflammation.

- Certain members of Ranunculaceae are useful **in digestive disorders** like Hydrastis is a bitter tonic and stomachic; Similarly, Larkspur and Pulsatilla are also used in certain other digestive issues like constipation and dyspepsia. - Ranunculaceae are also useful in certain **skin conditions**, e.g. Hydrastis is used as a wash to treat eczema, ring worm and trichomonas etc. - There are few other members of Ranunculaceae like Larkspur, which are effective in jaundice and cholera. - Moreover, Larkspur is used in dropsy and asthma; similarly, Pulsatilla is also effective in asthma. - Pulsatilla is used in nervous tension and anxiety, Aconite also possesses sedative action.

**Important Members of Family**:

i. Aconitum. ii. Larkspur. iii. Pulsatilla. iv. Hydrastis

Aconitum

Synonyms: Aconite, wolf’s bane, Bichnak, Fuzi, Blue rocket, Mitha zehr (Urdu; Hindi). - Botanical Source: Dried roots of Aconitum napellus. - Family: Ranunculaceae. –

**Geographical Source:** distributed throughout the temperate zones of U.S.A, Canada, and many parts of Asia, Africa, Russia and Himalayas. –

Characteristics: The plant is a perennial herb, that grows in height of 0.6-1.5m.

Dark to bluish purple flowers are helmet shaped and grow in raceme (cluster).

Roots: Dried roots are conical in shape or fusiform, tuberous roots, 4-10 cm long and 2-3 cm wide at the crown and are dark brown in colour.

**Chemical Constituents:** Terpene alkaloids which account up to 1.5% of dry weight of the drug. Most commonly found alkaloids are Aconite (0.4-0.8%), picraconitine, aconine, hypaconitine and napelline. Aconinite hydrolyzes to picraconitine, which hydrolyses to aconine and benzyl aconine; aconitinic acid and abundant starch. A few traces of ephedrine, neoline, ascorbic acid etc. are also present.

C34H47O11N+ H2o\_\_\_\_\_\_\_\_\_\_\_\_\_ C32H45O10N + CH3COOH Aconitine Benzyl aconine Acetic acid

C32H45O10+H2O\_\_\_\_\_\_\_\_\_\_\_\_\_\_ C25H41O9N + C6H5COOH Benzyl aconine Aconine Benzoic acid

- Pharmacology: Aconitine is a neurotoxin. Aconitum has been reported to have antitumor, anti-bacterial, anti-inflammatory and analgesic activity; antifungal in invitro and in animals. –

**Uses:**

The drug is used as C.V.S depressant and C.N.S depressant, so used as sedative.

local analgesic to treat neuralgia.

Aconite is a potent and quick-acting poison, which is now rarely used in the UK, it was included in the BPC (1973) and was used for the preparation of antineuralgic liniment. o The drug is also used as antipyretic in small doses of tincture that is frequently repeated. o The drug is also used in homoeopathy. - Toxicology: Aconite in a dose of 2-3 mg can cause the death

Larkspur

**Synonyms**: Jadwar, knight’s spur; lark’s heel. –

**Botanical origin**: dried roots or whole dried herb of *Delphinium denudatum*, *D.ajacis* or D. consolidata. –

Characteristics of The Plant: It is a perennial herb; some species are annual and biennial. It grows one meter tall. Flowers: Inflorescence is raceme and flowers are deep purple blue colour and hermaphrodite. o Fruit: Fruit is a follicle. o It has about 250 species. - Habitat: The plant is native to Europe; however now a days it is cultivated in East Asia, Himalayas and America etc.

- **Chemical Constituents**: The drug contains alkaloids like bitter, acrid crystalline substance (an irritant poison) i.e.; delphinine, denudatin, delphine, condelphine, ajacine and ajacinine etc. - Pharmacology: The alkaloids cause inhibition of neuronal transmission in certain parts of brain (hippocampal neurons) that shows its effectivity in the treatment of epilepsy and other neurological disorders. –

**Uses:** o as anti-convulsant.

in dropsy (oedema)and asthma. o Used in toothache. o Used in snake and scorpion bite. o Used as a bitter tonic and stimulant. o

**Used** in cholera and jaundice. o Used as parasiticide. o As vermifuge. - Toxicity: It is toxic plant because of toxic alkaloids. In small doses, causes violent vomiting, purging and cathartic action, and in larger doses it may cause death. It is a cause of cattle poisoning.

**Pulsatilla:**

Synonyms: Easter flower, pasque flower; common pasque flower; wind flower; Meadow anemone; Anemone serotina; Rattan jog (Urdu). –

Biological Source: whole dried plant of *Pulsatilla vulgaris or Anemone pulsatilla.* - Characteristics: The plant is a perennial herb that grows 15-30 cm high; to 40 cm when it is fruit bearing. It grows in well drained, sandy or rocky soil. The whole plant is covered by silky hairs, having bell-shaped purple colour flower. Thick, woody root stock appears in early spring. All parts of the plant have acrid taste. –

Habitat: The plant is native to western, central and southern Europe. However, it is also found in North America and some areas of Pakistan and India. –

**Chemical Constituents**: glycoside Ranunculin. This glycoside is enzymatically hydrolyzed to protoanemonin and later on exposure to air it is converted to anemonin. Protoanemonin and anemonin (oil of Anemone) both are volatile, while Ranunculin is lactone. Some other constituents like saponins and Flavonoids are also present in minor quantity. –

Pharmacology: Protoanemonin has anti-bacterial, anti-fungal, anti-malarial and cytotoxic properties. This property may be due to alkylation of certain biomolecules. The drug also possesses anti-spasmodic, sedative and analgesic properties. –

**Uses:** as nervine in nervous tension and anxiety. O

as anti-spasmodic. o The drug is effective in disorders of mucous membranes of respiratory and digestive passages; it is also effective in diarrhea. o It is used in amenorrhea and as analgesic in headache, neuralgia, ear ache etc.; also effective in dysmenorrhea and ovarian pain and painful spasmodic conditions of reproductive systems. o Also effective in asthma.

Toxicity: o The symptoms are slow and feeble pulse, slow respiration, coldness, paralysis and death without convulsions. Paralyzing action is on motor centers in brain. o The toxin is also cardiogenic toxic leading to coma, convulsion, vomiting and hypotension.

o Now “Pulsatilla is given in monographs as “unapproved drugs”.

**Hydrastis:**

Synonyms: Golden seal roots; yellow root; yellow puccoon; jaundice root; Eye root. –

**Biological source**: dried roots and rhizome of Hydrastis canadensis. –

Characters of the plant: The plant is a small perennial herb with a short horizontal (cylindrical) rhizome that bears numerous long, slender roots. Internally, the rhizome and roots shows golden yellow colour.

Odour: It has slight but distinctive odour. o Taste: Bitter o The plants propagated from rhizome buds require 3-4 years to produce marketable drug. - Habitat: This plant is indigenous to the woods (forests) of eastern Canada and the eastern USA where it was plentiful; in recent years it has become almost extinct because of ruthless collection. Most of the commercial drug is now obtained from cultivated plants grown in America (Washington, Michigan,North Carolina, Oregon etc.) and in Europe.

* **Chemical constitutents**: the alkaloids hydrastine (1.5-4%) berberine (0.5-6%) and canadine (0.5%); some volatile oil,resin and starch *The hydrastis alkaloids (hydrastine and berberine) are used as astringent in the mucous membrane inflammation to check (control) uterine hemorrhage and menorrhagia.*
* ***USES***
* *in the treatment of catarrhal (inflammatory) conditions of the genitor-urinary tract and various other kinds of ulcerations (employed locally); and also of upper respiratory tract.*
* *It is a bitter tonic and stimulant.*
* *Used in nasal inflammation in flu preparations*
* *Externally, a wash is used to treat skin conditions e.g eczema, ring worm, and to treat trichomonas.*
* *Used as gargles in cases of gum infections and sore-throat.*

PAPAVERACEAE

Botanical characters: Papaveraceae is flowering plants family; and it is also known as “Poppy family”. It is a cosmopolitan family and there are many garden plants in this family. The family consists of 44 genera and 760 species. Most are herbaceous plants, but a few are shrubs and small trees, with solitary, showy flowers. Plants are laticiferous, i.e. all plants contain a well-developed duct system, these ducts are called “laticifers”, producing a milky latex. - Flowers: are not enclosed by sheath. They are pollinated by insects (entomophilous), a few by wind (anemophilous). Large flowers are bisexual. - Fruits: The fruit is generally a capsule with enormous seeds, each containing a small embryo in an oily endosperm e.g.; poppy capsule, that is lanced to obtain latex (opium). Latex is produced by vascular system; that sometimes occur in sac latex (egsanguinaria). - Distribution: This family is mostly confined to the northern temperate regions of the world, or subtropical region. - Important genera: o Papaver (100 species), Argemone (10 species), o Playstemon (about 60 species), Romneya (2 species), o Sanguinaria (1 species), Chelidonium (1 specie),

**Chemical Characters of Papaveraceae:** :

o **Alkaloids:**

Most medicinal plants of this family contain alkaloids i.e.; this family is rich in alkaloids; and these are related to those of the Ranunculaceae. Isoquinoline alkaloids are present in opium e.g. morphine, codeine, noscapine and papaverine, etc. Similarly, Sanguinaria canadensis also contains isoquineoline alkaloids e.g. sanguinarine and chelerythrine etc. Chelidonium majus yields alkaloids chelidonine. Corydalis ambigua, a perennial herb of this family contains tetrahydroprotoberberine type alkaloids (corybulbine, corydaline and cavidine etc.). Another species of the genus Corydalis i.e. C. yanhusuo yielded nine-Alkaloids, important ones are nantenine, and methylbulbocapnine. o

**Phyto-Sterols**: From Meconopsis integrifolia five compounds were isolated, they were identified as β-sistosterol, daucosterol, nonacosanol, ethyl linolenate, and protopine. O

**Fixed oils**: Certain species of the family like Papaver somniferum seeds have a very rich oil/lipid content; in some cases, accounting for 50% of the seed dry weight. The seeds are expressed for oil production. It is rich source of linoleic acid, i.e. 73% in addition it also contains palmitic (10%) arachidic (0.5%) and oleic (12%) acids. The oil is free of all narcotic alkaloids of opium. Sanguinaria seeds were analyzed by John culley (ibid; 1894, p. 189); petroleum ether extracted fixed oil and alkaloids (28%). Similarly, the endosperm of Argemone aurantiaca becomes cellular with numerous oil globules. o

**Volatile oils**: Poppy seed oil also contains volatile compounds, e.g. 1-pentanol, 1hexanol, and 2- pentylfuran etc. Similarly, several species of hypecoum (e.g H. pendulum and H. procumbens) contain scented constituents; composed of benzenoids, which are often nitrogenous; monoterpenes, sesquiterpenes and aliphatic ketones. Due to presence of these compounds the main floral visitors are beetles and bees.

- **Uses of Papaveracae family**:

**Novel, potent Analgesic**: o Papaver somniferum yields morphine like alkaloid; a potent narcotic analgesic. It is used in major surgeries like that of skull, chest, orthopaedic and gynae, etc. Morphine is also very effective analgesic in severe painful conditions like cancers, AIDS, burns.

**Anti-tussives:** Codeine and noscapine, isolated from opium are used in cough preparations as anti-tussives. o **Smooth Muscle Relexant**: Papaverine is an effective smooth muscle relaxant and useful in muscle spasms. o **Anti-Diarrhoeal, antidysentery agent**: Opium and its alkaloids are effectively used in diarrhea and dysentery. o Emetics: Apormorphine HCl derived from morphine is an emetic, and is particularly valuable in cases of poisoning, because it may be administered subcutaneously.

o **Use as cholagogue:** Chelidonium majus yields an alkaloid, chelidonine that is sometimes employed as cholagogue to improve digestive functions.

o **Sedatives, Hypnotics:** Although they are addiction forming but morphine and its allied products are very effective as sedatives (in smaller doses) and hypnotic (in larger doses). Similarly, Eschscholzia californica is used by Californian Indians as a sedative.

Opium

**Biological Source**: - Synonyms: Poppy; gum opium; afim; poast. –

Opium is the air dried latex obtained by incisions of unripe capsule of *Papaver somniferum*. **Habitat and cultivation**: Opium plant is an annual herb, about 50-150 cm in height. The flowers are large, regular, solitary and white to pink or purple in colour. Each plant bears about 5-8 capsules. Laticiferous vessels are found in all aerial parts, which are maximum in capsule. The colour of the seed is also variable ranging from blue-black or grey to yellow-white or rose-brown. They are sub-reniform in shape and about 1 to 1.25 mm long. Opium is cultivated under strict government control. For production of opium, the poppy seeds are shown in autumn (October) in well cultivated soil. The poppy blossoms (flowers) in April or May and the capsules mature in June or July. –

**Collection and preparation**:

While the capsules are still green or are just showing a tint of yellow, the incisions are made into the wall, about 4 cm in diameter (the capsule diameter is 4 cm). This time is critical for latex collection. The capsules are incised with knife which is usually 3- bladed, and the incision is made 1mm deep around the circumference of the capsule (vertically or horizontally) between midday and evening (afternoon), and the exuded latex is scraped off with a knife or a special instrument early on the following morning. The latex-tubes open into one another, therefore it is not necessary to incise them all. Great skill is required so that the endocarp (interior of the capsule) is not cut. When the endocarp is broken, the latex flows in to the interior of the capsule and is lost. Moreover, it prevents the seeds from ripening. Each capsule is cut several times at intervals of 2-3 days. The latex, which is at first white, rapidly coagulates and turns brown. It is transferred to the poppy leaf. When sufficient latex is collected, it is kneaded in to balls that are wrapped in poppy leaves and dried in the shade; and packed in air tight wooden container.

- Geographical source: The poppy plants is native of west Asia. It is cultivated and collected mainly in India, Iran, Yugoslavia, Afghanistan, Pakistan, Thailand, Egypt. etc. –

**Characters**: Opium occur in more or less rounded somewhat flattened mass

o External colour: External colour is pale olive brown or chocolate brown. It is more or less plastic like when fresh but becomes hard and brittle after some time. Internal surface is reddish brown in colour. o Odour: Characteristic. o Taste: Bitter and characteristic. -

**- Chemical constituents** : Opium contains about 30 alkaloids, the most important of these are morphine, which exists to the extent of 4 to 21%; Codeine, 0.8-2.5%; Noscapine (formely narcotine) 4 to 8%; papaverine, 0.5 to 2.5% and thebaine, 0.5 to 2%. Other alkaloids include narceine, protopine, laudanine, codamine, cryptopine, lanthopine and meconidine. All these are isoquinoline alkaloids.

Opium also contains from 3 to 5% of meconic acid which exist free or in combination with morphine, codeine and other alkaloids. Opium in its normal air-dried condition yields not less than 9.5% of anhydrous morphine. Morphine, codeine and thebaine contain phenanthrene nucleus. Morphine contains both phenolic and alcoholic hydroxyl groups, on acetylation converted into diacetyl morphine (heroin). It also contains other constituents like citric acid, acetic acid, tartaric acid, proteins, colouring matter, sugars, etc. Indian opium contains 9-12% of morphine, Turkish opium contains 10-16 % of morphine and Yugoslavian opium contains 15-17% of morphine.

**Uses:** an analgesic in major surgeries of skull, chest, abdomen, gynae etc.; and also, in severe painful conditions like cancers, burns, accidents an AIDS.

**A hypnotic**. o Codeine is less sedative than morphine and is useful in cough preparations.

o Papaverine is useful in muscular spasms **as smooth muscle relaxant**.

o Noscapine is a non-narcotic compound and is useful as anti-tussive.

o Opium is useful in diarrhea, dysentery. o Apomorphine hydrochloride is formed when morphine is treated with hydrochloric acid in a sealed tube. It is an emetic and is particularly valuable in cases of poisoning because it may be administered subcutaneously.

ii. **Sanguinaria**

Synonyms: Blood root;; Red Pucoon; Indian paint, Snakeroot, Red root. –

Botanical origin: dried rhizomes and roots of *Sanguinaria canadensis* (Family; Papaveraceae). **Characteristics**: The plant is a low perenmial (15cm high) herb with a horizontal branching rhizomes that bears slender roots and contains an orange-red latex. The pieces of rhizomes are cylindrical, sub-cylindrical, straight or slightly curved with dark brown colour; 2-10cm long and 5-15mm thick (diameter)

o Fracture: The drug breaks with short fracture. o Odour: Slight. o Taste: acid and bitter. - **Geographical Source:** The USA and Canada. The plant grows rich in open woodlands in North America, east of the Mississippi. Most of the collection takes place in the eastern states. - **Chemical constituents**: contains five alkaloids, a red resin and abundant starch. The alkaloids are: sanguinarine (1%) which is crystalline and colourless but yields reddish salt with nitric or sulfuric acid. Chelerythrine, which is colourless and yields bright yellow salts with acids. Protopine, also found in opium; β- and ¥-chelidonine which are colourless. S..canadensis cultured cells produced sanguinarine (about 80% of the total alkaloid)together with chelirubine and chelerythrine (Applied Microbiolg, Biotechnology 1992,36, 611).

- **Uses**: o Sanguinaria has stimulating expectorant and emetic properties.

o Blood root is used mainly in the USA, where it is an ingredient of Compound White Pine Syrup. (cough expectorant).

o In smaller doses, it increases appetite and improves digestion. o It has been used in atonic dyspepsia, bronchitis and asthma.

o It has been used in periodical diseases and has labour inducing effect.

**LEGUMINOSEAE/ FABACEAE**

Introduction: - Also called “Fabaceae” family- 730 genera & over 19400 species (Royal Bot. Gardens) - Includes more important drugs than any other family - large family of trees, shrub s, vines and herbs bearing pods; divided for convenience into three sub-families: Caesalpinaceae, Mimosaceace and Pipilinaceae.

The Important Genera: - Astragalus with more than 2000 species, cytisus (25-30 species). - Acacia with more than 900 species. - Indigofera with around 700 species. - Crotalaria with 600 species; and Mimosa with 500 species.

**Botanical Characters**: - It is found throughout the world, growing. In many different environments and climates. Majority of the plants in Fabaceae are herbaceous perennials having intermediate inflorescences, which are sometimes reduced to a single flower. The flowers have a short hypanthium and a single carpel, and after fertilization produce fruits that are legumes. - Leaves: The leaves usually alternate and compound; often trifoliate (e.g, Trifolium medicago). They always have stipules which can be leaf-like, (e.g. pisum), thorn-like (e.g. Robinia), or be rather inconspicuous. Leaf margins are entire or occasionally serrate. In some species, leaflets (the terminal one) have evolved or modified into tendrils (e.g. vicia). - In some Acacia, the modified hollow Stipules are inhabited by ants.

- Flowers: They have five generally fused sepals and five free petals. The corolla, formed of these five petals, has a very characteristic butterfly-like shape.

o Some species like in the genus Senna have symmetrical flowers with one of the lower petals larger than the opposing one, and the style bent to one side. The calyx, corolla or stamens can be showy in this group. The petals are small, and the stamens can be more than just ten have long coloured filaments, which are the moss showy part of the flower. All of the flowers in an inflorescence open at once. –

Fruit: The ovary most typically develops into **a legume**. A legume is a simple dry fruit that usually dehisce (open) on two sides. A common name for this type of fruit is pod (e.g. Acacia, Senna, glycyrrhiza, Cassia). –

Roots: Many Fabaceae host bacteria in their roots with in structures called root nodules. these bacteria known as rhizobia have the ability to take nitrogen as out of the air and convert in to a form of nitrogen that is usable by the host (NO3 or NH3). This process is called nitrogen fixation. The legume acting as a host and rhizobia acting as a provider of the usable nature form a symbiotic relationship.

**Chemical Constituents of the Leguminosae**: -

A wide variety of diversified chemical constituents. A few important chemical constituents belonging to different group are as follows: - Glycoside: Many plants of this family are rich in glycosides e.g. Anthraquinone glycoside (sennosides A, B, C, D) are common in plants like Senna leaf (C. angustifolia) and Cassia fistula. Glycyrrhiza glabra contains a sweet principle, Glycyrrhizin, which is a triterpenoid saponin glycoside. Glycyrrhiza glabra also contain flavonoid glycoside like liquirtin, isoliquiritin, which impart yellow colour to the drug. Flavonoid glycoside are also present in tamarinard, like vitexin, isovetexin etc. Senna contains kaempferol. - Carbohydrates: Certain members are rich in carbohydrates, e.g. Acacia contains carbohydrates i.e. Arabin, that is a mixture of Calcium, Magnesium, Potassium salt of Arabic acid, Arabic acid on hydrolysis yields arabinose, galactose and rhamnose etc. Cassia fistula contains about 50% sugar. Glycyrrhiza also contains sugars like glucose, sucrose and starch etc. - Organic Acids: o Tamarind pulp contains free organic acids (about 10% of tartaric, citric and malic acid) and their salts about 8% of potassium hydrogen tartarate, and little nicotic acid etc. o Cassia fistula contains fistulic acid. o Glycyrrhizinic acid is present in Glycyrrhiza glabra, in the form of glycyrrhizin, that is the potassium and calcium salts of glycyrrhizinic acid. o Acacia contains Arabic acid, in the form of arabin, that is the mixture of calcium, potassium and magnesium salts of Arabic acid. o Free benzoic acid and cinnamic acid are present in Tolu balsam and Peru balsam. - Tannins: Also common among the members of this family, containing tannin sacs example of the tannins containing crude drugs of this family: Acacia, Cassia fistula, Tamarind etc. - Alkaloids: The genera Genista and Cytisus (both commonly called broom) as well as Laburnum contain quinolizidine alkaloids, including cystine and sparteine are common. Acacia contains organic compounds which are psychoactive alkaloids e.g. Dimethyltryptamine etc. Tamarind also contains alkaloids. - Volatile Oils: Certain family members contain volatile oils e.g. peru balsam contains cinnamein (about 60%) which is volatile oil. Tolu balsam contains 7-8% volatile oil, chiefly benzyl benzoate.

**Therapeutic Use**: -

**Laxative/Cathartics**:

A few members like Senna leaves, Cassia fistula etc. contain anthraquinone glycoside, which are irritant principles for GIT (gut), hence they are effectively used as laxative and cathartic. - **Sweetening and flavouring agents**: Crude drug like Glycyrrhiza glabra is used as sweetening agent to mask the bitter and nauseous taste of such drugs as ammonium chloride, aloe, quinine etc. - Also used in chewing gums, chocolates, cigarettes etc. - Tamarind is used as a flavouring agent.

**Pharmaceutical Aid**: - Tragacanth gum and gum acacia are used in tablet formulation as binder, and adhesive - Also used as suspending and emulsifying agent in suspensions and emulsions - **Used in Throat Preparation**: Glycyrrhiza glabra is used as expectorant and demulcent and acacia is used as demulcent emollient in various preparations meant for respiratory tract e.g. Lozenges, Cough syrups etc. –

**Anti-Inflammatory Agents**: Glycyrrhiza glabra and Cassia fistula possess antiinflammatory properties, hence they are effectively used in certain inflammatory conditions like rheumatism. Tamarind is also applied as pulp on painful, inflamed joints. –

**GIT Ailments**: Crude drugs of this family like Tamarind, Cassia fistula etc. is used in digestive problems like acid reflux, indigestion and bile disorders. Tamarind is used as astringent in dysentery and diarrhea; it is also effective in hemorrhoids. Glycyrrhiza is an effective drug for peptic Ulcer and mouth ulcers. –

Used as anti-cancerous. –

Used in skin problems.

**Some Members** of the Family Leguminosae: o Acacia. o Glycyrrhiza. o Senna. o Cassia.

i. **Acacia: -**

**Biological Source:** the dried, gummy exudate from the stem and branches of *Acacia Senegal* and/or of some species of Acacia or *A. arabica*.

- **Geographical Source:** Acacia Senegal tree is abundant in Sudan, particularly in province of Kordofan, in Central Africa and in the West Africa. However, the gum is harvested commercially from wild trees throughout Senegal, Sudan, Somalia, Chad, Nigeria, Ethiopia, Kenya, Tanzania and north west Indo-Pak sub-continent. –

**Collection and Preparation**: These plants are thorny trees about 6 meters in height. Some gum exudes from trees as a result of the cracking of the bark. But most of the official drug comes from the cultivated trees in Kordofan. Generally, gum is obtained from about 6 year old plant. A transverse incision is made in the bark of the stem with the help of long handled axe having small blade. The gum is produced by living and physiologically active cells of the phloem, due to action of bacteria or ferment. Bacterial moulds and other organisms may gain admittance to the gum forming tissues through wounds. The gum is collected in leather bags. The gum is garbled to bleach it. In this process gum loses its weight about 30%. During the last few years, this bleached gum has become unobtainable. (the tear of the gum is collected every week till exudation ceases).

**Characters**: o Bleached Kordofan acacia occurs in rounded or ovoid tears up to about 3cm in appearance. o It is white or pale yellow in colour. o It breaks with glassy fracture. o Odourless. o It has a bland and mucilaginous taste. o It is soluble in water. o It is insoluble in alcohol.

- **Chemical Constituents**: o Acacia contains mainly arabin. It is a mixture of calcium, magnesium and potassium salt of Arabic acid. o Arabic acid on hydrolysis with sulphuric acid yields. ✓ L-arabinose, ✓ D-galactose, ✓ D-glucuronic acid ✓ L-rhamnose.

o It also contains enzymes like oxidases, peroxidases and pectinases

o The water content is about 14%. o The complete composition of the gum is extremely complex and has not been full elucidated. In addition to a branched polysaccharide, the gum also contains small amount of protein, including arabinogalactan proteins. o It yields about 2.7-4% of ash; and also contains tannins. o Acacia contains a number of organic compounds which are psychoactive in human. i.e. ✓ Dimethyltryptamine (DMT) 0.1% in leaf. ✓ 5-methoxydimethyltryptamine (5-MeO-DMT). ✓ N-methyltryptamine (NMT) in plant and bark.

**- Uses:** o Generally used as **emulsifying agent in emulsion**. o

As a suspending agent in the preparation containing heavy insoluble powders.

o As a binder in tablet granulation.

o Demulcent and emollient properties are employed in various preparations like lozenges, throat preparations, cough preparations, linctuses. o

Anti-diarrheal preparations in the form of mucilage.

**ii. Glycyrrhiza**

Synonyms: Licorice; Spanish Licorice, Radix Glycyrrhiza; sweetwood; Mulathi (Hindi, Urdu) – **B/S**: unpeeled dried roots and rhizomes of *Glycyrrhiza glabra*, known as Spanish licorice. **Geographical Source**: The plant is cultivated in England (chiefly in Yorkshire), Spain, Sicily, Afghanistan, Germany, France, USA, Russia and also in Indo-Pak subcontinent, Punjab, Sub-Himalayan tracts from Chenab eastwards, Sindh, Peshawar valley to Burma etc. G. violacea is grown in Persia, Iraq; It is the source of Persian liquorice. –

**Macroscopical Characters**: Licorice is perennial herb about 1.0 meter in height. Flowers are purple to pale whitish blue; fruit is oblong pod, 2-3 cm long, containing several seeds. Liquorice as peeled or un-peeled roots and rhizomes. o Shape: The un peeled pieces of the root are unbranched and cylindrical peeled pieces are angular, having longitudinal wrinkles.

**Colour**: Un-peeled drug is reddish brown and peeled drug is yellow. o Outer Surface: The outer surface shows longitudinal wrinkles and the stolon bears occasional small buds, scales leave and scars of slender side roots. o Fracture: Fracture is fibrous in the bark and splintery in the wood. o Odour: Faint but characteristic odour. o Taste: The drug is sweet in taste.

**Chemical Constituents**: The principal constituentof glycyrrhiza is the sweet principle, **glycyrrhizin (5-7%)** a triterpenoid saponin glycosides, which is 50 times sweet as sugar. Glycyrrhizin is the potassium and calcium salts of glycyrrhizic acid. Upon hydrolysis glycyrrhizin produces aglycone, glycyrrhetic and 2 molecules of glucuronic acid. Glycyrrhetic acid is a pentacyclic triterpene derivative of beta-amyrin type. It has some pharmacological activity e.g. antiviral, anti-fungal and anti-bacterial The drug also contain glucose (1.4%), Sucrose (2.5%), Starch (29%), proteins, asparginases (1%), fat and resins. The flavour of liquorice comes mainly from a sweet tasting compound anethole, an aromatic phenolic ether compound, also found in fennel, anise and other herbs Glycosyl: It is the radical of glucose that has lost its hemiacetal.

**Uses:** o It possesses demulcent and expectorant hence it is used in cough preparation.

o as flavoring agent to mask the taste of bitter drugs, e.g. Aloe, Ammonium chloride, Quinine etc.

o used in mouth ulcers and peptic ulcers.

o It is used in arthritis and allergy as it has anti-inflammatory activity. o It is used in Addison’s disease. -.

iii. Senna:

- Synonyms: Sana Maki; Sona ka pat. –

Biological source: leaflets and pods of *Cassia acutifolia and Cassia angustifolia*, Fam. Leguminosae

**Geographical Source:** C. acutifolia grows wild near the Nile river and tropical Africa. C. angustifolia grows wild to Somalia, the Arabian penisula and India. Most of the commercial material is also produced in the Jammu District of India and in Northwest Pakistan. - **Characteristics:** Senna is low branching small shrub of 1 meter height. Senna occurs in leaflets. o The leaflets of Alexandrian Senna are less entire and marked broken, curled at the margin about 2-4cm long and 7-12mm wide, and when dried are grayishgreen. o Apex is acute with sharp spine at apex; margin is entire. o They are unequal at the base tin, brittle and papery texture. They curl slightly as they dry. Taste is mucilaginous, bitter and unpleasant. o India Senna differs slightly from the Alexandrian senna; the leaves of Indian Senna resembles Alexandrian senna rather closely; but are generally yellowish green.. o There is also a slight but perceptible difference in the odour of the two varieties. –

**Chemical Constituents**: The constituents of Indian senna are identical with those of Alexandrian senna. Senna contains anthraquinone glycosides as Sennoside A, Sennoside B, Sennoside C, Sennoside d, Emodin, aloe emodin, Rhein etc.; and two naphthalene glycoside i.e.6-hydroxy mucizin glycosides and tinnevellin glycoside. It also contains flavonoids or flavonol colouring matters kaempferol, its glucoside, also a sterol and its glucoside, mucilage, calcium oxalate and resin. Those present in greatest concentration are Sennoside A and B (1.5-3%); they both hydrolyse to give two molecules of glucose and the aglycones Sennidin A and B. Sennidin A is dextrorotatory and B is its meso-form.

**Uses**: o It is used as laxative acting on lower large intestine (bowel) and hence useful in eliminating constipation.

o It is used to evacuate in colonoscopy.

o It is used to cure skin disorders.

**iv. Cassia** –

Synonyms: Cassia fructus; Golden shower tree; Cana fistula; Gurmula, Amaltas (Urdu). - Botanical Source: Cassia pods are the dried ripe fruit of *Cassia fistula*. –

Parts used: Dried ripe fruit; bark, leaves, seeds flowers.

- Habitat: native to Southern Asia, Pakistan, India, Myanmar, Sri Lanka, Indonesia, South Africa, Egypt but now widely cultivated in tropics.

Macroscopic Characters: It is a tall tree having height 10-20 meters that is cultivated worldwide as shade and beautiful ornamental tree having showy yellow flowers; i.e. golden yellow five petals. o Fruit: The fruit is an indehiscent pod about 40-70cm long and 25-27mm in diameter, straight or slightly curved, or sub cylindrical. Dark chocolate brown to black in colour, smooth o Taste: Pulp has sweet and prune like unpleasant odour. It differs from a typical legume in being indehiscent as well as many celled.

- **Constituents**: The pulp, the only part used medicinally, is separated by crushing the fruits.

o The pulp contains anthraquinone glycoside, i.e. free and combined rhein, sennidins and sennosides A and B (2%); emodin, Barbaloin; and 50% of sugar, 24% crude proteins, o 20% crude fibers, beta-sitosterol, colouring matter, traces of volatile oils

**Pharmacology**: o significant anti-inflammatory effect. o anti-bacterial activity

o anti-viral, liver protective, anti-tumorous, Cholesterol lowering, Laxative pain relieving, fever reducing action.

- **Uses:** o In Ayurvedic medicine fruit pulp is used in fever, all kinds of bleeding as well as cardiac conditions and stomach problems such as acid reflux. o As anti-tussive agent. o It is also employed as remedy for tumors of abdomen, glands, liver, stomach and throat. o It is effectively used in skin disease (Pimples, burns,wounds). o As anti-inflammatory in rhematism e.g. gout.

**Tamarind**

**B/ S :** Partially dried ripe fruit of  ***Tamarindus indica*** ( Fam: Leguminosae)

* Deprived of brittle outer part of the pericarp ( epicarp) & preserved in sugar or syrup

**Habitat**

* Indigenous to tropical Africa, but is now cultivated throughout India, Pak, The W indies, Sudan, America, Brazil, Mexico etc.
* **Characteristics of the plant** : Tree can grow up to 20m in height & stays ever green . Yellow flowers with orange or red. Streaks are produced in raceme.
* **Fruit** : brown . Legume having size of 5-20 cm long and 2 cm wide in diameter which contain soft pulp and many hard coated seeds . The epicarp of fruit is hard ,rough , brownish and brittle.
* Tamarind pulp occurs as a radish brown, moist, sticky mass. In which vascular strands or yellowish brown fibres are embedded.
* **Odour**  : The pulp has a characteristic , pleasant and fruity odour **Taste** : Sweet and acidic
* **Chemical constituents**
* The pulp contains free organic acids ( about 10% of tartaric acid, malic acid ) their salts ( about 8% potassium hydrogen tartrate ) .Little nicotinic acid and about 30-40 % of invert sugar.

**Uses** : Tamarind pulp is mild laxative . a commercial source of tartaric acid

* used in digestive problems like indigestion; in bile disorder
* Pulp(in the form of poultice) is applied on swollen joints (e.g in rheumatism)
* Used in gargles for sore throat As an astringent in dysentery and in diarrhea etc.
* also used in hemorrhoids

**UMBELLIFERAE (Apiaceae)**

**Introduction**: - a family of usually aromatic plants with hollow stems. - 300 genera & between 2500 and 3,000 species. - The earlier name of the family derives from inflorescence being in the form of a compound “umbel” and has the same root as the word “umbrella”.

**Botanical Characteristics**: - Leaves & stems: o Most members soft stemmed

o Annuals, biennials or perennials

o A few woody trees

o The stems are hollow, often ribbed or furrowed (an elongated ridge or (protrusion) o

- Flowers: o It is the flowers which give this plant family its original name of umbelliferae. o The radially symmetrical small flowers grow in umbel or cluster forming an umbrella shape flowers have stalk of different lengths, so that all flowers have the same lengths, thus umbel has a flat top o Each flower has 5-petals, 5-stamens and 5- small sepals.

.**Fruit**: Cremocarp o Frequently crowned with a stigma-hearing disc known stylopodium.

Similar ducts occur in the stem and roots in the species like asafoetida that yields oleo-resin gum.

**Chemical characteristics** –

**Volatile Oils**: Members of this family are often rich in volatile oil which is pharmaceutical importance for many of the apiaceous drugs. The main umbelliferous fruits and their volatile oils used in pharmacy are: o Fennel, Foeniculum vulgare (anethole, fenchone); o Caraway, Carum carvi (carvone); dill, Anethum graveolens; Indian dill, Anethum sowa; o Coriander, Coriandurm sativum (coriandrol); aniseed, Pimpinella anisum; and o Cumin, Cumminum cyminum, Bupleurum falcatum roots contain oleanenesaponins and are important antihepatotoxic drug in oriental medicine. –

**Glycosides**: Almost 300 species umbelliferae contains glycosides belonging to 2 main groups i.e.; o Flavonones (luteolin) o Flavonols (Kaempferol, quercetin) o Other classes of flavonoids include leucocyanidin,apigenin, isorhamnetin and glucoxanthone, magniferin etc. - Terpenoids: Terpenes, sesquiterpenoids and triterpenoid saponins are also found among the members of this family

- **Fatty acids**: Seeds of Carum carvi, carrot, Apium graveolens (celery) and parsely all contain triglycerides (TGA) and fatty acids. - Alkaloids: Alkaloids also occur in this family but are rare. e.g. hemlock (Conium maculatum) contains coniine, which is toxic.

**Therapeutic uses** of Apiaceae family: -

**Stimulant and carminative**: As many members of this family e.g. fennel, coriander, aniseed, caraway etc. are rich in volatile oil, so they are used as stimulant and carminatives. They increase amount of gastric enzymes, so gastric secretion and bile secretion is increased, that is responsible for improved digestion.

**Flavouring agents**: Members of apiaceae are used as flavouing agents.

- **Respiratory tract infections**: Apiaceae members are used in different respiratory tract ailments –

Coronary vasodilators: A few members of this family that are reported to have potent coronary vasodilator effects and are Ca++ antagonists. - Anti-oxidant agents: A few crude drugs are used for certain abnormal conditions of skin e.g. wrinkles, oily skins and anti- aging agents of the skin, e.g. fennel, caraway etc. - Anti-Coagulant agents: Many members contain anti- coagulant agents, e.g. coumarin, hydroxycoumarin, furanocoumarins, etc.

Some Member of the Family: - Fennel. - Caraway. – Coriander, Conium,

i. Fennel

- Botanical origin: *Foeniculum vulgare* Mill; - Family: Umbelliferae/Apiaceae

- Synonyms: Garden fennel, Sweet fennel; Saunf (Urdu)

- Parts used: Dried ripe fruit; also seeds, root, leaves & whole plants

- Habitat: Indigenous to Mediterranean countries (France, Greece, Turkey, Italy, Syria, Egypt). The plant is widely cultivated in many parts of Europe, China, Egypt, India, and Pakistan. In Indo-Pakistan, cultivated throughout this land

- Surface: The surface of the fruit is glabrous containing 5-primary ridges and bifid stylopod at the apex. - Colour: Greenish brown to yellowish brown

- Odour: Aromatic - Taste: Characteristic & sweet aromatic

- **Chemical constituents**: The fruit contains: o 1-4% volatile oil, o Fixed oil (9-12) o Proteins 20%. o The main constituents of volatile oils are phenolic ether, anethole (50-60%) the ketone, fenchone, (10-30%). o Minor constituents: Monoterpene hydrocarbon such as limonene; anisaldehyde, estragole (methyl chavicol), α- and β-pinene, ascorbic acid, riboflavin, cineole. o Other components: Flavonoids, coumarins, and glycosides.

- **Therapeutic uses**:

o used as carminative, stimulant & stomachic in different digestive complaints, e.g. flatulence, heartburn, bloating, nausea, vomiting, anorexia, dyspepsia.

o Used as flavouring agent.

o Detoxifier by boosting metabolism.

o It has diuretic effect and is used to flush the kidneys.

o It acts as aphrodisiac. o anti-oxidant

o expectorant. anthelmintics.

Caraway

* **Synonyms**:Fructus carvi, sia-Zeera (urdu),Caraway seed; caraway fruit, carvomen;
* **Botanical Source**: the dried ripe fruits of Carum carvi; Fam :Umbelliferae/Apiaceae
* **Geographical Source:** occurs both wild and cultivated in central and northern Europe( the Netherlands, Denmark, Germany) and Egypt, Morocco, China etc. In India, and in the Hilly areas as Hills of Kashmir as a summer crop. The plant requires a dry temperate climate
* **Morphology/Character of the plant**:
* Caraway is a slender biennial herb about 1 meter high. Dried, ripe fruit is usually oblong slightly curved, smooth and tapering at both ends. Each mericarp has 5- primary ridges (ribs); the fruit has 6-vittae. **Size:** 4-7mm long and 1-2 mm broad.
* **Colour**: its colour is brown **Odour:** Characteristic, aromatic **Taste:** Spicy
* **Chemical constituents**:
* 3-7% of volatile oil, 8-20 % fixed oil, proteins, calcium oxalate, colouring matter& resin
* **the main constituents of vo**
* ketone,carvone (50-60%), terpene hydrocarbon, limonene,etc; also contains small quantities of α-pinene, α-phellandrene, carveol, dihydrocarveol & di-hydro –carbon
* **Therapeutical uses :** flavouring agent in many medicines.
* Its oil is used in preparation of mouth wash.
* used in different digestive complaints e.g. heart burn, bloating, dyspepsia ,anorexia etc. used for colic.
* Oil for colds; also useful in bronchitis, laryngitis & cough
* The drug is used as a lactogogue, i.e., promotes milk secretion. Anxiolytic .

**Coriander**.

* **Synm**: Chinese Parsely, Cilantro,Fructus coriandri ; Coriander seed; Dhania ( Urdu)

**B/S** dried ripe fruit & leaves of Coriandrum sativum; Fam: Apiaceae.

**Geographical source**: indigenous to Italy, however now is widely cultivated in Mediterranean and Caucasian region

**Characteristics**: The plant is a slender annual herb growing to 0.45m to 0.60m or 2-8 feet .Flower blossoms in the June to July . The shoots and leafy flower are white or (very pale) pinkish, which are scented and hermaphrodite; and are pollinated by insects.

**Chemical constituents:** contains up to 1.8% of volatile oil. Fixed oil, about 13%; tannin; calcium oxalate; and proteins 11-17%; other substance are Flavonoids, coumarins, carboxylic acid. The main constituents of volatile oil are (+) linalool (coriandrol) 65-70% and α-pinene (3.97%) and terpinene (4.64%) & small quantities of borneol and geraniol, cymene, camphor and malic acid. Some 43 constituents have been identified. The alcohol linalool (coriandrol) is the chief constituent that is 90%.

* **USES**
* carminative, aromatic stimulant, appetizer & digestant . also used in colic.
* As expectorant
* As flavouring agent in masking foul medicines,especially with purgatives, where it has anti-gripping property e.g. Rhubarb and Senna, Aloe, etc.
* used as antiseptic, especially in mouth ulcerations.
* generally beneficial to nervous system; & has been used as folk medicine for relief of anxiety, & insomnia; experiment in mice support its use as anxiolytic.
* Coriander mixed with turmeric powder or mint juice is used as a treatment for acne, applied to the face in the manner of a toner.
* **Conium**
* Synm: Hemlock fruit; Hemlock; snake weed, poison root; devil’s porridge. Shukran (urdu). **B/O:**the dried unripe fruits of Conium maculatum **Fam;** Umbelliferae.
* **Geographical source:** large herb indigenous to Europe and naturalized in north and south America & various parts of Asia
* **Characteristics:**
* herbaceous biennial plant,which is 1.5-2.5m (or 5-8 feet) tall, with a smooth green stem, usually spotted or streaked with red or purple colour on the lower half of the stem.Often referred to as “the blood of Socrates”.The flowers are small, white, clustered in umbels. The plants is often mistaken for fennel.The plant are resembles wild carrot. It is also often mistaken with anise and caraway.
* **Chemical constituents:**
* All parts of the plant are toxic because of the presence of several nicotine like alkaloids. The principal constituents of hemlock fruit are poisonous, volatile, liquid alkaloids to the extent of 1- 2.5%.
* (watery juice) coniine (hexahydropropyridine), conhydrine (hydroxyconiine), N-methyl coniine, pseudoconhydrine, conhydrinone &-coiceine; fixed oil, starch, calcium oxalate
* Uses: The drug is prescribed in cases of undue nervous motor exitability.
* Analgesics in arthritis.
* Hemlock is used in spasmodic and convulsive diseases such as tetanus, and epilepsy; in asthma, whooping cough and spasmodic affections of the larynx and gullet (respiratory, bronchial spam). The drug is a sedative. As an antidote to strychnine poisoning. Externally, it is applied to haemorrhoids and irritable conditions of rectum.
* Conium was fromely used to a considerable extent in medicine, but today has fallen in to almost complete disuse.
* **Asafoetida**

**Synonyms**: Devil’s dung, food of gods, Gaint fennel; Hing (Urdu)

* **B/ origin**:Asafoetida or gum asfoetida is the oleo-gum-resin obtained as exudation by incising the living rhizomes and roots of *Ferula assafoetida* or *Ferula foetida*, Ferula rubricaulis and other species of Ferula; Fam :Umbelliferae)
* **Geographical source:** large umbelliferous plants growing in eastern Persia, Western Afghanistan and Pakistan. cultivated in the North Western part of India.
* **Characters of the plant:**
* The plant is a perennial herb, 2-4 meter high. The leaves are 30-40 cm long tripinnate or even more finely divided with a stout basal sheath. The flowers are yellow produced in large compound umbels.
* **Characteristics of the drug:**
* Asafoetidaoccurs as soft and solid mass or almost semi- solid mass. There are two principal forms of asafoetida: (1) Tears form (ii) Mass form
* **Tears Form**: rounded or flattened and about 5-30mm diameter; solid or semi-solid grayish white, dull yellow (whitish yellow), or reddish-brown ; internally, milky white.
* **Mass Form**: similar to tears but agglutinated mass. More or less uniform and mixed with varying quantities of extraneous substance
* Asafoetida has a strong, alliaceous odour, and taste is bitter, acrid and alliaceous
* **Chemical constituents**:
* Asafoetida consists of volatile oil 4-20%,resin 40-65%, gum 25% and impurities.
* The oil has particularly evil smell and contains sulphur compounds .
* The main constituents of the oil is isobutylpropanyl disulfide that is accompanied by a number of related organic disulfides.
* Some terpenes are apparently also present.
* The resin consists of asaresinotannol, both free and combined with ferulic acid (i.easaresinolferulate), pinene, vanillin, and freeferulic acid.
* Umbelliferone also presenet in combined form
* **Uses:**
* carminative, diuretic, in digestive disorders, abdominal pain
* employed to expel flatulence
* Anti-asthmatic
* Expectorant
* Anti-spasmodic
* Laxative
* Applied externally to ring worm
* In whooping cough
* Chronic bronchitis
* Stimulant action on bowel, and relieve constipation.
* It is used in fighting flu;
* in 1948 it was used to fight Spanish influenza pandemic

APOCYNACEAE

Characteristics of The Family: -

a family of flowering plants, consists of 355 genera and 3700 species and that includes trees, shrubs, herbs and lianas (long stemmed woody vines). –

five sub-families in apocynaceae: o Rauvolfiodeae o Apocynoideae o Periplocoideae o Asclepiadoidae (Asclepiadaceae is now included in Apocynaceae) o Secamonoideae –

Species in the family are mainly distributed in tropical regions; e.g. in central America, Indo-Malaya, Indo-Pak. - Members of the family often contain juice or sap. - Leaves: The leaves are simple, usually opposite and decussate or whorled, lacking stipules. - Flowers: Flowers are usually showy, radially symmetrical (actinomorphic), aggregated in cymose or racemose inflorescence. They have petals fused and typically overlap the bud.

Fruit: The fruit is usually a berry, a drupe, a capsule or follicle.

- Important genera: Rauwolfia (100 species); Apocyanum (7 species); Allamanda (15 species); Alstonia (50 species); Lochnera-catharanthus (5 species); Vinca (5 species); Cerbera (6 species); Nerium (3 species); Aspidosperma (80 species). –

**Chemical Composition**: Different members (plants) of this family consist of chemical constituents belonging to different groups.

Followings are a few important groups:

**o Alkaloids**: A few plants of this family contain indole-alkaloid, as they possess an indole ring as a part of their nucleus, e.g. Rauwolfia and Catharanthus, i.e; Ravwolfia serpentina contains reserpine, ajmalacine etc., and Catharanthus rosea contains vincristine, vinblastine etc. Alstonia species contain alstonine, alstoniline, Picralima nitida (seeds) contain opoid alkaloids; these are Akuammidine, akuamine, akuamicine etc.

o **Glycosides:** A few plants like Strophanthus kombe contains strophanthoside i.e. the principal primary glycosides. Similarly, Nerium oleander and its relatives contain oleandrin, digitalinum, venum and gitoxigenin. Similarly, Apocynum venetum contains glycosides like apocynosides. Moreover, there are also flavonoid glycosides, e.g. flavonoids are found in Folium apocyni and new flavonoid triglycosides have been isolated from the leaves of Cerbera manghas (sea mango). The other flavonoids are quercetin, kaempferol etc. found in the leaves and flowers of Apocynum venetum.

o **Tannins:** 40-50% Tannins were found in no. of latex samples obtained from 4 different species of the family e.g. Periwinkle.

o **Resinous Matter**: Certain members of this family contain resinous substance, for example, Rauwolfia’s sedative and hypnotic actions are due to this resinous matter.

o **Phyto-sterols**: Phyto-sterols are present in a few member of this family, e.g. flowers of Apocynum venetum contain daucosterol, and Rauwolfia serpentina also contain phyto-sterol. o Antibacterial agents: Picralima nitida possesses antibacterial activity against certain bacteria like Staphylococcus.aureus, B. Subtilis, E. coli and Pseudomonas aeruginosa; The results provide a rationalization for traditional use of the herb in disease like diarrhea, salmonellosis and malaria.

**Therapeutic uses of Apocynaceae**: -

**Drugs Used in Cardiac Diseases**: o

**Anti-Hypertensive**: A few species like Rauwolfia serpentina contains reserpine, that is an effective anti-hypertensive agent. Leaves of Apocynum venetum are antihypertensive due to vasodilation. o Anti-Arrhythmic agents: Ajmaline is marketed in japan for the treatment of cardiac arrhythmias.

o **Cardio-tonics**: The family contains certain drugs which act as cardio-tonics like digitalis, example of such drugs are strophanthus, Neriuma and Apocynum. These have influence on circulation, especially in case of chronic heart weakness, they act as cardio-tonic and stimulant, so they are effective in heart failure. Similarly, Cerbera manghas contains “cerberin”, that is also cardiotonic. o

**Drugs used in C.N.S diseases**: Indole-alkaloids, like reserpine is very effective in certain C.N.S diseases, e.g. Reserpine is an excellent sedative and hypnotic because of this tranquilizing action. So the drug is effective in certain forms of insomnia. Reserpine is also effective in certain neuropsychiatric disorders like certain forms of insanity and schizophrenia. Reserpine has also shown its effectiveness in epilepsy.

o **Anti-Cancerous Agents**: Catharanthus roseus contain vincristine, vinblastine, which are very effective in certain cancers. e.g. leukemias, lymphomas, choriocarcinoma etc.

o **Miscellaneous Uses**: Asian jasmine, native to South Asia is used in Korea to treat rheumatism, heal abscesses, ulcers, and sooth laryngitis. Extract of A. venetum is protective against lipid-peroxidation-related stress in C.N.S, associated with progress of depression, so it is an effective anti-depressant.

❖ **RAUWOLFIA/RAUVOLFIA**

- Snake root, Sarpaghanda (Sanskrit); Chota chandan; Paglay key Dawa (Urdu).

- Biological Source: dried roots and rhizomes of Rauwolfia serpentina. - Family: Apocynaceae. - Geographical source: It is a native plant of Indo-Pakistan, Burma, Sri-Lanka, Vietnam, Malaysia, Thailand, Indonesia and the Philippines, etc; and occurs in hot moist regions. Practically all commercial supplies at the present time come from India and Thailand.

- Plant Characters: Rauwolfia serpentina is an erect, perennial shrub that reaches 1 meter in height and has cylindrical stems.

Characteristics of The Drug: - **Shape**: Drug occurs in cylinder or slightly tapering pieces; tortuous and rarely branched roots and rhizomes

The roots and rhizomes closely resemble each other. The rhizomes can be identified by the presence of small central pith.

- Size: Majority of the pieces of roots and rhizomes are about 8 to 15 cm long and 0.5-1 cm thick. Some pieces are as much as 40 cm long and may be up to 2.0 cm thick. –

Colour: The outer surface is dull and grayish brown or light brown. The outer surface shows faint longitudinal ridges in case of old drug; while young pieces have wrinkles. Sometimes circular scars of rootlets are present.

- Fracture: Short; and fractured surface shows a pale yellowish white, finely radiate and compact wood. It has 3 to 8 growth rings. –

Odour: Odourless or slight. - Taste: Bitter taste.

- **Chemical constituents**: The drug contains resinous matter along with alkaloids 1.7-3% of which are present in root, stem, rhizome but root has more than 90% alkaloids. There are about 50-alkaloids, the important ones are reserpine, rescinnamine, serpentine, ajmaline (rauwolfine), serpentinine, ajmalainine, yohimbine. In 1931, Dr. Salim-uz-zaman siddiqui (an organic chemist) of Pakistan isolated ajmaline (rauwolfine), ajmalinine, ajmalacine, serpentine and serpentinine. All these are indole alkaloids. The most active tranquilizing and hypotensive alkaloids are reserpine and its trimethoxycinnamate analogues.

- **Pharmacology**:

Reserpine (Rauwolfia alkaloids) has the ability to block the uptake of biogenic molecules into the synaptic vesicles. It causes depletion of catchecholamines from post ganglionic sympathetic nerves and the adrenal medulla. Both catecholamines and serotonin are depleted from the brain. The catecholamines that are not taken up into the neuronal granules are metabolized by the mitochondrial monoamine oxidase, causing the reduction of amine content.

- **Therapeutic uses**: o Rauwolfia serpentina and its preparations (like Reserpine) is used as (2nd line) **antihypertensive agent**.

o As **sedative and hypnotic** (sedative, hypnotic actions are due to resinous matter) o As tranquilizer o Reserpine is also used in certain neuropsychiatric disorders, e.g. insomnia, certain forms of insanity, schizophrenia, etc.

o Ajmaline, which has pharmacological properties similar to those of quinidine, is marketed in Japan for the treatment of cardiac arrhythmias.

o Also used in epilepsy

❖ **CATHARANTHUS**

- Synonyms: Vinca; Madagascar Periwinkle; Sada bahar(urdu). –

B/S : dried whole plant of the *Catharanthus roseus or Vinca rosea*; Family: Apocynaceae. - **Geographical source**: native and endemic to Madagascar, but is now cosmopolitan in the tropics and is widely cultivated in countries like India, Pakistan, Thailand, Taiwan, Florida, Australia etc. Eastern Europe, Spain.

- **Characteristics of The Plant**: The plant is an erect, ever blooming pubescent herb or sub-shrub that is woody at the base and stands 40-80 cm high.

o Leaves: The leaves are oppositely arranged, oblong with a petiolate acute base & entire margin.

o Flowers: The flowers are normally violet, rose, white (var. albus) or white with a red eye (var. ocelltus), or red with a white eye.

Odour: The drug has a slight odour. o Taste: Bitter.

**Chemical Constituents**: About 150 alkaloids have now been isolated from C. roseus; for example, serpentine, ajmaline, reserpine, etc. are also present in other genera of this family.

Of particular interest is a group of about 20 bis-indole alkaloids, which contains those having anti-neoplastic activity, including leurocristine, (vincristine) and vinca leukoblastine (vinblastine). Vincristine is structurally similar to vinblastine but has a formyl group rather than a methyl group on the indole nitrogen. Because these alkaloids are only minor constituents of the plant, i.e. relatively small amounts exist in the crude drug (vincristine yield is 0.0002% and vinblastine 0.03 % in crude drug), large quantities of raw material are required. Nearly 500kg of catharanthus are utilized to produce 1gm of vincristine. In addition, there is a growing demand for vincristine rather than vinblastine, but the plant produces a much higher proportion of vinblastine. Fortunately, it is now possible to convert vinblastine into vincristine either chemically,or via a micobiological N-demthylation using Streptomyces albogriseolus. To satisfy the demand, the plant is collected from both natural and cultivated sources.

**- Pharmacology: (Mechanism of action)** Vinca alkoids act by binding to the protein tubulin in the mitotic spindle; preventing polymerization and assembly of the microtubules (mitotic spindles are made of these microtubule). Thus, they exhibit anti-tumor activity as anti-mitotic and antimicrotubule agents. During mitosis, the chromosomes separate with assistance of these microtubules, and after cell division, the microtubules are transformed back to tubulin; which is a structural protein. –

**Uses:** o

**Catharanthus alkaloids are anti-neoplastic in nature**.

o Vinblastine (sulphate) is used mainly for the treatment of generalized Hodgkin’s disease (lymphoma) and non- Hodgkin’s lymphomas and choriocarcinoma (rare cancer of placenta) resistant to the other therapy. o Vincristine (sulphate) is recommended for acute leukemia and in combination therapy in Hodgkin’s disease. o It has other application for lymphomas, small cell lung cancer, cervical and breast cancer. o Vincristine has a superior anti-tumor activity compared to vinblastine but is more neurotoxic.

o In folklore medicine, vinca has been used as anti-diabetic, anti-hypertensive & haemostatic. o Periwinkle can be used to address haematuria, blood loss during menstrual period (menorrhagia) due to presence of tannins. Periwinkle is effective in digestive problems e.g. diarrhoea and colitis to reduce fluid loss or blood loss, whilst toning the membrane. It may be used in cases of nose-bleed, bleeding gums, mouth ulcers etc.

**ASCLEPIADACAE**

**Introduction:** The Asclepiadaceae are mostly herbs and shrubs with white sap. Many of these are lianas and some are cactus like succulents with reduced leaves. There are 348 genera, with about 2,900 species.

**Distribution**: mainly located in the tropics to subtropics, esp. in Africa and South America.

**Botanical Characters**: - Leaves: The leaves are simple and nearly always opposite or whorled; minute stipules present.

Flowers: The flowers are pedicellate, bracteate, hermaphrodite, actinomorphic; usually the flowers are small in size, but the flowers of Ceropegia, Stapelia and Stephanotis are quite large in size. - Pollination of Flowers: They are remarkable for the complex mechanisms they have developed for pollination,. The fragrance from the flowers, often called "carrion", attracts flies.. - Fruit: Fruit is a follicle. - Seeds: Seeds usually have a tuft of hairs at one end. –

**Chemical Composition**:

o **Glycosides:** Calotropin, calotoxin, calactin, uscharidin, anvoruscharin.

o **Triterpenoids Saponins**: (suppress the taste of sweetness.). The milky sap contains a complex mix of chemicals, such as steroidal heart poisons known as "cardiac aglycones"

- **Therapeutic uses**:

: o Anti-allergic.

o Antiviral.

o Lipid lowering activities. o Diabetes. o Metabolic syndrome. –

: These are used in treatment of following Diseases: o Syphilis o Boils. o Inflammation (swelling). o Epilepsy. o Muscular spasm, warts, leprosy, gout, snakebites. o Cancer.

- Plants: The important plants of Asclepiadaceae are o Calotropis procera. o Gymnema sylvestre.

**i. *Calotropis procera***

- Syms: Apple of Sodom, Sodom Apple, King's Crown, Rubber Bush, Rubber Tree.

- B/S : Latex obtained from riped fruit and stem of *Calotropis procera*. – Fam Asclepiadaceae.

- Geographical source: North Africa, Tropical Africa, Western Asia, South Asia and Indo-China- **Botanical description**:

o C. procera grows to about 3 to 6 ft o The flowers are about 1.5 to 2 in (3.8 to 5.1 cm) in size, with umbellate lateral cymes and are colored white to pink and are fragrant. o The seeds are compressed, broadly ovoid, with a tufted of long silky hair.

- **Chemical Constituents**: o Glycosides: calotropin, calotoxin, calactin, uscharidin and voruscharin. o Cardiac Aglycones: Steroidal heart poisons. The steroidal component includes an hydroxyl group in the C3β position, a second attached to the C-14 carbon, a C/D-cis ring junction and an α,β-unsaturated-γ-lactone in the C17 position.

- Toxic Principles: o The Milky exudation from the plant is a corrosive poison.

o Calotropis species are poisonous plants; calotropin, a compound in the latex,is more toxic than strychnine. Calotropin is similar in structure to two cardiac glycosides which are responsible for the cytotoxicity of apocynum cannabinum. o Extracts from the flowers of calotropis procerahave shown strong cytotoxic activity. The extracts are also harmful to the eyes.

- **Therapeutic Uses**:

o Digestive disorders including diarrhea, constipation and stomach ulcers;

o For painful conditions including toothache, cramps, and joint pain.

oparasitic infections including elephantiasis and worms.

o For syphilis, boils, inflammation (swelling), epilepsy, hysteria, fever, muscular spasm, warts, leprosy, gout, snakebites,

and cancer

ii. Gymnema sylvestre.

- Synonyms: Gymnema, Cowplant, Australian cowplant, guramari, Gurmar booti,(urdu)- **Biological Source**:

active ingredient gymnemic acid, is extracted from leaves and roots.

- **Geographical source**: Native to the tropical forests of southern and central India & Sri Lanka. - **Botanical characters**: Gymnema sylvestre is a large, woody climber.

o Leaves: Leaves are elliptic, narrow tipped, base narrow. Leaves are smooth above, and sparsely or densely velvety beneath.

o Flowers: Flowers are pale yellow, bell-shaped . Pale yellow flowers are small,

- **Chemical Constituents:**

o Triterpenoids saponins. o Gymnemic Acid.

- **Therapeutic Uses**:

o Its principle constituent is gymnemic acid which has anti-diabetic properties. o It abolishes the taste of sugar and is believed to neutralize excessive sugar present in the body in diabetes mellitus. o The leaf extracts contain gymnemic acid which is said to inhibit hyperglycemia. o It has also been shown to have a regenerative effect on pancreatic beta cells and is insulinotropic.

o The leaf extract is a cardiovascular stimulant and hypoglycemic.

o It is useful in glycosuria and has purgative properties.

o The plant is stomachic, stimulant, laxative and diuretic.

o One of the alternative medicines to both diabetes and obesity.

**COMPOSITAE/ASTERACEAE**

- Introduction: Compositae is the largest family of flowering plants.

It contains about 900 genera and 13000 species. Chemical research in recent years has increased medical interest in the family; thus, a better knowledge of many almost-discarded folk remedies as well as hither to uninvestigated plants developed.

- Distribution: Composite flowers have a cosmopolitan distribution and are found everywhere except Antarctica and the extreme Arctic. They are especially numerous in tropical and subtropical regions (notably Central America, eastern Brazil, the Mediterranean, the Levant part of the Middle East, southern Africa, central Asia, and southwestern China.

- **Botanical Characteristics**: Asteraceans are mostly herbaceous plants, but some shrubs, trees and climbers do exist. Asteraceans are generally easy to distinguish from other plants, mainly because of their characteristic inflorescence and other shared characteristics. o Roots and Stems: Asteraceans generally produce taproots, but sometimes they possess fibrous root systems. Stems are generally erect but can be prostrate to ascending. Some species have underground stems in the form of caudices or rhizomes. These can be fleshy or woody depending on the species o Leaves: The leaves and the stems very often contain secretory canals with resin or latex (particularly common among the Cichorioideae). The leaves may be simple, but are often deeply lobed or otherwise incised, often conduplicate or revolute.

o Fruits and Seeds: The fruit of the Asteraceans is achene-like and is called a cypsela (plural cypselae).

.The mature seeds usually have little endosperm or none.

- **Uses:**

o Artemirinin and its derivatives are the most rapidly acting antimalarials and are highly selective against malaria parasites. o Echinacea (Echinacea purpurea) is used as a medicinal tea. Arctium lappa as diuretic, diaphoretic. -

1. **Artemisia –**

Introduction: Artemisia is a large, diverse genus of plants with between 200 and 400 species. - Synonyms: mugwort, wormwood and sagebrush.

- B/S : Hardy herbaceous plants and shrubs of Artemisia which are known for the powerful chemical constituents. - Family: Asteraceae.

Artemisias are perennial, tender perennial, or rarely annual. - Botanical characters: o Plant Form: Shrub o Size: Ranges from small 6 to 8 inch mounds to erect stems and branches reaching up to 10 feet in height. Most garden varieties are between 1 and 4 feet tall with a 3-foot spread. o Flowers: Arranged in panicles or umbels; although some are attractive, most are very small, mainly pale yellow to bright yellow, and relatively insignificant. o Aroma: Many Artemisias are highly fragrant due to the presence of cineole.

**Chemical Constituents**:

o Terpenoids o Sesquiterpene lactones o Artemisinin o Artemisinin derivatives

- Pharmacology: o Artemirinin and its derivatives are the most rapidly acting antimalarials and are highly selective against malaria parasites. o As with Quinine, Haeme is involved in their mode of action but the mechanism is quite different. o *Artemisia capillaris* Thunberg (A. capillaris) has been found to have potent sedative-hypnotic effects, which are probably mediated through potentiation of the GABAA receptor- Cl- ion channel complex.

**Therapeutic uses**: o Artemisinin (from Artemisia annua) and derivatives are a group of compounds with the most rapid action of all current drugs used to treat malaria. Treatments containing an artemisinin derivative (artemisinin combination therapies) are now standard treatment worldwide for malaria caused by Plasmodium falciparum.

o *Artemisia cina* and other Old World species are the source of the antihelminthic drug, santonin. o Artemisia capillaris Thunberg (A. capillaris) has been found to have potent sedative-hypnotic effects. o Artemisia austriaca has beneficial effects in reducing the withdrawal syndrome of morphine

ii. Silybum marianum

- Synms: Cardus marianus, milk thistle, blessed milkthistle, Marian thistle, Mary thistle- Distribution: Originally a native of Southern Europe through to Asia, it is now found throughout the world. - Biological source: Traditional milk thistle extract obtained from the seeds of Silybum marianum. - Family: Asteraceae. –

Botanical characters: It grows 30 to 200 cm tall, having an overall conical shape with an approx. 160 cm max. diameter base. o Stem: The stem is grooved and more or less cottony.

o Flower: The flower heads are 4 to 12 cm long and wide, of red-purple colour.

- **Chemical Constituents**: Traditional milk thistle extract Contains; o 65–80% silymarin (a flavonolignan complex) o 20–35% fatty acids, including linoleic acid.

o Silymarin is a complex mixture of polyphenolic molecules, including seven closely related flavono lignans (silybin A, silybin B, isosilybin A, isosilybin B, silychristin, isosilychristin, silydianin) and one flavonoid (taxifolin).

- **Therapeutic Uses**: o Milk thistle has been used for a number of purposes including liver disease, and cancer

o Silymarin in higher doses have been studied, such as 600 mg daily in the treatment of type II diabetes. o 600 or 1200 mg daily dose in patients chronically infected with hepatitis C virus.

1. ***Arctium lappa***

Synonyms: Arctium lappa, commonly called greater burdock, gobo, edible Burdock -–

Biological source: Dried burdock roots of *Arctium lappa*. - Family: Asteraceae - Botanical characters: Greater Burdock is a biennial plant, rather tall, reaching as much as 3 m (10 ft). o Leaves: It has large, alternating, cordiform leaves that have a long petiole and are pubescent on the underside. o Flowers: The flowers are purple and grouped in globular capitula, united in clusters. o Fruits: The fruits are achenes; they are long, compressed, with short pappuses.

**Habitat:** This species is native to the temperate regions of the old world, from Scandinavia to the Mediterranean, and from the British Isles through Russia, and the Middle East to China and Japan, including India.

**Chemical Constituents**: Burdock roots contain: o Mucilage. o Sulfurous acetylene compounds. o Polyacetylenes. o Bitter guaianolide-type constituent. Seeds contain: o Arctigenin. o Arctiin. o Butyrolactone lignans. –

**Therapeutic Uses**: o Dried burdock roots (Bardanae radix) are used in folk medicine as a diuretic, diaphoretic, and a blood purifying agent.

o As a component of some cosmetics, shampoos and hair care products.

o The seeds of greater burdock are employed in traditional Chinese medicine particularly for skin conditions and in cold/flu formulas.

1. **Echinacea –**

Synonyms: Cone flower, purple cone flower. –

. - Biological source: The dried rhizome and roots of *Echinacea angustifolia*, *E.purpurea*. - Family: Compositae.

- **Botanical characters**: Echinacea species are herbaceous, drought-tolerant perennial plants growing up to 140 cm or 4 feet, in height.

o Stems: They have erect stems that in most species are unbranched.

Flowers: They have large, showy heads of composite flowers, blooming from early to late summer. The entire fresh, flowering plant is employed medicinally.

Distribution: They are found only in eastern and central North America

- Chemical Constituents: o Echinacoside; a caffeic acid gycoside, is a bacteriostatic principle. o Echinacea normal healing effects are attributed to a polysaccharide Echinacin B.

o A hydrocarbon obtained from the root oil.

o 1,8-pentadecadiene possesses in-vivo antitumor activity. –

**Uses:** o It is used primarily in lotions and cosmetics for its wound-healing action. o It increases resistance against infections.

o Echinacea is widely used to fight infections, especially the common cold, the flu.

o Other uses include anxiety, low white blood cell count, chronic fatigue syndrome (CFS), Rheumatoid arthritis, migraines, acid indigestion, pain, dizziness, rattlesnake bites,

Attention Deficit-Hyperactivity Disorder (ADHF), and improving exercise performance.

**SOLANCEAE**

**Introduction**: - A family of flowering plants contains a number of important agricultural and medicinal plants; as well as many toxic plants. - The family is also informally known as “the night shade” or “potato family” - The family includes: o Datura (Jimson weed) o Belladonna (Deadly nightshade) o Capsicum (chili pepper) o Solanum (potato, tomato) o Nicotiana (tobacco). The family is characteristically ethnobotanical, that is extensively utilized by human. It is an important source of food, spice and medicine however, species are often rich in alkaloids. It is a large family of 90 genera and 2000-3000 species.

**Habitat**: - It is found in most temperate and tropical regions with a large number coming from Australia, and central and South America - But is widely distributed in most parts of the world.

**Characters of The Family**: - A family mainly of herbs, with a few shrubs and trees and many contains food plants including potatoes, tomatoes, & peppers - Often with hairy stems and leaves - The leaves are variable and may be entire, or dissected, without stipules & are usually alternate, solitary or paired, simple, or pinnately compound. - Leaf-blade is entire, dentate.

- Flowers: These are typically conical, funnel or star-shaped, but often tubular or bell shaped;. Bisexual and actinomorphic or only slightly seldom zygomorphic

- Fruit: These are generally berry or capsule that is often a dehiscent capsule as in case of Datura.

**Chemical Constituents** -

**Alkaloids**: A wide range of diverse alkaloids of great taxonomic & pharmaceutic interest **Types of alkaloids**: □ Tropane alkaloidal: Belladonna, Datura and scopolia etc. contains atropine, hyoscine, hyoscyamine. □ Pyridine, pyrrolidine alkaloids: Tobacco contains nicotine. □ Steroidal alkaloid: Potato contains solanidine. - Steroidal saponins: (steroidal lactones) o The plant Withania somnifera in addition to producing alkaloids, contains steroidal lactone e.g. withanolides and withaferin etc. o Pungent principles: Some of the members of this family contains pungent principles, which have pharmacological actions. e.g.; capsicum contains, pungent principle, a phenolic compound capsaicin.

- **Flavonoids**: o Several species of Nicotine and solanum have been examined for their exudates flavonoid o Most of the aglycones are the widespread flavonoids, but rare and unusual Flavonoids are also found.

- **Carotenoids**: o Fully grown and mature red chilly shows an increased synthesis of carotenoids o Capsanthin the main carotenoid.

- **Coumarin**: Tobacco contains coumarin derivates like 7-methyl esculin o Sesquiterpenoid compounds: o Solavetivone, solanascone etc. were identified in the leaves of N. tabacum.

- **Fixed oil**: Capsicum contains 4-16% - Volatile oils: Capsicum contains 1.5% volatile oil

**Therapeutic uses** -

**Mydriatic agents**: Alkaloids of Solanaceae family like atropine, balladonnine etc. are used in eye preparations as mydriatic agents, where they cause pupil dilation.

**Antispasmodics**: Alkaloids like atropine, hyoscyamine, hyoscine etc. are used to relieve the spasm of smooth muscles of gastro-intestinal tract and urinary tract by reducing the gastric and salivary secretions. Hence, they are an important components in anti-diarrheal preparations and antispasmodics.

**Bronchodilators**: Alkaloids of Atropa belladonna etc. are used in asthma and other spasm conditions of respiratory tract, where they cause bronchodilatation.

**Carminative stimulant**: Capsicum is used as carminative and stimulant, improving digestion of food**.**

**Counter-irritant, anti-inflammatory**: Capsicum contains capsaicin, that is used as counter-irritant and anti-inflammatory in certain painful conditions (externally) lumbago, rheumatism etc. - **Anti-dotes:** Tropane-alkaloids like atropine is used in certain poisoning as antidote, e.g. Cholinergic, mushroom, opium and chloral hydrate poisoning.

- **Immuno-stimulant and adaptogenic**: Withania somnifera is used as adaptogenic, aphrodisiac, alternative and immune-stimulant that improves quality of life, in certain disease conditions like AIDS.

i. Belladonna:

- Synonyms: Deadly nightshade, Poison black berry, Devil’s cherries, Naughty Man’s cherries. **B/S** : The fresh and dried leaf, and flowering tops of *Atropa belladonna*. - Family: Solanaceae - **Habitat**: Indigenous to central and southern Europe & Asia minor, and is cultivated in England, Germany, United States. In India, in temperate Himalayan (western Himalayan) from Kashmir to Simla; Pakistan - Belladonna is an Italian word; bella means beautiful and donna means lady. Here by means that by putting its fruit juice in eyes, causes dilation of the pupils, thus giving a striking appearance.

- **Characteristics of the plant**: A perennial herb or herbaceous perennial plant, that can grow up to 1.5 m tall. o Dull green leaves. and bell-shaped flowers that are in shade of dull purple black, shiny berries (fruits) faintly scented and sweets. 1 cm in diameter. o Leaves are ovate having entire margin and acuminate apex.

**Chemical constituents**: 0.3to 0.6% tropane alkaloids; The chief alkaloids are hyoscyamine, atropine & scopolamine (hyoscine) The other components are apoatropine, asparganine and choline o The yield of alkaloids: □ Root 0.6 percent; □ Stems 0.05 percent □ Leaves 0.4 percent.

**Pharmacology:** o The alkaloids possess anti-cholinergic properties o Atropine is **a muscarinic receptor blocker**, interferes with Acetylcholine transferase in synapses competitively, hence blocks receptor sites and prevents acetylcholine binding to the receptor sites. o Thus, inhibits the parasympathetic nervous system which controls involuntary activities of the body.

o Atropine has **stimulant action on C.N.S**; but depresses nerve endings to secretary glands and plain muscles o Reduce intestinal, saliva, gastric, bronchial nose, lungs secretions o So excessive mucus secretion is controlled in conditions like allergy, flu, infection etc. o Atropine causes bronchodilation

o It relaxes smooth muscles of G.I.T and urinary tract. o It causes mydriasis in eye by causing dilatation of pupil. o It can cause tachycardia.

- **Therapeutic uses**: o Atropine (As Atropine sulphate 1% sol: or ointment) is used in eye preparations as mydriatic agent.

o It is used to relieve the spasm of G.I.T in colic, abdominal pain and cramps; and also, of urinary tract.

o It is one of the components of anti-diarrheal preparations.

o It is used in peptic ulcer.

o It is used in asthma where it causes bronchodilation

o It is used as sedative.

o In Parkinson’s disease to treat rigidity, tremors; excessive salivation and sweating. o Used as local anaesthetic. o In motion sickness.

**- Products**: o Tab. Buscopan o Tab. Lomotil o Eye drops Atropine sulphate

**ii. Hyoscyamus**

- Synonyms: Henbane, Insane root, poison tobacco, Khurasani Ajvayan (Urdu).

**B/S**: Dried leaves, with or without the stem and flowering or fruiting tops, of *Hyoscyamus niger*. - Family: Solanaceae

**Geographical source**: Indigenous to Europe, West Asia, Persia and India. In IndoPakistan, cultivation in temperate western Himalayan. Worldwide cultivated in Germany, Russia, Hungary and England. The Balkan, Belgium, USA & Canada.

- **Characteristic of the plant**: A biennial or annual herb grows up to 1.5 meter. o Leaves: Ovate leaves which has dentate margin, hairs on the surface and 5-6 lobes on each side. o Flowers: Yellowish in colour, with purple veins. o Dried drug is pale grayish green in colour, resinous to touch. o Odour: Characteristic odour. o Taste: Bitter.

- **Chemical constituents**: o Leaves contain about 0.045 to 0.14% of alkaloids, hyoscyamine and scopolamine (hyoscine) the principal alkaloids.

o **Atropine has been reported, but its presence is doubtful**

o The petiole appears to contain more alkaloid than the lamina or stem. o The ash varies from 8 to 12 percent in commercial samples. Often yield a larger amount, up to 22 percent, owing to the presence of earthy matter. o Seeds contain about 20 percent of fixed oil.

- Pharmacology: o A muscarinic receptor blocker. o Possessing the anti-cholinergic properties hence block receptor sites and prevents acetyl-choline binding to the receptor. o It decreases the mucus secretion; thus, reducing the gastric, salivary, intestinal and bronchial secretions - **Therapeutic uses**: o Used to relieve the spasm of G.I.T and urinary tract.

o **More effective than belladonna** o Does not give rise to the cerebral excitation caused by belladonna and is therefore effective in insomnia.

o Relieves the griping caused by drastic purgative. o The seeds have been used as source of alkaloid hyoscine. o They have similar action to leaves but are rarely used.

o Thrown upon hot coals, They give off a vapour, which is domestic remedy for toothache.

***iii. Datura Stramonium***:

- Synonyms: Thorn Apple, Devil’s apple, Jimson weed, Zombie’s cucumber.

- Biological source: The dried leaf and flowering and fruiting tops with branches of Datura Stramonium or of its variety. Tatula or its Indian variety, D. metel. D. alba (15-species). - Family: Solanaceae

- **Geographical source**: Native range of the drug is unclear however, it is believed that indigenous to the Caspian Sea and to have spread throughout Europe about first century now, this is common throughout Europe, Asia, America and South Africa, cultivated for the production of the drug in England, Germany, France and Hungary and Indo-Pak. - **Characteristics**:

o Flowers: The flowers are solitary and short-stalked (pedicel-short) they have a sweet scent. Each has tubular, five toothed calyx, 4.5 cm long; a white or purplish (violet)or pinkish, funnel-shaped (trumpet-shaped) about 8 cm long; o Fruit: The immature fruit is somewhat conical, egg-shaped walnut-size capsule is either covered with spines (short-stiff emergences) or bold, having numerous black seeds o Odour: distinct, heavy and narcotic. o Taste: unpleasant & nauseous.

- **Chemical constituents**: o Tropane alkaloids; 0.2-0.45% of alkaloids, the chief of which are hyoscyamine & hyoscine (2:1), the former being in excess. o A little atropine may be formed from the hyoscyamine by racemization. o It contains same alkaloids as belladonna but in somewhat less properties. o It also contains volatile oil, total ash about 17%. o Also, fastudine, fastunine, fasturic acid, ascorbic acid. Potassium nitrate etc.

- Pharmacology: o Hyoscyamine or hyoscine is a muscarinic receptor blocker. o It produces sedation and hallucination by acting on C.N.S. o It causes bronchodilation. o It relaxes the smooth muscles of GIT and urinary tract. o It causes mydriasis in eye. o Hyoscine lack the central stimulant action of atropine. i.e. atropine has a stimulant action on the central nervous system and depresses the nerve ending to the secretary glands and plain muscle. o Hyoscine has the sedative properties slightly more than belladonna, that enable it to be used in motion-sickness. –

**Therapeutic uses**: o Stramonium is an anticholinergic and has action like that of belladonna. Therefore, it is employed in all conditions for which belladonna is more commonly used; but acts much more strongly on respiratory organs.

o Used as antispasmodic and narcotic

o Used in motion-sickness o Hyoscycine hydrobromide is employed in pre-operative medication, usually with papavertum, some 30-60 min before the induction of anesthesia.

o The powdered stramonium is burnt, and the resultant vapour is inhaled for the relief of asthma. These so –called asthma powders were widely sold on an overthe-counter basis; but now the FDA has placed stranonium-containing asthma powder in the prescription-drug category. –

**iv. Capsicum**:

- Synms: Chilies; chili pepper; Spanish pepper; cayenne pepper; Lal Mirch (Urdu).

B/S: The dried, ripe fruit of capsicum frutescence, known in commerce as African chilies, or of Capsicum annuum, or Capsicum mimimum. - Family: Solanaceae

- **Habitat**: Native to tropical America. Cultivation in tropical regions of India, Japan, Southern Europe, Mexico, Sri Lanka but more especially in Africa. Japanese chilies are more pungent than Madras or Bombay chilies from India. **Characteristic**s: Small shrubs or annual herbs which grows up to 1.5 m high. o Flowers are white and hermaphrodite. o Fruit is green in colour, when not mature but later it becomes red/orange to brown. Fruit is a narrowly ovoid or ovoid-conical pod or oblong in shape o Surface is shriveled. o African chilies are oblong-conical in shape. Internally, the fruit is divided into two cells by a membranous dissepiments to which the seeds are attached in each loculus (cell), there are five to ten seed. The seeds are disc shaped, The testa is pale buff coloured. o Fracture: Horny o Odour: Distinct (characteristic) o Taste: Aromatic, pungent & bitter. – **Chemical constituents**: o A phenolic compound, capsaicin (about 0.02% to 0.5%) an oleo-resin; An extremely pungent principle Found in the dissepiments of the fruit It imparts distinctly pungent taste to water, even when diluted to 1 part in 11 million parts of water. o Capsicum also contains about 1.5% of a volatile, o A fixed oil (4-16%); Carotenoids, and up to 0.2% of ascorbic acid; it is four to six times that found in an orange. Carotenoids as red carotenoids like capsanthin; also, carotene and lutein. contains pro-vitamins A, P, B1, B, B6 etc. o Steroidal alkaloidal glycosides (solanine and solasadine) o Carbohydrates reported in chilies are fructose, galactose, sucrose etc.

**Pharmacology**: o Powerful irritant o Causes the neuronal depletion (release) of substance “P” on repeated application. o This substance is believed to be mediator in transmission of painful stimuli from periphery to the spinal cord. o Methoxy-phenol portion of capsaicin molecule interferes with lipo-oxygenase and cyclo-oxygenase pathway o causes the release/stimulation of GIT enzymes which help in digestion.

- **Therapeutic uses**: o A stimulant, carminative and digestive; used in flatulence, dyspepsia, and to rouse appetite. o Externally, it is used as counter-irritant and analgesic, anti-inflammatory agent etc. o A rubefacient and initial dose/application causes profound pain, but repeated applications produce desensitization, with analgesic and anti-inflammatory effects. Heat sensation is produced by stimulation of specific local afferent nerve fibers. o Effective in rheumatism, lumbago, sprains, pain associated with neuropathy, neuralgia and complex pain syndromes.

**SCROPHULARIACEAE**

Introduction: - It is also called as the figwort family, it is the family of following plant. Plants are annual or perennial herb with flowers with bilateral (zygomorphic) or rarely radial (actinomorphic) symmetry; few trees; some semi-parasites.

- Members of the family have cosmopolitan distribution, with the majority found in temperate areas, including tropical mountains. The family name is on the basis of the included genus Scrophularia. - It has 275 genera and over 5,000 species.

- Macroscopic Characters: o Leaves: The leaves are opposite, alternate or sometimes whorled; o Flowers: The flowers are bisexual and zygomorphic; sometimes are brightly coloured and conspicuous associated with bracts. Calyx is commonly deeply 4-5 lobed or cleft. The gynoecium consists of a single compound pistil of 2 carpel, and a single style; and superior, sometimes asymmetric ovary with 2 sometimes unequal locules. o Anatomical characters include glandular hairs in which the head is divided by vertical walls only, and the stomata, which are surrounded by three or more epidermal cells. Calcium oxalate is relatively rare, when present, it occurs in solitary crystals. - Important Genera are: Verbascum (306 species) Calceolaria (300 species), Linaria (150 species), Scrophularia (300 Species), Veronica (300 Species), Digitalis (20-30 Species), Euphrasia (200 species).

- **Chemical constituents of Scrophulariaceae**: Following are the important chemical constituents belonging to different groups:

o **Glycosides**: Digitalis purpurea and D.lanata contain cardenolide glycosides e.g. purpurea glycosides A and B and gitoxin, digitoxin and lanatoside A,B,C,D and E etc. Similarly, Indian gentian or picrorhiza rhizome from Picrorhiza kurroa contains bitter iridoid glycosides (Kutkin). Euphrasia officinalis contains a cubin glycosides. From the roots of Scrophularia buergeriana 4-Iridiol glycosides have been isolated e.g. methoxycinnamoylharpagide. Some species of Linaria like Linaria striata contains cyanogenetic glycosides; which release hydrogen cyanide and are toxic. A new steroid glycoside was isolated from leaves of Digitalis ciliata.

**Saponin glycosides** are present in a few species like Verbascum thapsus. Similarly, lignin glycosides are there in Verbascum thapsus.

**Naphthaquinone** (derivative of naphthalene). These compounds are present in Calceolaria andina and wood of Kigelia pinnata, which possess insecticidal activity against pests and arthropods, and have herbicidal action.

o **Aurones:** These are bright yellow flavonoids which are present in a limited range of a few species of this family. Bitter principle (Leptandrin): It is a resinous matter, that is present in Veronica (Leptandra virginica); a black, shining very bitter powder.

o **Volatile oil**: Some species of this family contains volatile oil with esters of cinnamic acid, etc.; e.g. Veronica viriginica / L. virginica).

o **Tannins**: Tannins are present in Black root Leptandra virginica, Digitalis purpurea and Verbascum thapsus and so on.

- **Therapeutic uses** of Scrophulariaceae:

o **Cardiotonics**: A few members of this family like Digitalis purpurea and Digitalis lanata contain cardenolide glycosides, which are used as cardiotonics. They provide energy and strength to the weaker cardiac muscles, which increase the activity of heart, by directly stimulating it. These are very effective in congestive heart failure (CHF), atrial fibrillation, and tachycardia etc.

o **Cough products**: Verbascum thapsus is used in sore-throat and as expectorant in cough preparations.

o **Cathartic and emetic**: Veronica virginica possesses cathartic and emetic properties. It is also used a cholagogue; similarly, picrorhiza is also used as cathartic, cholagogue and immunogogue; moreover, it is a biter tonic, stomachic; and is also used in jaundice and other liver ailments.

o **Anti-inflammatory agents**: Euphrasia officinalis possesses anti-inflammatory activity, so it is used as astringent, anti-carnal in blepharitis, in mouth wash and gargle for inflammation of mouth and throat. o Protective against neurodegeneration: Iridiod glycosides isolated from S. buergeriana roots have protective effects against glutamate-induced neurodegeneration in primary cultures of rat cortical neurons.

o **Anti-microbial activity**: Many members of this family e.g. Verbascum protractum, Scrophularia mersinensis, Pedicularis olympica and Veronica lycica have demonstrated antimicrobial activity against gram +ve and gram –ve bacteria e.g. Staphylococcus aureus, K. pneumonia, P.aeruginosa, Proteus vulgaris, etc. - Important Plants of Family: o Digitalis. o Verbascum thapsus.

**i. Digitalis:**

- Synonyms: Foxglove, Fairy Finger, Lion’s mouth. –

Biological Source: The drug consists of dried leaves of Digitalis purpurea, - Family: Scrophulariaceae. Digitalis is from the Latin “Digitus” meaning a finger and refers to the finger shaped corolla; purpurea is Latin and refers to the purple colour of the flower.

- **Habitat**: The plant is native to central and southern Europe, but now is naturalized in various parts of Europe and in the northern and western United States, Canada. In India, it is cultivated in Kashmir & Nilgiris Hills; In Pakistan, it is found in Azad Kashmir, Northern Areas, Hazara division, Peshawar valley. –

**Characteristics**: The plant is a biennial herb which grows up to 6- ft. Leaves are 10-20 cm long and 4-10 cm wide. Upper surface of the leaf is dark green and greyish green and lower surface is pale green and more is grayish. o Lamina is oval-lanceolate and simple. The margin is crenate to serrate, and dentate. The surface is pubescent and texture is papery. Flowers are arranged in a showy, terminal elongated cluster, each tabular, pendent (hanging); purple (also pink rose) in colour. o Leaf is bitter in taste and contains slight somewhat tea-like odour.

- **Constituents**: The drug contains 35 glycosides. The cardenolides are 0.1-0.6%. The primary or the parent glycosides occurring in the leaf are purpurea glycosides A and B. o It also contains gitaloxin, glucogitaloxin, verodoxin and gluco verodoxin. Purpurea glycoside A upon hydrolysis yields a glycoside “digitoxin”, which on further hydrolysis yields aglycone, “digitoxigenin”, and three molecules of digitoxose (sugar).

o Purpurea glycoside B upon hydrolysis gives a glycoside, “gitoxin”, which on further hydrolysis yields aglycone “gitoxigenin” and three molecules of sugar o called digitoxose. o The digitoxigenin, digitoxin and gitoxin, gitoxigenin are important medicinal compounds. They are also called secondary glycosides. It also contains flavonoids, saponins and tannins. o The steroid aglycones or genins are of two types: a cardenolide or bufadienolide. The most prevalent in nature are the cardenolides, which are C23 steroids that have an α ,β- un-saturated 5-membered lactone ring as a side chain at 17-position. The bufadienolides are C24 homologs of the cardenolides & carry a doubly un-saturated 6-membered lactone ring at the 17-position.

**Pharmacology of Foxglove**: o The pharmacological effectiveness of the cardioactive glycosides is dependent on both the aglycones and sugar attachment; the inherent activity resides in the aglycon, but the sugars render the compounds more soluble and increase the power of fixation of the glycosides to the heart muscles. o The overall action of digitalis glycosides is complicated by the number of different effects produced, and their exact mode of action on myocardial muscle is still an area of investigation. The end result is an increase in Na+ and a decrease in K+ within the cell which, in turn, results in an increase in Ca++. Digitalis probably acts in competition with K+ ion for specific receptor enzyme (Na+--- K+ATPase) sites in the cell membrane of the cardiac muscle and particularly successful during the depolarization phase of the muscle when there is influx of Na+ ion. The clinical effects in CHF is to increase the force of contraction (+ve inotropic effects) resulting in complete emptying of ventricles. The atrio-ventricular conduction time is increased.

- **Therapeutic uses:** o The drug is cardiac tonic and stimulant. It directly stimulates the cardiac muscle and is used in congestive heart failure (CHF), atrial flutter/ atrial fibrillation.

o The drug is also effective in/ reduces cardiac arrhythmias.

The drug is also used as diuretic because of its so, improves renal secretion and relieves oedema.

**ii. *Verbascum thapsus****.*

- Synonyms: Great or Common Mullein, Candle flower, lungwort

- **Biological source**: The drug consists of dried leaves and flowers of Verbascum Thapsus. - **Geographical source**: The plant is indigenous to Europe, north Africa and Asia; however, it is found throughout the USA as well; in Gilgit, Baltistan.

Characteristics: It is a biennial common weedy hairy plant, and can grow up to 4 feet, 2 meter or taller. o Leaves: There is a rosette of leaves, i.e. I meter diameter blade is entire to dentate. Flowers: There is 5- lobed corolla of yellow colour flower; which are densely packed spikes and bloom pretty. Flowers are fragrant and taste sweet; Flowers’ odour is faint honey like. leaves are not fragrant and taste slightly bitter. However, fresh leaves make a mucilaginous tea.

**Chemical constituents**: o The drug contains saponins glycosides, mucilage e, tannins volatile oils, fatty acid, lignins, and malic acid.

o Mullien contains glycyrrhizin compounds with bactericide and potential anti-tumor action.

o Coumarins; Flavonoids, o Rotenone (an insecticide).

- **Pharmacology**: Saponins, mucilage and tannins contribute to its demulcent and emollient effects. (emollient: That softens and soothes the skin)

o It has mild expectorant activity due to saponins. o It has some antiviral activity.

o Different extracts have varying levels of efficiency against bacteria.

**Uses:** o The drug is soothing for lungs, mucous membrane and glands therefore, it is indicated in cough and related problems like sore-throat, etc. bronchitis, colds. It has also used as expectorant in cough preparation

o Used in topical applications against a variety of skin problems (as antiinflammatory agent).

o As anti-viral. o As anti-septic/Antibiotic. o As astringent. o As diuretic.

**LABIATAE (LAMIACEAE)**

Introduction: - It is also called mint family - It has about 200 genera & 3300 species - It is aromatic, annual or perennial herb or under -shrubs. Petals are fused into upper and lower lip, hence named so. The family is well represented in the Mediterranean area, the Great Britain, central Asia and Asia etc. i.e., cosmopolitan - Herbaceous members of the family have square stems; particularly the young stems often being four angled.

**Botanical Characters**: o Leaves: Leaves are opposite, simple or rarely pinnate leaves or whorled (decussate). (Each pair of leaf at one node is at the right angles to the previous one or next node’s pair, this is called decussate). o Glandular Hairs: Leaves and other aerial parts have glandular hairs or very characteristic short stalked epidermal glands which secrete the volatile oil. o Flower: Flowers are zygomorphic, bisexual and are arranged in verticillasters. o Important Genera: Mentha (18 species, and 13 hybrid species), Thymus (300-400 species), Ocimum (150 species), Lavandula (28 species), Salvia (700species), Scutellaria (300 species), Laminum (30-40 species), Rosmarinus (3 species). o Fruit: Usually non- fleshy.

- **Chemical constituents**: o **Volatile Oils**: Many members of the family contain volatile oil, i.e.; a volatile oil rich family. Essential oil in the epidermal glands is very common. Followings are important medicinal plants containing volatile oil belonging to the different groups: Peppermint (Menthol), Spearmint (carvone), Thyme (thymol), Salvia (thujone), Lavandula (lavander oil) Ocimum (euginol).

o **Glycosides**: Monoterpenoid (iridoid) glycosides, like catalpol have been isolated from certain species of Scutellaria; similarly, sterol glycosides have been isolated from Prunella vulgaris.

o **Diterpenoid, Triterpenoid Compounds**: These organic compounds are found in Labiatae family in different species. Triterpenoids named amblyol was isolated, besides amlyone from aerial parts of Salvia aspera. Similarly, triterpenoid saponins from Stachys parviflora have been isolated & characterized. Moreover, other triterpenoids like ursolic acid, oleanolic acid. Diterpenoids, like rabdoloxin B and rabdokunmin D, were isolated and characterized from the aerial parts of Isodon loxothyrsus. Monogynol (triterpenoids) are present in Salvia macrochlamys.

o **Rosmarinic acid:** Many species also accumulate rosmarinic acid and other derivates of caffeic acid (e.g. Rosmary). Rosmarinic acid is of some pharmaceutical importance because of its inhibition of biosynthesis of leukotrienes (leading to anti-inflammatory effect), as well as its anti-viral activity.

o **Tannins**: The ethanolic extract of Mentha arvensis leaves revealed the presence of catechic tannins, flavones, steroids flavones and steroid etc. similarly, thyme salvia tannins, flavones, and steroids, etc. Similarly, salvia, thyme etc. also contain tannins. Their antibacterial activity is more significant against Staphylococcus aureus, as compared to Escherichia coli, Pseudomonas aeruginosa. o Resin: Some members like peppermint contain resin.

**Therapeutic Uses of Labiatae:**

**o Carminative and spasmolytic agents**: Due to presence of volatile oil, many members of this family are used as carminative, digestant, and spasmolytic agents in GIT problems e.g. Thymus vulgaris, Rosmarinus officinalus, Salvia officinalus, Mentha piperata etc.

o **Antiseptic:** Some members contain volatile oils possessing antiseptic properties. e.g. thymol, salvinorin A etc. are used as antiseptic agents in certain conditions like respiratory problems, mouth-ulcers, bad-breath and so on; some are used as topical antiseptic(gargling) e.g. menthol, thymol (Rx. Listerine mouth wash).

o **Analgesic**: Rosemary oil from Rosmarinus officinalis (rosemary) is used in liniment as a rubefacient. Menthol is also used as a counter-irritant (Rx Vicks-vaporub, MintRub, Ben-Gay. o It is also used in neuralgia, rheumatism, toothpaste.

o **Anti-Pruritic**: Certain volatile oils like menthol is used as a anti-pruritic in burn ad sun- burn preparations, prickly-heat powder etc. e.g. Johnson and Johnson medicated powder. These are also used to treat poison ivy rash.

o **Anti-Oxidant**: The extract of Salvia macrochlamys showed anti- oxidant activity due to presence of triterpenoids (monogynol). o Agents acting on CNS: Salvia officinalis possess cholinergic activity and is used is Alzheimer’s disease and memory loss, and other psychic disorders. Similarly, ocimum and thyme possess anxiolytic and sedative properties.

Important Members of Family: i. Peppermint. ii. Thyme. iii. Salvia. iv. Ocimum. v. Spearmint.

**i. Peppermint**

- Synonyms: Mint, Pudina (urdu).

- Botanical source: Fresh or dried leaves and flowering tops or aerial parts of *Mentha piperita* (Family: Labiatae).

Peppermint (Mentha piperita, also known as Mentha Balsamea) is a hybrid mint, a cross between the water mint (Mentha aquatic) and spearmint (Mentha spicata).

- **Habitat:** The plant is indigenous to Europe but now is wide-spread in cultivation throughout all regions of the world. So, cultivated in India, Pakistan, Canada, North America.

**Botanical Characteristics**: It is a perennial herb grow up to 30-120 cm. The stem is erect, square and smooth. o Leaves: Leaves are dark green with reddish veins 3-8 cm long and 1.5-4 cm brood having acute apex & serrate margin. Leaves and stems are usually hairy. o Flowers: Purple & are arranged in spike. Corolla is 4-lobed Strong odour Pungent cooling taste.

**Chemical constituents**: Peppermint contains volatile oil (about 1.2%); resin, tannins etc. **Volatile oil (i.e.; peppermint oil**): contains menthol (about 70%). o Also contains menthone, menthyl acetate, and other terpene derivatives (monoterpenes, diterpenes) like cineole, pinene, limonene, camphene, menthofurone, piperiton. o Small quantites of sesquiterpenes, o The pigment flavonoid compound, rutin etc.

- **Pharmacology**: o The drug contains volatile oil. Which increases the gastric motility and secretion of gastric, salivary and other GIT enzymes. o It has smooth muscle relaxant activity and relaxes the muscles that allow painful gas to lower esophageal cardiac sphincter.

o The drug possesses antiseptic activity, i.e.; Mentha arvensis (the Japanese peppermint) leaves revealed the antibacterial activity against Staphylococcus aureus, E. coli and Pseudomonas aeruginosa.

- **Therapeutic uses:** o It is used as carminative, stimulant and antispasmodic in different digestive problems like dyspepsia, bloating, heart burn, nausea, vomiting, motion sickness, bad-breath, stomachache, hiccup. Therefore, used in different digestive preparations, e.g. Antacids, Rx. **Digex MP**, **Polycrol suspension**; **Gelusil tablet**, Philips’ Milk of Magnesia etc.

o It is used as a carminative and flavouring agent. o It is used as a flavouring agent in tea, ice cream, chewing gums, tooth paste and confectionery; as well as in soaps ad shampoo. As a medicine, it has been larger replaced by peppermint oil

o Peppermint oil is used as counter-irritant in painful conditions, where it acts as analgesic, e.g.; rheumatism, sciatica, lumbago, neuralgia, headache, migraine. o Menthol is applied to forehead and temples help reduce headache in colds & flu (RxVicks vap-rub).

o Menthol is an effective decongestant and good expectorant, it thins mucus, loosens and breaks up cough with sputum. It is soothing and calming for sore- throat (pharnygitis etc) e.g Rx. Pulmonol & Hydryllin cough syrup.

o Menthol is used as anti-pruritic in burn and sun burn preparation as Noxzema medicated cream; preparations to treat poison ivy rash; in diaper rash and prickly heat preparations, as Johnson & Johnson medicated powder.

**ii. Thyme:**

- Synonyms: Ban ajvoin (Urdu)

- Biological source: Dried leaves & flowering top of *Thymus vulgaris*, Fam. Labiatae

- **Habitat**: Indigenous to southern Europe (Spain, Italy). Now is extensively cultivated in Germany, France & England for centuries, also in the USA, Middle east, Pakistan & India. - **Botanical Characteristics**: a low growing perennial herb up to 15-40 cm. Leaves: Leaves are oval, entire and opposite. 1/8 inch long, 1/16 inch broad., greenish grey in colour. o Flowers: white/pale pink to purple.

**Chemical constituents**: Thyme contains a yellowish red volatile oil (1-2.6%); resin, tannin and gums. o Thyme Oil: Thyme oil yields not less than 40%, by volume of phenols. It is a colourless, yellow or red liquid with a characteristic, pleasant odour and a pungent persistent taste. It also contains cymene, borneol, linalool, pinene etc.

o Thyme oil B.P: Thyme oil B.P is obtained by steam distillation from the fresh aerial parts and contains thymol 36-55%, carvacrol 1-4%; p-cymene 15-28%, terpinene 5-10% .

**Pharmacology**: o The drug has carminative, stimulant, anti-spasmodic activity, spasmolytic effect may be due to Flavonoids of leaves. o It has anti-tussive, expectorant activity.

o Also possesses antiseptic activity. –

**Therapeutic uses:** o Thyme is a flavour and possesses stimulant and carminative properties.

o Oil of thyme is a rubefacient and counter-irritant in rheumatism, sciatica, neuralgia, lumbago.

o Thymol may be obtained from thyme oil and is used to medicate gauze and wool for surgical dressings. o Thymol is less irritant to wounds and may be applied as antiseptic o Thymol is disinfectant against bacteria and fungi, therefore it is used in: o Dental caries and gingivitis; o Fungus of toe nails, tinea paedis, (Ringworm; athlete’s foot).

o Externally, thymol is applied in tonsillitis, bronchitis, sore-throat, and gumdisease.

o An active ingredient in Rx Listerine mouth wash (Pfizer) where it is recommended for inflammation and other problems of throat as gargles 3 times a day; inflammation disappears within 2-3 days. Rx. Thymol-glycerin compound Mouth Wash. .

o Moreover, thymol is preservative and flavouring agent in meats, poultry, sauces etc. o Thymol is also used in aromatherapy.

**iii. Salvia**

- Synonyms: Magic mint: sage; diviner’s sage **B/S**: dried leaves of *Salvia officinalis*.

**Geographical source**: Indigenous to Mediterranean region (Southern Europe, Germany) and the US; but now is cultivated in parts of Asia, as well as worldwide. **Characteristics:** a small perennial herb attaining the height of about 50-60cm or 2 feet. An ornamental garden plant with woody stems. - Flower: Flowers are blue to purplish. Trichomes/ hairs growing on leaves, stems or flowers, sometimes are elongated and secrete volatile oils that give distinct aroma to the plant. - Odour and Taste: Characteristically pungent.

**Chemical constituents**: o Volatile oil (0.5 to 2.5 percent), a bitter principle somewhat resembling marrubiin, resin, and tannin o The volatile oil of sage contains about 50% of α-β-thujone together with cineole, borneol and other constituents; camphor (34%), and salvene etc. o Sage leaves also contain tannic acid, oleic acid, ursolic acid, chlorogenic acid, caffeic acid, nicotinamides etc.

Pharmacology: o It is carminative and antispasmodic properties. o The drug possesses most potent naturally occurring psychoactive compound, that has cholinergic activity, and memory-improving properties;. o It possesses antiseptic properties.

- **Therapeutic uses**: o used as a stimulant, carminative and condiment.

o It is extensively used as a seasoning agent (condiments), especially with meats and sausage.

o used as mouthwash and gargle for its antiseptic and astringent action, therefore the drug is effective in skin, mouth, throat and gum infections

o The drug has its possible role in the treatment of Alzheimer’s disease and memory loss. o It is also useful in anxiety, depression. o As a flavouring agent, it is used in ice-cream, sweets and baked goods. o Effective as analgesic. o The drug is used in perspiration, e.g. profuse perspiration in tuberculosis. The drug due to presence of phenolic glycosides possesses anti-oxidant properties; and keep skin healthy and clear; helps in dryness and scalyness; adding firmness and smoothness to the skin’s texture and also known for its anti-aging benefits.

iv. Ocimum:

- Synonyms: Basil; holy basil; sweet basil; Tulsi,Niazboo (Urdu)

- Biological source: fresh and dried leaves of Ocimum sanctum; O. basilicum (Fam; Labiatae). - **Geographical source**: It is native to Iran, Indo-Pak & other tropical regions of Asia, but now-a –days commercially cultivated in Europe, Egypt, Indonesia, Malaya, Australia and Morocco etc.

**Botanical Characteristics**: a low growing tender, strongly scented annual herb or under shrub; 30-60 in height. The branches are generally purplish and clothed with soft hair; with green stem usually woody at base. o Leaves are simple, oblong, opposite with acute apex, margin is entire serrate, and both the surfaces are pubescent. There is distribution of glandular hairs on the surfaces of leaves containing volatile oil. Flower: purplish or white in colour. 15-17cm long in racemes or close whorls. Odour: Aromatic & pleasant; taste: Sharp, spicy aromatic & pungent.

**Chemical Constituents**: The important chemical constituents of tulsi is volatile oil which is yellow coloured; leaves contain maximum volatile oil contents (0.4-0.8%). The volatile oil contains eugenol (70%), methyl eugenol (20%), carvacrol (3%), caryophyllene (1.7%), cineole, linalool, camphor, camphene, ocimene, limonene, citral, anethol also small quantities of Rosmarinic acid and lithospermic acid.

**Pharmacology**: o increases the secretion of gastric enzymes. o It relaxes the smooth muscles. o It affects central nervous system. o Fungistatic effects. o Cinnamic, coffeic and sinapic acid showed anti-tumor activity. o Rosmarinica acid can capture free radicals and is an anti-oxidant. - **Therapeutic uses:** o flavouring agent

o aromatic, carminative and antispasmodic antibacterial & antiseptic properties.

o The Drug is expectorant& is used in cough, bronchitis. o The Juice of tulsi leaves is applied on skin in ring worm and other cutaneous diseases. o It is also used in gonorrhea. o It is used in anxiety. o It is also used in hepatic affections. o

v. Spearmint:

- Synonyms: Ordinary/ Common garden mint; Common spearmint, Silver mint.

B/S dried leaf and flowering top of Mentha spicata & M. cardiaca.

**Habitat**: The plant is indigenous to Mediterranean region, much of Europe and south west Asia. Though its exact natural range is uncertain due to extensive early cultivation.

- **Characteristics of the plant**: It is a perennial herb growing upto 30-100cm. o Leaves: These are opposite, more or less crumpled, acute and almost sessile margin, bright green in colour. **Flower**s: Flowers are small, pinkish or lilac in colour. These are densely arranged in whorls or rings in the axis of upper leaves, forming spikes. o Odour and taste: Both are characteristic. - **Chemical constituents**: volatile oils (0.5%); major volatile oils are carvone 55%, borneol, eugenol, limonene 2-25%, menthone and phellendrine etc. Moreover, it contains dihydrocarveol acetate, esters of acetic, capric and butyric acid etc.

Pharmacology: o The drug increases gastric enzyme secretion o It has also antiseptic property. - **Therapeutic Uses**: o Carminative. o Antispasmodic. o Anti-emetic. o As a flavour in drinks, chewing gums and tooth paste. (e.g. Mentos chewy drages, Wrigley’s spearmint (chewing gum). o Also used as flavour for confectionery, for milk shake in New Zealand and other countries. o Spearmint oil is effective in headache, chills, fever, bronchitis etc. o Oil is useful in rheumatism, stiffness and muscles soreness etc. o an antiseptic, & also possesses diuretic properties.

**Difference between peppermint and spearmint**: - The **peppermint tends to grow taller** than spearmint, up to four feet tall (1.5 m). - A peppermint leaf is also a little larger. Peppermint has a purplish blossom while spearmint has a pink or light to dark blue blossom not approaching purple. - **Leaves:** Peppermint leaves have more teeth than Spearmint i.e, Spearmint leaves are sessile. - Stems: Spearmint stems, while lacking the purple, are distinctly square while peppermint stems are not. - **Scent**: The scent of spearmint tends to be little sweeter and lighter, while peppermint has a very noticeable mint smell; it can be uncomfortable being near a peppermint field. Spearmint taste is not followed by cooling sensation.

- **Medicinally,** these two mints are very similar; clearly, these two mints are more similar than dissimilar. - The essential oils of peppermint and spearmint are distinguished by the position of oxygenation on the p-menthone monoterpenes. Peppermint produce moterpenes having an oxygen at C3, whereas spearmint and oxygen at C6. - Properties of both mints resemble, both are stimulant and carminative, but spearmint effects are less powerful than peppermint and it (Spearmint) is less used than peppermint.

LILIACEAE

Introduction: - The liliaceae or **the lily family** of monocotyledons in the order liliales. - Plants have linear leaves, mostly with parallel veins but with several having net venetion. - Several members have bulbs while others have rhizomes mainly constituted by grasses. - One of the largest plant families. - About 280 genera and 4000 species, distributed throughout the world. - Mainly ornamental plants but include vegetable of the onion family (onion, garlic, leek, chives). - Asparagus and some species have been used medicinally. - The majority are herbacious (perennial) with the swollen storage organ but there are also ever green succulents (Aloe) and woody ever green climbers (Lapageria). **Characteristics**: - Leaves, Stems and Roots: The leaves are often long and thin; in extreme cases, they have been reduced to scales (Asparagus) or modified to extend into tendrils (Gloriosa). Monocotyledons, i.e. they have only one seed leaf. - **Flowers**: The flowers are showy although, **they may also be solitary as in Tulip** usually have six petals which may be joined to some degree, may form a tube (Kniphofia) may be of different or equal sizes or shapes nearly always six stamens. Actinomorphic bisexual and not so frequently zygomorphic. - **Bulbs or other storage organ**, long and thin leaves or rosette of leaves includes species sometimes divided among the following families: o Alliaceae o Aloeaceae o Asparagaceae o Xanthorrhoeaceae, o Colchicaceae. - Fruit: A capsule; or a berry. - Distribution: Found in the Northern temperate to Mediterranean regions. While others like aloe is widely distributed in South Africa, and many other parts of the world, including Indo-Pak - The Principal genera: o Allium (450 species) o Colchicum (65 species) o Veratrum (25 species) o Aloe (330 species) o Tulipa (100 species) o) o Asparagus (300 species)

**Chemical Characters**: Some members are cultivated for their flowers Vegetables include asparagus (Asparagus officinalis), onion, garlic, shallot, leek and chives. However, drugs include squill, veratum, sarsaparilla, colchicum seed and corm, aloe, cevadilla seed and garlic, an age-old remedy frequently used for the treatment of colds, bronchitis etc.; has recently received much attention as a drug for cardiac diseases.

o **Alkaloids**: Many members of this family contain alkaloids, which are of steroidal, isoquinoline, tropolone or purine types. Steroidal alkaloids: certain liliaceae plants e.g. Germinaline and Germitetrine in Veratrum lobelianum, and stenophylline A in aerial parts of V.stenophyllum; Colchicum contains tropolone type alkaloids e.g. colchicine and demecolcine. o **Glycosides**: Steroidal glycosides Anthraquinone glycosides etc. Saponins may be steroidal saponins as are present in sarsaparilla root (smilax) i.e. sarsa, ponin, and sarsasaponoside Steroidal cardiac glycosides that may be of bufadienolides type of Indian squill or urgenia contains scillaren A and scillaren B. Anemarrhenae also contain, steroidal saponins; Asparagus contains steroidal saponin glycosides, Shatavarin. **Anthraquinone glycosides** are present in few plants, **like Aloe** contains a number of anthraquinone glycosides, the principal of which is barbaloin (aloeemodin)

**Essential oils** Certain species of this family contain essential (volatile) oils; e.g. garlic (Allium sativum) contains allicin and alliin Similarly, Aloe contains large amounts (16-63%) of resinous material & a volatile oil.

o **Carbohydrates**: In aloe, polysaccharides like aloeferon, aloeulcin etc. are present Similarly, garlic also contains carbohydrates. Similarly, glycon moeities of glycosides are also carbohydrates, e.g.; such as glucose, rhamnose etc.

o **Resins:** Some species of this family that contain resins e.g. Aloe contains aloeresin A, B and C; having purgative action.

**Therapeutic uses of Liliaceae**:

o **Drugs used in CVS**: Species like squill (Indian squill, Urgenia indica; and white variety of Urgenia maritima) contains cardio-active glycosides (scillaren A & B), which possess digitalis like actions and are used as cardiotonic in heart failure and atrial fibrillation etc. Allicin and alliin are effective in reduction of hypertension, decreasing cholesterol level and it is also antithrombotic and effective in prevention of arteriosclerosis and stroke.

**o Drugs Used in GIT Ailments**: Garlic due to presence of volatile oils (allicin & alliin) is effective in digestive disorders, where it plays its role as stimulant and carminative, hence improves digestion Aloe is also used in digestive issues like heart burn, IBS etc. Aloe contains anthraquinone glycosides, which are useful as laxative and cathartic and very effective and most valuable purgative in certain forms of constipation.

**o Anti-inflammatory, Analgesic agents**: Colchicine, isolated from colchicum is an effective anti-inflammatory and analgesic to relieve inflammation and pain, and shortens the duration of acute gout and certain gouty actions. Similarly, aloe is effective in painful, inflammatory conditions of skin, and also in acne.

**o Antibacterial agents**: Allin and allicin (present in garlic) are potent antibacterial agents, hence are affective in certain infections (esp. chest problems, like bronchitis). The fresh mucilagenous leaves juice of Aloe vera is used in the treatment of burns, abrasions and skin infections. o Aloe is topically applied in genital herpes and psoriasis. o Garlic is also effective in gastro-enteritis. o An antiseptic to prevent gangrene.

o **Anti-cancerous agents**: Colchicine has been used experimentally in the treatment of various neoplastic diseases (e.g. leukemia). o Also use to reduces the risk of liver-cancer/hepatitis-related liver cirrhosis. o Skin products: There are a few medicinal plants of this family that are used as skin products/preparation e.g. Aloe vera is used in treatment of burns, and skin irritations. It is effective in the treatment of sun-burn cases, deep thermal burns, and radiation burns, like x-rays and atomic radiations. It tends to minimize keratosis and ulceration. Also used as lotion in moisturizer soap, shampoos and sun-screens, and is a part of many cosmetic products for its emollient properties. Fresh gel is used in ointments.

i. Garlic:

- Synonyms: Allium - Botanical origin: Ripe bulbs of *Allium sativum*. - Family: Liliaceae - **Habitat**: Native of Eurasia; but now a days it is cultivated in Central Asia, Southern Europe, USA and Indo-Pak; China, Korea, Russia etc. **Characters**: A perennial herb containing bulbs with several cloves. i.e. bulb is divided into numerous fleshy cloves. o The aerial stem is 1.0 m tall, green, glabrous mostly hollow; bulb grows 4-6cm in diameter. o Each bulb of garlic contains about 15-25 cloves, covered by thin, whitish papery scales, these are discarded. o Garlic bulbs are spherical or sub-spherical in shape. o Cloves are curved and tapering at the base and apex. o Leaves: leaves are flat or very slightly folded o Flowers: Small flowers are greenish, whitish, pinkish and tubular with acute lobes. o Color of clove: Whitish pink or yellowish white externally and yellowish internally. o Characteristic alliaceous odour and taste.

- **Chemical Constituents**: o Carbohydrates, proteins (albumin), fats, mucilage. o 0.06 to 0.10% essential oil. o The volatile oil is the main active constituent. o It contains allicin, diallyldisulphide-S-oxide, (responsible for characteristic odour) and alliin (odourless). o Alliin is converted into allicin by action of enzyme allinase. o Ajoene is also one of the important constituent of garlic

**Pharmacology**: o antibacterial and antiseptic property to reduce the risk of atherosclerosis

o Reduce sugar level, o Effective in decreasing cholesterol level & lipids. o Improves digestion.

- **Therapeutic Uses**: o Due to the presence of volatile oils (allicin and alliin), garlic is effective in digestive disorders, where it plays its role as stimulant, carminative

o Garlic (ajoene) is in antithrombotic (decrease platelet aggregation). o Garlic is effective in decreasing high cholesterol level due to its hypolipidaemic role. o Garlic is effective to prevent atherosclerosis (hardening of the arteries of heart)

o also helpful in decreasing elevated blood pressure. effective in certain infections (esp. chest problems, like bronchitis); o Effective in amoebic dysentery, gastro-enteritis etc.

o An anthelmintic. o Has also shown its activity in regulating blood glucose level.

**ii. Colchicum:** -

Vernacular Name/synonyms: Autumn crocus, Surinjan-italkh (Hindi, Urdu).

B/S : Dried, ripe seeds & corms of *Colchicum autumnale*; Indian colchicum, *Colchicum luteum*.

**Geographical source**: Widely distributed over Europe and abundant in some parts of England in moist meadows and pastures. Commercial supplies come from Poland, Czechoslovakia, former Yugosalvia and the Netherlands, Italy, India, Pakistan.**Characters/ Morphology**: o Corm: A vertical, swollen underground part. The corm consists of an enlarged underground stem. The fresh corm is conical in shape, 3-4 cm long and 2-3 cm wide. One side of the corm is flat ant the other is convex. The dried corm is in conical, sub-reniform or elongated pieces; **Colour**: Yellow to brown in colour and wrinkled. o Fracture: Breaks with short mealy fracture. Odour: Slight or odourless. o Taste: Slightly bitter and acrid taste. o Seeds: globular in shape and 2-3mm in diameter. Extremely hard. o Colour: Reddish- brown in colour, minutely pitted testa. Odour: Odourless o Taste: Unpleasantly bitter. o Flowers: purplish pink to white

**Chemical Constituents**: Tropolone type of alkaloids, i.e. colchicine and a number of other colchicine-type alkaloids (e.g. demecolcine) also contains a resin (colchico-resin), fixed oils (17%), and sugar (5%), and 3% ash. Colchicum seeds contain 0.6%-1.2%, while corm contains up-to 0.6% of colchicine.

- **Pharmacology**: o Colchicine produces anti-inflammatory effects by binding to the cellular protein tubulin and thereby inhibiting leukocytes and phagocytosis.

oinhibits inflammatory mediator & has inhibitory effect against lipo-oxegenase, urease enzyme and acetylcholine-esterases.

**Uses**: o Colchicine is chiefly used to relieve the pain and inflammation and shortens the duration of acute gout and certain gouty affections.

o in the treatment of various neoplastic diseases (leukemia).

o Being a microtubular inhibitor, it inhibits rapidly proliferating cells and has been used in cancer therapy. colchicine may reduce the risk of liver cancer/hepatitis-related liver cirrhosis;

**iii. Aloe:**

- Synonyms: curacao aloe, Bardados aloe, Kanwar gandal (urdu).

- Biological source: the dried latex of the leaves of Aloe barbadensis, A.ferox, A.africana and A.spicata, (known in commerce as cape aloe). Aloe barbadensis is also known as Aloe vera. There are almost 330-400 different species of Aloe. - Family: Liliaceae

**Geographical source**: Most of the aloes originated in Africa grow in arid climate widely distributed in Africa, India, Kenya, Sudan, Arabian Pennisula; many have been introduced into the West Indies and Europe. Now commonly occurs in temperate region. The official (BP, USP, EP) varieties of aloe are Cape from South Africa, Kenya and Barbados (Curacao) from the West Indian Islands of Curacao, Aruba and Bonaire.

- **Characteristics**: A succulent xerophytic perennial plant, containing thick fleshy leaves, a stemless or very short stemmed plant, growing **60-100 cm tall** (24-39 inch).

o **Leaves**: Thick, fleshy; green to grey in colour Margin of the leaf is serrated and has small white teeth (spine) Erect and are crowded in the rosette form 30-60 cm long and 5-10 cm wide The fleshy leaves are cut at base and the juice exudes out.

o **Flowers:** Yellow or red, each flower is pendulous.

o **Stem**: A simple and 2.5 cm in diameter Short and scarcely rising above the ground.

o Colour of drug: Juice occurs as an opaque mass; colour is dark brown, greenish brown or brownish black after drying. o Fracture: The fracture of leaf is porous or breaks with smooth, even, waxy fracture. o Odour: Strong characteristic, unpleasant sour odour ( or iodoform like) or appletart like o Taste: Nauseous and bitter taste

- **Chemical Constituents**: o Mixture of crystalline glycosides called “aloin”, (10-30%); these are anthraquinone glycosides. o Aloin contains glycosides like barbaloin (the principal one), isobarbaloin, aloeemodin, β-barbaloin also contains resins, flavonoids, minerals etc.

o The principal constituent of all the varieties of aloes is the pale yellow, crystalline substance, barbaloin..

- **Pharmacology**: o Orally, it stimulates the motility of intestine (acts chiefly on large intestine). o On topical application, it has emollient protective immune stimulating and antiseptic properties. –

**Uses**: o All varieties of aloes have a more or less powerful purgative action, all of them working with remarkable slowness. Aloe is one of the most valuable purgative in certain forms of constipation as it improves digestion and does not lose its activity by repetition.

o Aloe is an irritant purgative; it seldom prescribed alone and its activity is increased when administered with small quantities of soap or alkaline salts, while carminatives moderate its tendency to cause griping.

o Aloe is a pharmaceutic aid for “Compound Benzoin tincture” • (Friars Balsam)

o In skin problem, the fresh mucilagenous juice of th e leaves of Aloe barbadensis (A. vera) has been used for centuries for treatment of burns, abrasions and other skin irritations

o It is used in the treatment of sun-burns, deep thermal burns, and radiation burns like x-rays burns and atomic radiation burns. It affords relief from pain and itching and tends to minimize keratosis and ulceration. Similarly, Aloe vera gel is put on skin infections, inflammation, wounds and other skin conditions. o It is also used as lotion in moisturizer, soap, sunscreens, shampoos etc (Rx “Aloe vera Olivia” moisturizing cleansing milk).

o Also used for relief of digestive issues such as heart-burn, irritable bowel syndrome (IBS), ulcerative colitis; in such cases, it is taken orally as juice. o Also effective in acne. o Used to decrease elevated lipids and also effective in diabetes. o Aloe is topically applied in genital herpes and psoriasis.

**ZINGIBERACEAE**

**Introduction:** - It is also known as the ginger family. - It is a family of flowering plants consisting of aromatic perennial herbs with creeping horizontal or tuberous fleshy rhizomes.It has 52 genera & 1300 species.

- **Distribution** throughout tropical Africa, Asia, and the America; many members of this monocotyledonous family (embryonic leaf in the single seed) native to Indo-malayan region and are thus practically important in Asian medical system. Its many Species are important ornamental plants, species, or medicinal plants. - Ornamental genera include the Shell ginger (Alpinia), Siam or summer tulip (Curcuma alismatifolia), ginger lilly (Hedychicum), Kaempferia, torch ginger, & ginger (Zingiber). - Generally, it includes aromatic herbs. Which have very prominent thickened rhizomes. These herbs are often rich in essential oil which is stored in typical secretary cells.

**Botanical Characters**: - **Leaves:** Leaves are arranged spirally with a sheath around the stem (similar to grasses). However, these sheaths are arranged in such a way that they form a stem-like structure (pseudo-stem), which supports the real, rather weak stem.

- **Flowers**: Flowers are hermaphrodite, usually strongly zygomorphic; inflorescence of flowers is in racemes, heads or cymes. Flowers are often very large and prominent and are polinated by large often nocturnal insects, birds or bats.

- Fruit: Fruit is a capsule or berry; epicarp is soft, and mesocarp and endocarp are fleshy.

Important genera: Important genera of this family are: o Curcuma (5 species). o Alpinia (250 species). o Zingiber (80-90 species). o Amonum (150 species). o Elettaria (7 species).

**Chemical Characteristics** of The Family:

- **Essential oils:** This family rich in essential oil with terpenes, such as borneol, camphor and cineole (all oxygen-containing monoterpenes), camphene, pinene(monoterpenes) and zingiberene (a sesquiterpene). Typically, these compounds accumulate in oil cells, an important microscopic characteristic of the rhizomes of the zingiberaceae. Similarly, turmeric contains turmeric oil, which is the mixture of sesquiterpenes, alcohol, ketone and monoterpene. Cardamom fruits are rich in volatile oils.

**Colouring matters**: A few members of this family contain colouring matter e.g. species of Curcuma (C. longa etc) contain **Curcuminoids** which are diaryl-heptanoid. A number of diaryl-heptanoids similar to curcuminoids, are also present in ginger.

- **Oleo-resin and Resins**: Certain species of this family, like ginger (Zingiber officinale) contains oleo-resin (5-8%). It gives pungency to ginger. Alpinia officinalis contains 20 % resin. - **Phenolic acids**: Alpinia speciosa (important plant in food culture of Japan) contains Ferulic acid, that is a new antioxidative phenolic acid. Similarly, gingerol is present in ginger. - **Carbohydrates:** Many members of this family contain abundant carbohydrates. o Ginger contains 50-60 % starch. o Turmeric contains glucose, fructose, arabinose and starch grains. o Cardamom also contains starch (up-to 50 % in seeds).

- **Flavonoids:** Some of the members like Alpinia officinalis contains flavonoids like kaempferol, galangon and alpinin etc.

- **Therapeutic Uses**:

o **Stimulant carminative**: Many plants of this family are used as a source of aromatic stimulant and carminative drugs. e.g. turmeric, ginger, cardamom etc. o Anti-emetics: Some members possess excellent anti-emetic properties. e.g. ginger. They are more effective than synthetic anti-emetics. e.g. Dimenhydinate (Dramamine tab) in controlling nausea and vomiting.

o **Flavouring agents**: Due to abundance of volatile oils, medicinal plants like ginger and cardamom etc are used as flavouring agents, not only in food articles and beverages, but also in medicines e.g. Compound cardamom Tincture contains cardamom.

o **Antiseptic, anti-bacterial agents**: The ginger oil is used as anti-septic in mouth washes. Similarly, turmeric also possesses antimicrobial activity. o Anti-inflammatory agents: A few members of this family are used as antiinflammatory agents; e.g. turmeric, galangal, in inflammatory conditions e.g. Rheumatism etc. Ginger also inhibits prostaglandins synthetase, so is effective as anti-inflammatory agent. o In chest problems: Ginger is effective in respiratory tract problems like bronchitis, common cold, sore throat etc. Similarly, turmeric is also used in cold preparations.

**o In Hepatic diseases**: A few plants of this family are used in various ailments of liver. e.g. ginger and turmeric act as cholgogue. Turmeric is hepatoprotective and is useful in liver diseases like jaundice.

o **Anti-oxidants**: Turmeric acts as anti-oxidant and also Alpinia speciosa. A potent antivenom agent was isolated. (i.e. ar-turmerone) from turmeric. - Important Plants of Family: The important plants of this family are: o Ginger. o Turmeric.

i. Ginger:

- Synonyms: Zingiber, Adrak,Saunth (Hindi, Urdu).

- **Biological Source**: dried rhizome of *Zingiber officinale*, known in commerce as Jamaica ginger, African ginger. The outer cortical layer is often either partially or completely removed i.e. the darker outer skin.

- **Geographical Source**: Native of South-Eastern Asia, but now is cultivated in many tropical countries, notably in the West Indies, India, Pakistan, China. The most highly valued kind comes from Jamaica; varieties from India and African are more pungent and less pleasantly in taste. - **Characteristics:** perennial herb growing up to 1 m high. The plant grows from tuber like rhizome, which is warty and branched. **o Leaves:** Leaves are green. o **Flowers:** There is spike of yellowish green flowers with purplish lips; unfortunately, it rarely flowers in cultivation. o Stem: The stem is surrounded by sheathing bases of two ranked leaves. o The dried scrapped drug shows little resemblance to the fresh rhizome, owing to loss in weight and shrinkage. o Size:1m high perennial. The pieces are 5-15 cm long and 3-6 cm wide. o Thickness: 0.5-1 cm thick. o Shape: Laterally flattened on upper side with short flattened branches or fingers. o Fracture: Sharp with projecting fibers and mealy. o Colour: Externally rhizomes are buff colours (pale yellow) showing longitudinal wrinkles

**Constituents**

* ***1-2% volatile oil* ; *5-8% resinous matter and mucilage.***
* ***Starch is more than 50%. Oil of the ginger to which the drug mainly owes to its aroma; contain a mixture of over 50 constituents of monoterpines ( beta phellandrene, camphene, cineole, citral, borneole)*. *Pungency of ginger is due to gingerol, an oily liquid.***
* ***PHARMACOLOGY:-***
* ***The drug increses the gastric enzyme secretion. The gengerols possess potent inhibitory actions against PG synthesis which corresponds with the anti inflammatory properties of drug.* *A strong antibacterial and anti fungal action has been demonstrated for a number of rhizome constituents.***
* **Therapeutic Uses**
* ***Carminative and aromatic for digestive disorders, e.g. dyspepsia, colic and anti-emetic; anti emetic properties. It may ameliorate the effects of motion sickness in the GIT itself.***
* ***Applied as base of temples in headache, a headache due to migraine.***
* ***In cold preparations, in mouth washes as well as beverages*. *The drug is used in cold preparations (Rx.Sterpsils Herbal) for common cold,flu, sore throat, hoarseneses and loss of voice***

**TURMERIC or CURCUMA**

***Synm: Curcuma domestica; indian saffron.***Haldi ( in Urdu)

***B/S***  ***dried rhizomes of Curcuma longa.***

**Habitat *:*** ***Curcuma is a native of southern Asia;*** ***now the plant is cultivated throughout the tropical countries West indies, Malaysia, China ,India and Pakistan***

***CHARACTERISTICS****:-*

Perennial herb grows upto 2-3 feet. The drug is found in the form of bulb (round)& finger turmeric. The primary rhizomes are shorter and thicker and oval or pear shaped up to 2cm thick and often short branche & are known as round or bulb turmeric.The secondary rhizomes are from the fleshy rhizome branches are more cylindrical or fusiform, lateral branched, curved or nearly straight.

**Colour** :The external surface is yellow to deep brown They are hard and heavy and break with short fracture. **Internal surface**: yellowish orange or orange

**Fracture** : tough and break with horny fracture Odour : aromatic and distinctive odour

Taste : Bitter and pungent; when chewed t coloures the saliva yellow

**Constituents:**About 5% curcuminiods ( diaryl heptanoid) as colouring matter, the chief of which is curcumin; also contains carbohydrates like glucose, rhamonse, galactose, fructose and starch granules (30-40%). Curcumin is freely soluble in alcohal, ether, fixed and volatile oils, imparting a bright yellow colour to them.

***PHARMACOLOGY:-***

***It has carminative, anti-inflammatory, anti-septic and antitumer properties; also possesses hepato-protective properties.Polysaccharide fraction of the drug has a marked immunological activity.curcumin’s anti-oxidant actions enables it to protect (colon) cells from free radicles; also helps body to destroy mutated cancer cells.***

***USES:-***

***stimulant, carminative and stomachic etc.***

***blood purifier It is used in the treatment of jaundice and hepatitis.***

***It is used as anti-oxidant and analgesic.***

***It is used in cuts, wounds, bruises, psoriasis (inflammatory condition in head)***

***anti-inflammatory agent. in arthritis and other inflammatory conditions of skin.***

***It is used in neuro-degeneration of CNS, melanoma and lung cancer treatment.***

***For aroma and colouring in food products.*** ***It lowers the rate of lung, breast, prostate and colon cancer.***

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