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## Sources of Crude Drug, Classification of Crude Drug, Principles of Plant Classification, Families

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### CRUDE DRUGS

Crude drugs are the drugs, which are obtained from natural sources like plant, insects, animals and minerals. They should be used as such as they occur in nature without any processing except, collection, drying and size reduction.

Crude drugs are also defined as drugs that have not been advanced in value or improved in condition by shredding, grinding, chipping, crushing, distilling, evaporating, extracting, artificial mixing with other substances or any other process beyond that which is essential to its proper packing and to prevention of decay or deterioration during manufacturing.

Crude drugs and their constituents are commonly used as therapeutic agents. Source of crude drugs are plant (senna, opium, digitalis and Clove), Animal (Musk, Honey, Shark liver Oil) and Mineral (Shilajit, Talc, Bentonite).

### SOURCES OF CRUDE DRUG

<b>Plant</b>	<ul style="list-style-type: none"><li>➤ Oldest source of drugs.</li><li>➤ 25% of the drugs prescribed worldwide come from plants</li><li>➤ More than 200 drugs considered as basic and essential by the World Health Organisation (WHO)</li></ul>
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	<ul style="list-style-type: none"><li>➤ Significant number of synthetic drugs obtained from natural precursors.</li><li>➤ Example: Digoxin from <i>Digitalis</i> species, quinine and quinidine from <i>Cinchona</i> species, vincristine and vinblastine from <i>Catharanthus roseus</i>, atropine from <i>Atropa belladonna</i> and morphine and codeine from <i>Papaver somniferum</i>.</li></ul>
<b>Animal</b>	<ul style="list-style-type: none"><li>➤ Second largest source of crude drugs.</li><li>➤ Example: Honey from honeybee, beeswax from bees, cod liver oil from shark, bufalin from toad, animal pancreas is a source of Insulin, musk oil from musk, spermaceti wax from sperm whale, woolfat from sheep, carminic acid from colchineal, venoms from snake</li></ul>
<b>Mineral</b>	<ul style="list-style-type: none"><li>➤ Highly purified form of naturally occurring mineral substances is used in medicine</li><li>➤ Example: Sulphur is a key ingredient in certain bacteriostatic drugs, shilajit is used as tonic, calamine is used as anti-itching agent</li></ul>
<b>Marine</b>	<ul style="list-style-type: none"><li>➤ Major part of earth is covered with water bodies and hence bioactive compounds from marine flora and fauna (microorganisms, algae, fungi, invertebrates, and vertebrates) have extensive past and present use in the treatment of many diseases</li></ul>
<b>Marine</b>	<ul style="list-style-type: none"><li>➤ Serve as compounds of interest both in their natural form and as templates for synthetic modification. Several molecules isolated from various marine organisms are currently under study.</li><li>➤ Number of anticancer, anti-inflammatory, cardio tonic chemical moieties are isolated from marine plants and animals.</li><li>➤ Example: Agar-agar, a popular pharmaceutical excipient, from red algae, Carrageenans or carrageenins (linear sulfated polysaccharides) from red seaweeds</li></ul>
<b>Plant tissue culture</b>	<ul style="list-style-type: none"><li>➤ It involves <i>in-vitro</i> multiplication of cells, tissues and organs on defined solid or liquid media under aseptic and controlled environment</li><li>➤ Multiplication of cells, tissues and organs on defined solid or liquid media under aseptic and controlled environment</li></ul>

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	<ul style="list-style-type: none"> <li>➤ Controlled production of useful desired secondary metabolites</li> <li>➤ Example: Antihypertensive ajmalicine from callus culture of <i>Catharanthus roseus</i>, anti-inflammatory berberine from suspension culture of <i>Thalictrum minus</i>, antiparkinson L-DOPA from callus culture of <i>Stizolobium hassjo</i>, immunomodulatory ginsenoside from callus culture of ginseng etc.</li> </ul>
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## ORGANISED AND UN-ORGANISED CRUDE DRUGS

Organised crude drugs		Un-organised crude drugs	
Parts of plants or animals		Obtained from parts of plants	
Well defined structure		Not well defined structures	
Solid in nature		Semisolid, solid, liquid in nature	
Microscopic studies are useful in quality control		Chemical tests are more useful in quality control	
<i>Examples</i>		<i>Example</i>	
Parts	Example	Class	Example
Leaves	Senna, digitalis, vasaka, eucalyptus	Resins	Balsam of tolu, myrrh, asafoetida, benzoin
Barks	Cinchona, kurchi, cinnamom, quaillia	Gums and mucilages	Acacia, tragacanth, guar gum
Woods	Quassia, sandal wood	Dried latices	Opium
Roots	Rauwolfia, ipecacuanha, aconite	Dried juices	Aloes, kino
Rhizomes	Turmeric, ginger, valerian, podophyllum	Volatile oils	Cinnamon oil
Seeds	Nux-vomica, strophanthus	Fixed oil	Castor oil and lard
Flowers	Clove, saffron	Waxes	Beeswax
Fruits	Coriander, colocynth, fennel, bael	Extracts	Catechu
Entire plant	Vinca, belladonna	Saccharine substances	Honey

## CLASSIFICATION OF CRUDE DRUGS

<p><b>Alphabetical classification</b></p>	<p>Classified in alphabetical order using either their Greek name or Latin name.</p> <p><b>Advantage:</b> Easy and hence many pharmacopoeias, formulary, encyclopedias of various countries follow this classification.</p> <p><b>Disadvantage:</b> This classification lacks scientific value and hence now-a-days it is not preferred.</p>	<p>Example: acacia, bael, chinchona, dill, ergot, fennel, ginger, henbane, ipecac, jalap, kurchi, licorice, myrrh, nux-vomica, opium, podophyllum, quassia, rauwolfia, senna, tea, urgenia, vasaka, wool fat, yam, zedoary etc. Major Advantage of this method is that it provides quick reference.</p>	
<p><b>Morphological classification</b></p>	<p>Crude drugs are grouped into organized drug (parts of plant like root, rhizome, flower, leaf, fruit, bark, seed, wood etc) and unorganized drug (dried lattices, dried juice, gum, wax, oil etc).</p> <p><b>Advantage:</b> It is most simple classification.</p> <p><b>Disadvantage:</b> Morphologically similar drugs are difficult to distinguish and it is not suitable and acceptable for powder form of crude drug</p>	<p><b>Part</b></p>	<p><b>Example</b></p>
		Leaves	Senna, digitalis, vasaka, eucalyptus
		Barks	Cinchona, kurchi, cinnamon, quailia
		Woods	Quassia, sandal-wood
		Roots	Rauwolfia, aconite
		Rhizomes	Turmeric, ginger, podophyllum
		Seeds	Nux-vomica, strophanthus
		Flowers	Clove, saffron
		Fruits	Coriander, colocynth, fennel, bael
		Entire plant	Vinca, belladonna

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		Resins	Balsam of tolu, myrrh, asafoetida,
		Gums and mucil-ages	Acacia, guar gum tragacanth,
		Dried latices	Opium
		Dried juices	Aloes, kino
<b>Taxonomic classification</b>	Crude drugs are arranged according to taxonomic order i.e., phylum, division, class, sub-class, orders, families, genus and species. <b>Advantage:</b> Precise and orderly arrangement of drugs <b>Disadvantage:</b> Lacks scientific value and unorganized crude drugs are difficult to classify.	Phylum - Spermatophyta Division - Angiospermae Class - Dicotyledons Sub-class - Sympetalae Order - Tubiflorae Family - Solanaceae Genus - <i>Atropa</i> Species - <i>belladonna</i>	
<b>Biological or pharmacological classification</b>	Crude drugs having similar therapeutic effects or pharmacological activity are grouped together <b>Advantage:</b> It provides quick review of pharmacological actions of any crude drug <b>Disadvantage:</b> Drugs having more than one therapeutic effect are difficult to classify.	<b>Pharmacological Action</b>	<b>Crude Drugs</b>
		Carminatives	Fennel, dill, coriander, and clove
		Purgatives	Cascara, aloe, senna, and rhubarb
		Cardio tonics	Digitalis, squill, strophanthus
		Anti- cancer	Taxaol, vinca, podo phyllum
		CNS Stimulant	Nuxvomica

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		Expectorant	Vasaka, liquorice
		Bitter tonic	Gentian, chirata
<b>Chemical classification:</b>	It is purely based on chemistry of major active constituents. <b>Advantage:</b> It is most acceptable and informative classification <b>Disadvantage:</b> It is very complex.	<b>Chemical class</b>	<b>Drugs</b>
		Alkaloid	Cinchona rauwolfia, datuara.
		Volatile oil	Clove, fennel oil, coriander
		Glycoside	Senna, digitalis, licorice.
		Resin	Jalap, ginger, tolu balsam
		Carbo- hydrates	Acacia, honey, starch, isapgol
		Tannins	Arjuna, ashoka
		Lipid	Castor oil, peanut oil, mustard
		Proteins Enzymes	Casein, gelatine Papain, trysin
<b>Chemo-taxonomic classification</b>	This classification establishes relation between chemistry and taxonomy by exact choice of group, sound sampling, analysis of chemical content, interpretation and comparison. <b>Advantage:</b> Taxonomic characters directly links to chemistry of plants. <b>Disadvantage:</b> It is also very complex	Example: In case of eucalyptus, feather-veined leaves have high Pinene content in their essential oil, while intermediate veined leaves contain both pinene and cineole.	

## PRINCIPLES OF PLANT CLASSIFICATION

The red algae, or Rhodophyta	These are one of the oldest groups of eukaryotic algae. The Rhodophyta also comprises one of the largest phyla of algae, containing over 7,000 currently recognized species. The red algae form a distinct group characterized by having eukaryotic cells without flagella and centrioles, chloroplasts that lack external endoplasmic reticulum and contain unstacked (stroma) thylakoids, and use phycobiliproteins as accessory pigments, which give them their red color. Red algae store sugars as floridean starch, which is a type of starch that consists of highly branched amylopectin without amylose, as food reserves outside their plastids. Most red algae are also multicellular, macroscopic, marine, and reproduce sexually.
Diatoms	These are a major group of microalgae, and are among the most common types of phytoplankton. Diatoms are unicellular, although they can form colonies in the shape of filaments or ribbons (e.g. <i>Fragilaria</i> ), fans (e.g. <i>Meridion</i> ), zigzags (e.g. <i>Tabellaria</i> ), or stars (e.g. <i>Asterionella</i> ). A unique feature of diatom cells is that they are enclosed within a cell wall made of silica (hydrated silicon dioxide) called a frustule.
Fungi	A fungus is any member of the group of eukaryotic organisms that includes microorganisms such as yeasts and molds, as well as the more familiar mushrooms. These organisms are classified as a kingdom, Fungi, which is separate from the other eukaryotic life kingdoms of plants and animals. Fungi do not photosynthesize. Similar to animals, fungi are heterotrophs; they acquire their food by absorbing dissolved molecules, typically by secreting digestive enzymes into their environment.
Mushroom	A mushroom, or toadstool, is the fleshy, spore-bearing fruiting body of a fungus, typically produced above ground on soil or on its food source. The word "mushroom" is most often applied to those fungi (Basidiomycota, Agaricomycetes) that have a stem (stipe), a cap (pileus), and gills (lamellae, sing. lamella) on the underside of the cap. Mushrooms may be edible, poisonous, or unpalatable.

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Mycotoxins	Many fungi produce biologically active compounds, several of which are toxic to animals or plants and are therefore called mycotoxins. Of particular relevance to humans are mycotoxins produced by molds causing food spoilage, and poisonous mushrooms (see above). Particularly infamous are the lethal amatoxins in some <i>Amanita</i> mushrooms, and ergot alkaloids, which have a long history of causing serious epidemics of ergotism (St Anthony's Fire) in people consuming rye or related cereals contaminated with sclerotia of the ergot fungus, <i>Claviceps purpurea</i> . Other notable mycotoxins include the aflatoxins, which are insidious liver toxins and highly carcinogenic metabolites produced by certain <i>Aspergillus</i> species often growing in or on grains and nuts consumed by humans, ochratoxins, patulin, and trichothecenes (e.g., T-2 mycotoxin) and fumonisins, which have significant impact on human food supplies or animal livestock.
Yeast	Yeasts are eukaryotic, single-celled microorganisms classified as members of the fungus kingdom. They are estimated to constitute 1% of all described fungal species. Yeasts, with their single-celled growth habit, can be contrasted with molds, which grow hyphae. Yeast is useful in alcohol generation and as probiotic too.
Penicillium	Penicillium is ascomycetous fungi are of major importance in the natural environment as well as food and drug production. Some members of the genus produce penicillin, a molecule that is used as an antibiotic, which kills or stops the growth of certain kinds of bacteria. Other species are used in cheesemaking, mycoremediation and production of a number of biotechnologically produced enzymes and other macromolecules.
Gymnosperm	The gymnosperms are a group of seed-producing plants that includes conifers, cycads, Ginkgo, and gnetophytes. The non-encased condition of their seeds stands in contrast to the seeds and ovules of flowering plants (angiosperms), which are enclosed within an ovary. Gymnosperm seeds develop either on the surface of scales or leaves, which are often modified to form cones, or solitary as in Yew, <i>Torreya</i> , Ginkgo. By far the largest

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	<p>group of living gymnosperms are the conifers (pines, cypresses, and relatives), followed by cycads, gnetophytes (Gnetum, Ephedra and Welwitschia), and Ginkgo biloba (a single living species).</p>
Pinaceae	<p>The Pinaceae (pine family) are trees or shrubs, including many of the well-known conifers of commercial importance such as cedars, firs, hemlocks, larches, pines and spruces. The family is included in the order Pinales, formerly known as Coniferales. They are the largest extant conifer family in species diversity, with between 220 and 250 species (depending on taxonomic opinion) in 11 genera.</p>
Turpentine	<p>Turpentine (also called spirit of turpentine, oil of turpentine, wood turpentine and colloquially turps) is a fluid obtained by the distillation of resin obtained from live trees, mainly pines. It is mainly used as a solvent and as a source of materials for organic synthesis. Turpentine is composed of terpenes, mainly the monoterpenes alpha-pinene and beta-pinene with lesser amounts of carene, camphene, dipentene, and terpinolene. As a solvent, turpentine is used for thinning oil-based paints, for producing varnishes, and as a raw material for the chemical industry. Turpentine has long been used as a solvent, mixed with beeswax or with carnauba wax, to make fine furniture wax for use as a protective coating over oiled wood finishes. Commercially used camphor, linalool, alpha-terpineol, and geraniol are all usually produced from alpha-pinene and beta-pinene, which are two of the chief chemical components of turpentine. These pinenes are separated and purified by distillation. The mixture of diterpenes and triterpenes that is left as residue after turpentine distillation is sold as rosin. Turpentine is also added to many cleaning and sanitary products due to its antiseptic properties. As an organic solvent, its vapour can irritate the skin and eyes, damage the lungs and respiratory system, as well as the central nervous system when inhaled, and cause damage to the renal system when ingested, among other things.</p>

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Colophony	Colophony, also called Rosin or Greek pitch, is a solid form of resin obtained from pines and some other plants, mostly conifers, produced by heating fresh liquid resin to vaporize the volatile liquid terpene components. It is semi-transparent and varies in color from yellow to black. Rosin is the resinous constituent of the oleo-resin exuded by various species of pine, known in commerce as crude turpentine. The separation of the oleo-resin into the essential oil (spirit of turpentine) and common rosin is accomplished by distillation in large copper stills. Rosin is an ingredient in printing inks, photocopying and laser printing paper, varnishes, adhesives (glues), soap, paper sizing, soda, soldering fluxes, and sealing wax. Rosin can be used as a glazing agent (E915) in medicines and chewing gum. In pharmaceuticals, rosin forms an ingredient in several plasters and ointments. Glycerol (E445), sorbitol, and mannitol esters of rosin are used as chewing gum bases and as an emulsifier in soft drinks for medicinal applications.
Copal	Copal is a name given to tree resin, particularly the aromatic resins from the copal tree <i>Protium copal</i> (Burseraceae) and <i>Hymenaea verrucosa</i> (Fabaceae). It is resinous substances in an intermediate stage of polymerization and hardening between "gummier" resins and amber. Copal can be easily distinguished from genuine amber by its lighter citrine colour and its surface getting tacky with a drop of acetone or chloroform.
Gnetaceae	Gnetum is a genus of gymnosperms, the sole genus in the family Gnetaceae and order Gnetales. They are tropical evergreen trees, shrubs and lianas. Unlike other gymnosperms, they possess vessel elements in the xylem. Many Gnetum species are edible, with the seeds being roasted, and the foliage used as a leaf vegetable.
Angiosperm	The flowering plants, also known as angiosperms, Angiospermae or Magnoliophyta, are the most diverse group of land plants, with 416 families, approximately 13,164 known genera and c. 295,383 known species. Like gymnosperms, angiosperms are seed-producing plants. However, they are distinguished from gymnosperms by characteristics including flowers, endosperm within the seeds, and the production of fruits that contain the seeds.

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Pteridophytes	A pteridophyte is a vascular plant (with xylem and phloem) that reproduces via spores, and therefore was a member of the former and now invalid taxon Pteridophyta. The term is now used only informally to denominate a fern (monilophyte) or lycophyte. Because pteridophytes produce neither flowers nor seeds, they are also referred to as "cryptogams". The pteridophytes include the ferns, horsetails, and the lycophytes (clubmosses, spikemosses, and quillworts).
Male fern	<i>Dryopteris filix-mas</i> , the male fern, is a common fern of the temperate Northern Hemisphere, native to much of Europe, Asia, and North America. It is garden plant. The root was used, until recent times, as an anthelmintic to expel tapeworms, but has been replaced by less toxic and more effective drugs. The anthelmintic activity has been claimed to be due to flavaspicid acid, a phloroglucinol derivative.

## PLANT FAMILIES

Calyx = K, Corolla = C, Androecium = A, Gynoecium = G, Male = ♂, Zygomorphic = %	
<b>Acanthaceae</b>	<p>Dicot family</p> <p><b>Floral formula:</b> X, K 5, C 2+3, A 2+2 or 2, G 2</p> <p><b>Chemical constituents:</b> It contains almost 250 genera and about 2500 species. The leaves may contain cystoliths, calcium carbonate concretions, seen as streaks on the surface. It contains glycosides, flavonoids, benzenoids, phenolic compounds, naphthoquinone and triterpenoids. Acanthaceae possess wound healing, anti-tussive, antifungal, cytotoxic, anti-inflammatory, anti-pyretic, antioxidant, insecticidal, hepatoprotective, immunomodulatory, anti-platelet aggregation and anti-viral potential.</p> <p><b>Important Medicinal Plants of the family are as follows:</b></p> <ul style="list-style-type: none"> <li>➤ <i>Adhatoda vasica</i>: Anti-tussive</li> <li>➤ <i>Andrographis paniculata</i>: Bitter tonic, hepatoprotective, anti-viral</li> <li>➤ <i>Blepharis edulis</i>: Wound healing</li> </ul>

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<p><b>Apocynaceae</b></p>	<p><b>Dicot family</b>  <b>Floral formula:</b> ♂K(5) C(5) A(5) G 2 Or (2)  <b>Chemical constituents:</b>The family is a rich source of indole and steroidal alkaloids as well as cardioactive glycosides. The other constituents are cyanogenetic glycosides, saponins, tannins, coumarins, phenolic acids and triterpenoids.  <b>Important medicinal plants of the family are as follows:</b></p> <ul style="list-style-type: none"> <li>➤ <i>Catharanthus roseus</i>: anticancer</li> <li>➤ <i>Holarrhena antidysenterica</i>: bitter and antidiysenteric</li> <li>➤ <i>Rauwolfia serpentina</i>: management of essential hypertension</li> <li>➤ <i>Strophanthus kombe</i>: diuretic</li> <li>➤ <i>Thevetia nererifolia</i> (yellow oleander): cardioactive</li> </ul>
<p><b>Compositae Asteraceae or Daisy family</b></p>	<p><b>Dicot family</b>  <b>Floral Formula:</b> ♂ K pappus or OC (5)G (2)  <b>Chemical constituents:</b> A characteristic feature of the family is the storage of carbohydrate in the form of inulin; sesquiterpene lactones; polyacetylenic compounds and essential oils; alkaloids of pyridine, quinoline, diterpenoid and pyrrolizidine group in small amounts; diterpene glycoside. It includes plants having antitumour or antibacterial activity. Some members are also commercial sources of rubber latex. Important medicinal plants of the Family  <b>Important medicinal plants of the family are as follows:</b></p> <ul style="list-style-type: none"> <li>➤ <i>Artemisia annua</i>: Antimalarial</li> <li>➤ <i>Calendula officinalis</i>: Topical use for skin infections</li> <li>➤ <i>Arnica montana</i>: Externally in hair preparations and for bruises</li> <li>➤ <i>Stevia rebaudiana</i>: Stevioside; sweetener for soft drinks.</li> </ul>
<p><b>Convolvulaceae</b></p>	<p><b>Dicot family</b>  <b>Floral Formula:</b> ♂K (5) C(5) A (5) G(2)  <b>Chemical constituents:</b> It includes indole, isoquinoline, pyrrolidine and tropane and pyrro-</p>

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	<p>lizidine alkaloids. Purgative resins, phenolic acids and triterpenoid saponins are also reported in some species. Important medicinal plants of the Family</p> <p><b>Important medicinal plants of the family are as follows:</b></p> <ul style="list-style-type: none"> <li>➤ <i>Ipomoea hederacea</i>: Purgative</li> <li>➤ <i>Cuscuta reflexa</i>: As hypotensive and have bradycardiac effects</li> <li>➤ <i>Ipomoea purga</i>: Strong purgative</li> <li>➤ <i>Argyreia speciosa</i>: Roots in rheumatic afflications and leaves in skin diseases and wounds</li> </ul>
<p><b>Leguminoceae</b> (legume, pea, or bean family)</p>	<p><b>Dicot family</b></p> <p><b>Floral Formula:</b> % ♂K(5)C(5) A(9) + 1G1</p> <p>It is divided into three sub families:</p> <p>Many fabaceae host bacteria in their roots within structures called root nodules. These bacteria, known as rhizobia, called nitrogen fixation.</p> <p><b>Important medicinal plants of the Family are as follows:</b></p> <p><b>Papilionaceae (Fabaceae)</b></p> <p><i>Psoralea corylifolia</i>: Various skin infections</p> <p><i>Mucuna pruriens</i>: Parkin-sonism</p> <p><i>Astragalus gummifer</i>: Demulcent, suspending and emulsifying agent</p> <p><i>Trigonella foenagræum</i>: Source of steroids</p> <p><i>Glycyrrhiza glabra</i>: Expectorant</p> <p><i>Tolu balsam</i>: Cough mixtures and antiseptic</p> <p><i>Peru balsam</i>: Antiseptic and expectorant</p> <p><b>Caesalpiniaceae</b></p> <p><i>Cassia acutifolia</i>: Laxative</p> <p><i>Cassia angustifolia</i>: Laxative</p> <p><i>Caesalpinia sappan</i>: Red dye</p> <p><i>Cassia tora</i>: Laxative</p> <p><i>Cassia occidentalis</i>: Laxative</p> <p><i>Cassia fistula</i>: Laxative</p> <p><b>Mimoseae</b></p> <p><i>Acacia senegal</i>: Gums</p> <p><i>Acacia catechu</i>: Astringent, tanning and dyeing industry</p> <p><i>Acacia farnesiana</i>: Perfumery</p> <p><i>Albizia lebbek</i>: Timber tree</p>

<b>Labiatae</b> <b>Lamiaceae or</b> <b>Mint family</b>	<b>Dicot family</b> <b>Floral Formula:</b> ♂K(5)C(5)A4G(2) <b>Chemical constituents:</b> Volatile oils; menthol and thymol; other constituents include: Diterpenoids and triterpenoids, saponins, polyphenols, tannins, iridoids and their glycosides and coumarins. Pyridine and pyrrolidine alkaloids are also present.
	<b>Important medicinal plants of the family are as follows:</b> <ul style="list-style-type: none"> <li>➤ <i>Ocimum sanctum</i>: Antipyretic, respiratory problems</li> <li>➤ <i>Mentha piperita</i>: Source of menthol; Flavouring, carminative</li> <li>➤ <i>Thymus vulgaris</i>: Antispasmodic</li> <li>➤ <i>Rosemarinus officinalis</i>: Carminative and spasmolytic</li> </ul> <i>Lavandula angustifolia</i> : Carminative and spasmolytic
<b>Rubiaceae</b>	<b>Dicot family</b> <b>Floral Formula:</b> ♂K(4-5)C(4-) A (4-5)G(2) <b>Chemical constituents:</b> A large diversity in constituents; alkaloids indole, oxindole, quinoline and purine type are common; catechins; anthraquinones, di and triterpenoids; irridoid glycosides. <b>Important medicinal plants of the family are as follows:</b> <ul style="list-style-type: none"> <li>➤ <i>Cinchona ledregiana</i>: Antimalarial, bitter tonic</li> <li>➤ <i>Cephaelis ipecacuanha</i>: Rxpectorant and emetic</li> <li>➤ <i>Uncaria gambier</i>: Astringent, tanning and dyeing industry</li> <li>➤ <i>Coffea arabica</i>: Stimulant</li> <li>➤ <i>Morinda citrifolia</i>: Traditional drug, Anthraquinones</li> </ul>
<b>Rutaceae</b>	<b>Dicot family</b> <b>Floral Formula:</b> ♂K4-5C4-5A8, 10 G (4, 5) <b>Chemical constituents:</b> Essential oil, Vitamin-C and citric acid are the common constituent of this family. Essential oil is found in lysigenous secretory cavities in the parenchyma and pericarp. Furano and pyranocoumarins are the typical constituents of this family. Imidazole, acridone and benzyltetra hydro isoquinoline type of alkaloids have been also reported.

	<p><b>Important medicinal plants of the family are as follows:</b></p> <ul style="list-style-type: none"> <li>➤ <i>Citrus aurantium</i>: As food, flavouring agent</li> <li>➤ <i>Citrus limonia</i>: Vitamin C</li> <li>➤ <i>Aegle marmelos</i>: Immunomodulatory activity</li> <li>➤ <i>Ruta graveolens</i>: Formerly used as emmenagogue and spasmolytic</li> <li>➤ <i>Pilocarpus jaborandi</i>: Pilocarpine, used in glaucoma treatment</li> </ul>
<p><b>Scrophulariaceae</b> <b>Figwort family</b></p>	<p><b>Dicot family</b> <b>Floral Formula:</b> ♂K(5)C(5)A4or 2G(2) <b>Chemical constituents:</b> Cardiac glycosides, bitter irridoid glycosides, other constituents include: steroidal and triteroenoid saponins, cyanogenetic glycosides and anthraquinones. <b>Important medicinal plants of the family are as follows:</b> <i>Digitalis purpurea</i> : Cardioactive <i>Digitalis lanata</i> : Cardioactive <i>Picrorhiza kurroa</i> : Liver ailments <i>Baccopa monnieri</i> : Brain and nerve tonic</p>
<b>Solanaceae</b>	<p><b>Dicot family</b> <b>Floral Formula:</b> ♂K(5)C(5)A(5)G(2) <b>Chemical constituents:</b> Tropane and steroidal type of alkaloids. <b>Important medicinal plants of the family are as follows:</b></p> <ul style="list-style-type: none"> <li>➤ <i>Atropa belladonna</i>: Pain relief, inflammatory conditions, anti-emetic</li> <li>➤ <i>Datura stramonium</i>: Spasmodic affections of the respiratory organs</li> <li>➤ <i>Hyoscyamus niger</i>: Spasmolytic and anticholinergic properties; atropine is used in ophthalmology.</li> <li>➤ <i>Withania somniferum</i>: Antioxidant, immune-modulatory</li> <li>➤ <i>Solanum nigrum</i>: Source of steroids, hepatoprotective</li> <li>➤ <i>Capsicum annum</i>: Counter irritant</li> <li>➤ <i>Nicotiana tabacum</i>: Source of nicotine; insecticide</li> </ul>

<p><b>Umbelliferae</b> Presently called as Apiaceae</p>	<p><b>Dicot family</b>  <b>Floral Formula:</b> %♂K5C5A5G(2)  <b>Chemical constituents:</b> Rich source of essential oils; some species accumulate alkaloids and furanocoumarins, coumarins, terpenes and sesquiterpenes and triterpenoid saponins.  <b>Important medicinal plants of the family are as follows:</b>  <i>Carum carvi</i>: Carminative and spice  <i>Coriandrum sativum</i>: Carminative and spice  <i>Cuminum cyminum</i>: Carminative and spice  <i>Anethum graveolens</i>: Carminative and spice  <i>Foeniculum vulgare</i>: Mild carminative and an excellent eye wash</p>
<p><b>Liliaceae (Lily family)</b></p>	<p><b>Monocot family</b>  <b>Floral Formula:</b> P3+3A3+3G(3)  <b>Chemical constituents:</b> sulphur containing compounds, anthraquinone and saponin glycosides, rarely alkaloids  <b>Important medicinal plants of the family are as follows:</b>          &gt; Aloe (<i>Aloe vera</i>): Anthraquinone glycosides          &gt; Colchicum (<i>Colchicum autumnale</i>): alkaloids          &gt; Sated musli (<i>Chlorophytum borivilianum</i>): Saponins          &gt; Shatavari (<i>Asparagus recemosus</i>): Saponins</p>
<p><b>Gramineae or Poaceae (Grass family)</b></p>	<p><b>Monocot family</b>  <b>Floral Formula:</b> P2+4 a4 or 6 G2(□3)  <b>Chemical constituents:</b> Polysaccharides, sugar  <b>Important medicinal plants of the family are as follows:</b>          &gt; Sugarcane (<i>Saccharum officinarum</i>)          &gt; Corn (<i>Zea mays</i>): Edible</p>
<p><b>Papaveraceae (Poppy family)</b></p>	<p><b>Dicot family</b>  <b>Floral Formula:</b> Ca 2Co2+2A∞G(2-25)          Woody shrubs or small tropical trees.  <b>Chemical constituents:</b> Latex, alkaloids  <b>Important medicinal plants of the family are as follows:</b>          &gt; <i>Chelidonium majus</i> : alkaloid chelidonine          &gt; <i>Papaver somniferum</i> L.(opium): narcotic alkaloids.</p>



<b>Cruciferae or Brassicaceae (Mustard family)</b>	<b>Dicot family</b> <b>Floral Formula:</b> $Ca_2+2Co_4A_2+4G(2)$ or (4) Herbs/shrubs <b>Chemical constituents:</b> Glucosinolates <b>Important medicinal plants of the family are as follows:</b> <ul style="list-style-type: none"><li>➤ <i>Brassica oleracea</i> : edible</li><li>➤ <i>Brassica nigra</i>: seed oil is useful in cosmetics</li><li>➤ <i>Sysimbrium officinale</i>: leaves and stem used in curing scurvy.</li><li>➤ <i>Lepidium sativum</i>: seeds are used for treating liver disorders.</li></ul>
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