Volatile oils Containing Sesquiterpenes as Active Constituents

Prof. Dr. Ali H. Meriçli

MATRICARIA (mayıs papatyası)

MATRICARIAE FLOS
MATRICARIAE AETHEROLEUM

Matricaria chamomilla* = *Chamomilla recutita* = *Matricaria recutita **Asteraceae**

There are many Asteraceae plants similar to Matricaria. To diagnose the real Matricaria :

-The reseptaculum is conical and hollow.

-The leaves are very fine, not thick

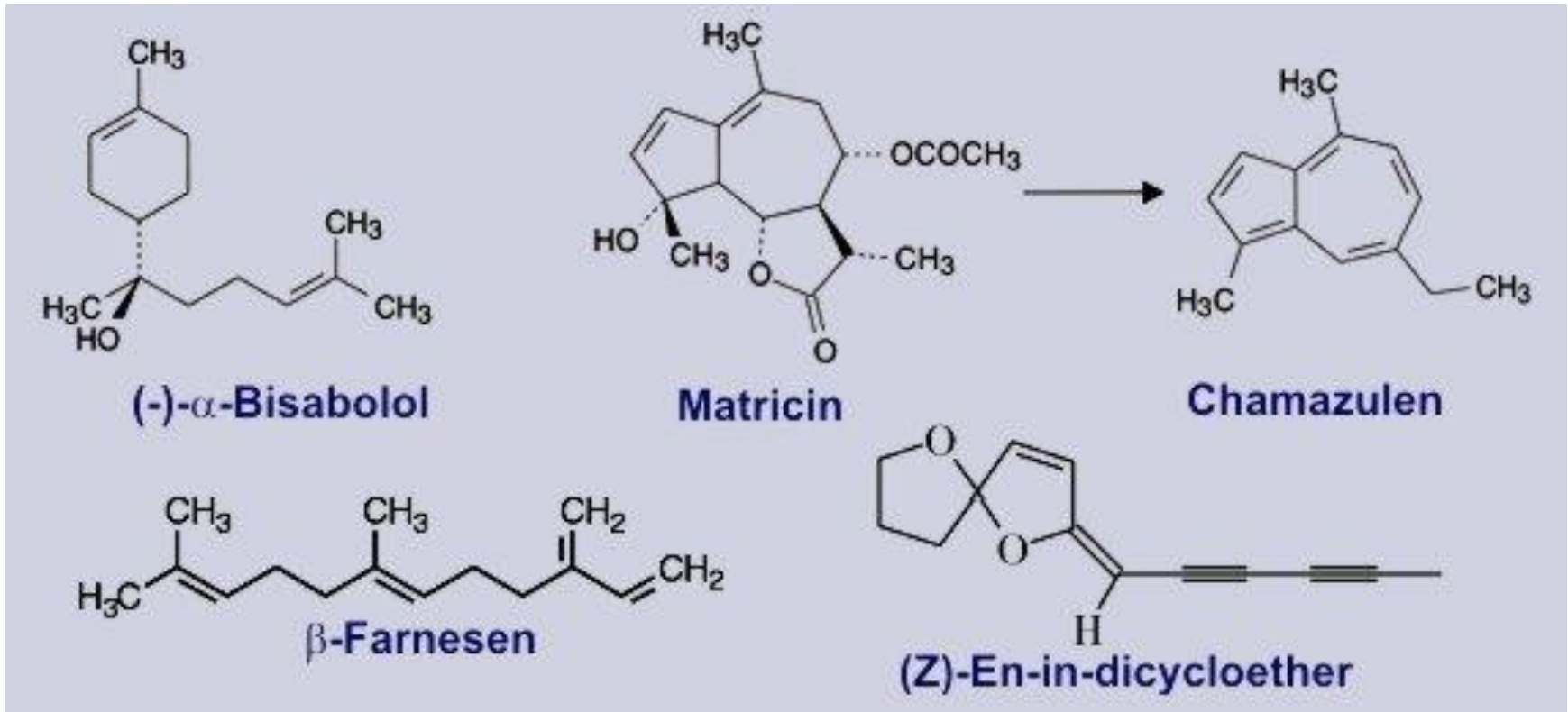
-The flowers have a special odor, more or less similar to lime

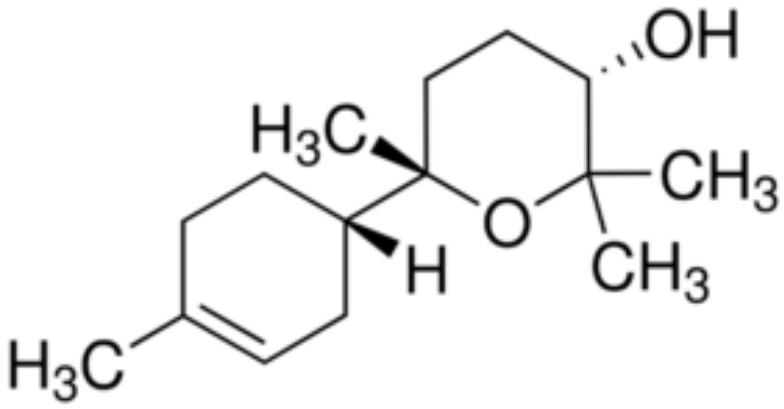
-The dried drug easily loses its form and the yellow tubular flowers fall out

Chemical Composition : Together with an acidic mucilage, coumarins (umbelliferone, herniarin) and flavonoids (up te 6%, major flavonoids are apigenin and its 7-glucoside, luteolin, quercetin, isorhamnetin and their glycosides are also present; in the dried drug, the glycosides are partially hydrolized, and the apigenin concentration may be high). The drug contains an essential oil 3-15 ml/kg). The essential oil owes its blue color to chamazulene, which is often found at a hifh level (1-15%), and arises from the decomposition of a sesquiterpenoid lactone, matricin.

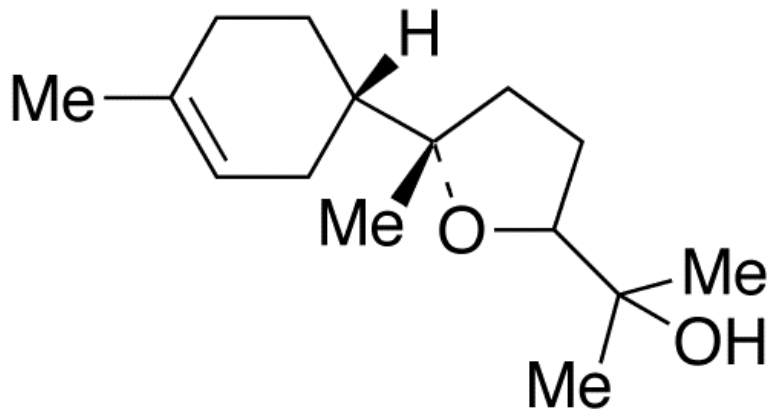
The drug contains an essential oil 3-15 ml/kg). The essential oil owes its blue color to chamazulene, which is often found at a high level (1-15%), and arises from the decomposition of a sesquiterpenoid lactones, matricin and matricarin.

It also contains spirononeoid dicycloethers with double and triple bonds, formed by the cyclization of polyalkines, as well as several sesquiterpenes with a bisabolene skleton : (-)-α-bisabolol, its A and B oxides, and the A oxide of (-)-bisabolene. These sesquiterpenes represent up to 50% of the essential oil, but their propertions vary as a function of the chemotype. The essential oil also contains another sesquiterpene, β-farnesene (10-12%).

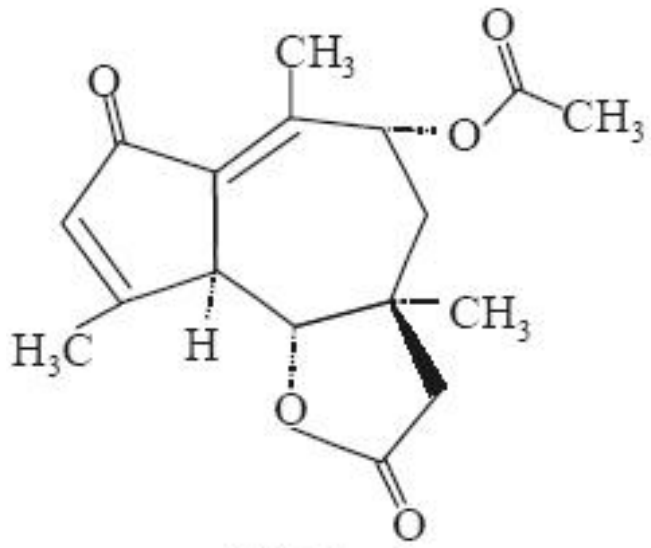

CH3
CH3
H3C
HO
CH3
(-)-α-Bisabolol
H3C
OCOCH3
HO
CH3
O
CH3
O
Matricin
H3C
CH3
H3C
Chamazulen
CH3
CH3
CH2
H3C
CH2
β-Farnesen
O
O
H
(Z)-En-in-dicycloether



(-)-α- Bisabolol oxide A



(-)-α-bisabolol oxide B



Matricarin

Pharmacological Properties : Matricaria is considered an anti-inflammatory. This activity may be due to chamazulene (an inhibitor of leukotrienen synthesis) and to (-)-α-bisabolol, whose effects on different experimental models heve clearly been shown. The hydroalkolic extract of capitulums is a spasmolitic. This activity may be due to flavonoids (apigenin), and also to one of the bicyclic ethers, and to (-)-α-bisabolol which under similar experimental conditions, has an activity resembling that of papaverine.

The essential oil of matricaria is an antibacterial and antifungal agent; it stimulates biliary secretion (cat,dog) and thought to be hypotensive. Finally (-)-α-bisabolol counteracts the gastric ulceration induced by various agents, including ethanol, stress, and indomethacin in the rat *per os*. Observation on humans show that the drug is a sedative. Other trials indicate that matricaria extracts probably have wound healing and antieczema activities.

Tests : The drug is identified by the color obtained upon addition of a phosphoric acid and acetic acid solution of dimethylaminobenzaldehyde to a dichloromethane extract (characterization of the proazulenes).

Uses : The drug and its preparations, which seem devoid of toxicity, are traditionally used by the oral route to treat the symptoms of digestive ailments (epigastric bloating, impaired digestion, eructations, flatulence), and to stimulate the appetite.

Locally, the drug is an ingredient of preparations designed for the adjunctive emollient and itch-relieving treatment of skin disorders, and a trophic protective agent for cracks, bruises, frostbite, and insect bites. The preparations may also be used as antalgics in diseases of the oral cavity, oropharynx, or both, and in the case of eye irritation or discomfort of various etiologies (eye strain, seawater or swimming pool water, or smky atmospheres).

The German Commission E monograph contains virtually identical indications. Orally : gastrointestinal spasms and inflammation. Topically : inflammation of the skin and mucous membranes, bacterial infections (skin, mouth; gargles); anal and genital disorders (bath, washes); respiratory irritations (inhalations).

In cosmetology, matricaria is used in ahampoos (to lighten hair color), and in suntan lotions. The essential oil is an ingredient of perfumes and soaps.

Comments : The presence of lactones in matricaria-based preparations (medicinal, cocmetic, or other) may cause allergic reactions (contact dermatitis) in sensitive persons. The reactions to chamomile is uncommon, and the cases in which matricaria is formally incriminated seem exceptional (which is not true for species such as *Anthemis cotula*).

IMPORTANT NOTICE

The essential oil of turkish (including Cyprus) and some mediterranean *Matricaria chamomilla* samples is not **blue**, but **yellowish-green**, because of the lack of chamazulene. These samples do not contain any sesquiterpenoid lactones (matricin, matricarin). It is a **chemical race**. But all the other compounds are in turkish matricaria present

CHAMOMILLAE FLOS

Matricaria chamomilla (Chamomilla recutita)

WORMWOOD (pelin) *Artemisia absinthium*

Absinthii herba Asteraceae

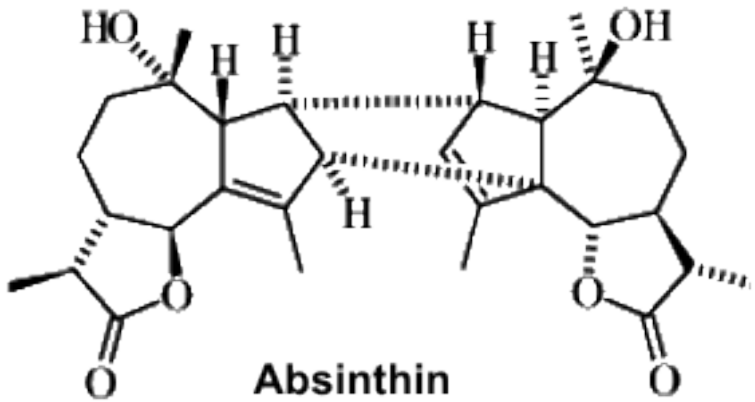
This perennial Asteraceae consists of the leaves and the flowering tops (herba).

Wormwood (Absinthii herba), a very aromatic herbaceous plant, is common in the Mediterranean area and in Turkey.

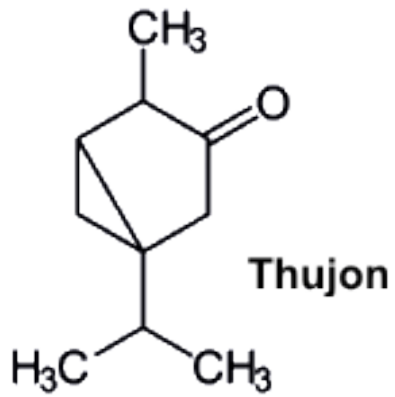
Chemical Composition :

Wormwood (Absinthii herba) : The drug concentration in essential oil reaches a maximum before blooming, and ranges from 2 to 6 ml/kg; the official drug must contain not less than 3 ml/kg. Older texts describe this essential oil as containing mostly thujones. But the systematic analysis of specimens from different sources has shown that there are many chemotypes : with *Z*-epoxy-α-ocimene, with thujone, with sabinyl acetate or with chrysanthemyl acetate as major compound.

The plant also contains polyalkynes, flavonoids, and sesquiterpenoid lactones : absinthin (dimer), arartabsin, matricin, and closely related derivatives.

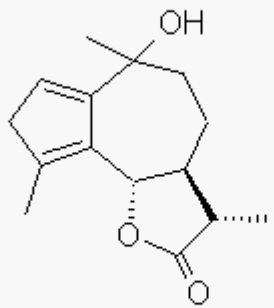


Absinthin



Thujon

Artabsin



$C_{15}H_{20}O_3$

Properties : The neurotoxicity of wormwood liquor, now known to be linked to thujone. The current European Union regulatory texts set limit concentrations for thujones in foods and beverages

Uses : The drugs, especially wormwood is thought to be anthelmintic, antibacterial, antipyretic and emmenagogue, but there are no reliable data on their pharmacology. This drug is traditionally used to stimulate the appetite.

In Germany, wormwood is used to stimulate the appetite and for dyspepsia.

More than 20 *Artemisia* species grow wildly in Turkey. Some of them are rich in sesquiterpenoid lactones, some of them are rich in coumarins and sesquiterpene-coumarin ethers. But their chemistry are strong different from each other.

Artemisia abrotanum ***A. araratica***

LIME (LINDEN) (ıhlamur) **TILIAE FLOS**

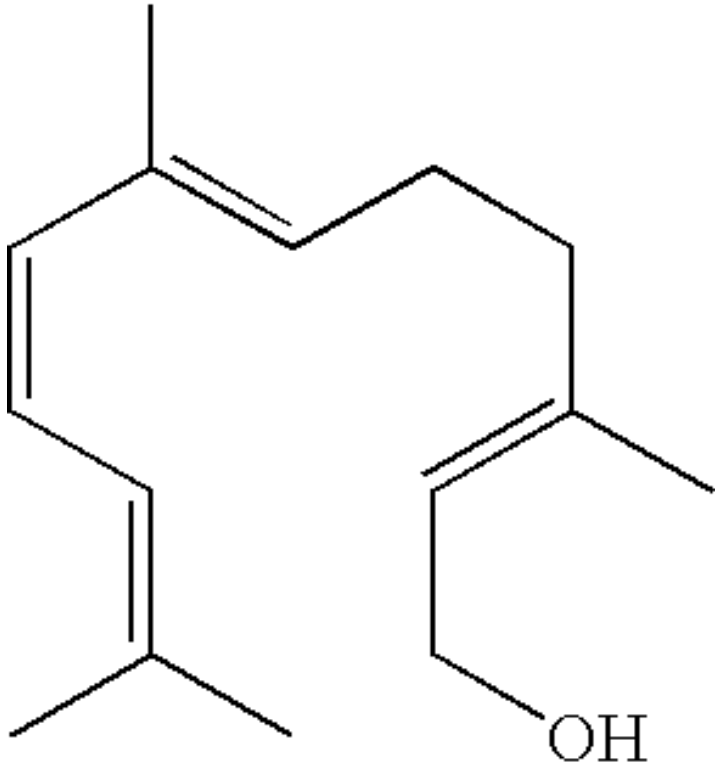
Tilia cordata, T. platiphyllos **Tiliaceae**

Tilia cordata

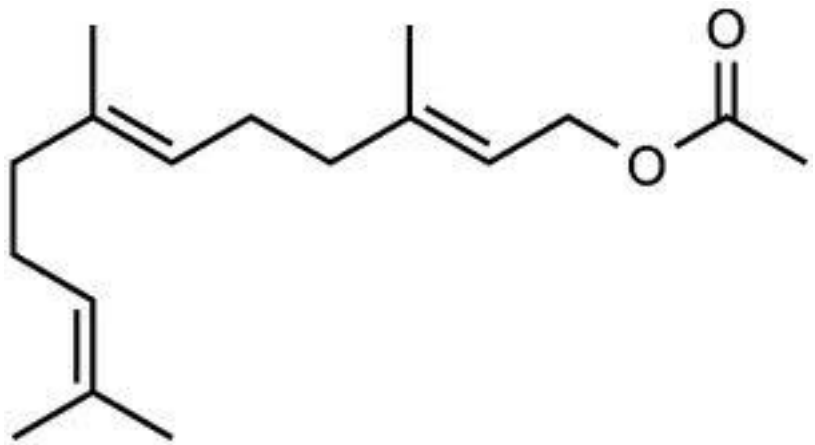
The drug consist of the whole dried inflorescence. The flowers and bracts have been available over the counter for a long time and they are used to prepare infusions that would be slightly sedative.

Chemical Composition : The drug is rich in phenolic compounds (phenolic acids, proanthocyanins, flavonoids) and mucilage.

The odor of the drug is linked to a small amount of essential oil, which varies in composition with the localization : that from bracts is rich in phenylacetaldehyde and other aldehydes, whereas that from flowers is dominated by monoterpenoid hydrocarbons. Both contain oxygenated mono- and sesquiterpenes (linalool, geraniol, farnesol, acetyl farnesol, camphor, cineole, carvone), aromatic alcohols (phenylethanol, benzylic alcohol).

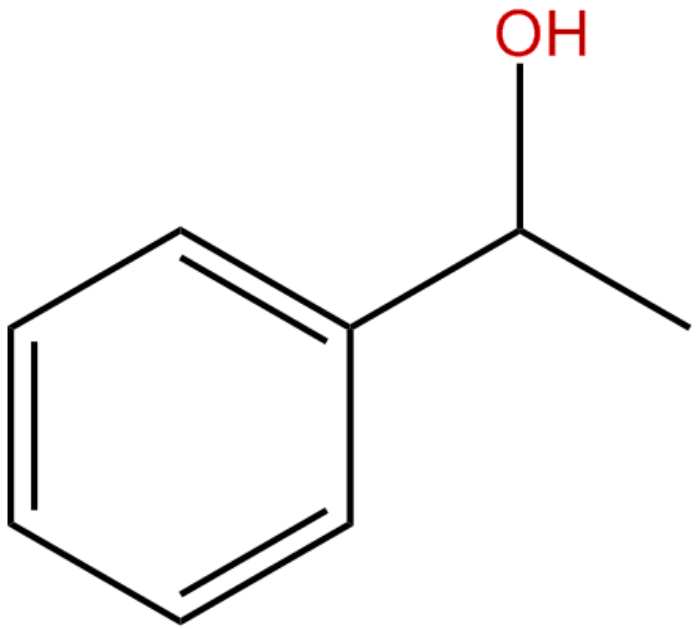


2E, 6E-farnesol



farnesyl acetate

phenylethanol



Action, Medical Uses, and Dosage

The European species (*Tilia europaea*) is a common domestic remedy in Europe for the relief of many nervous and catarrhal disorders. ***Tilia* × *europaea***, generally known as the **common lime** (British Isles) or **common linden** (North America), is a naturally occurring hybrid between *Tilia cordata* (small-leaved lime) and *Tilia platyphyllos* (large-leaved lime). It occurs in the wild in Europe at scattered localities wherever the two parent species are both native. It is not closely related to the lime fruit tree, a species of citrus.The leaves, flowers, and buds are employed, and their properties may be regarded as stimulant, lenitive, tonic, and nervine. The infusion is generally preferred, and may be given to allay irritation and restlessness, and to promote rest and sleep. The hot infusion is employed to check diarrhoea from cold, and in the various forms of colds and catarrhal conditions, while, either hot or cold, it may be used in restlessness, nervous headaches, painful and difficult digestion, and mild hysteria. The effects upon the nervous system are sometimes obtained by an enema, or bath, prepared from the flowers. The infusion is prepared from 30 or 40 grains of the flowers and 1 pint of water. It forms an agreeable vehicle for other medicines. A strong tincture may be prepared of the flowers and strong alcohol. Dose, 1 to 20 minims. The other species undoubtedly possess similar properties.

Tilia x europea

GINGER **ZINGIBERIS RHIZOMA** **Zingiberaceae**

Zingiber officinale **Zencefil**

Ginger (Zingiber) is the scraped or unscraped rhizome of *Zingiber officinale* (Zingiberaceae). *Z. officinale*, a reed-like plant, is grown in many parts of the World, including Jamaica, China, India and Africa (Nigeria). Jamaican ginger, once the traditional pharmaceutical ginger, has been largely replaced by other sources.

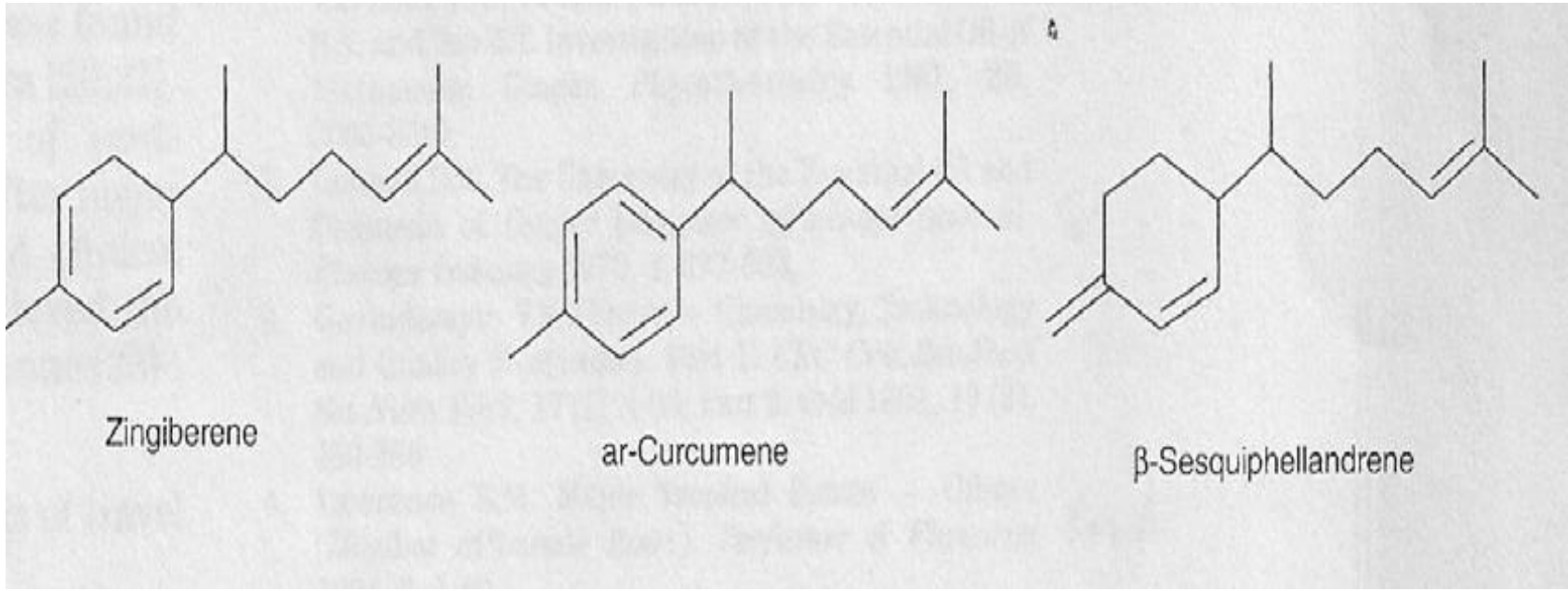
History : Ginger has been cultivated in India from the earliest times; the plant is unknown in the wild state. The spice was used by the Greeks and Romans, and was a common article of European commerce in the Middle Ages. It was well known in England in the eleventh century.

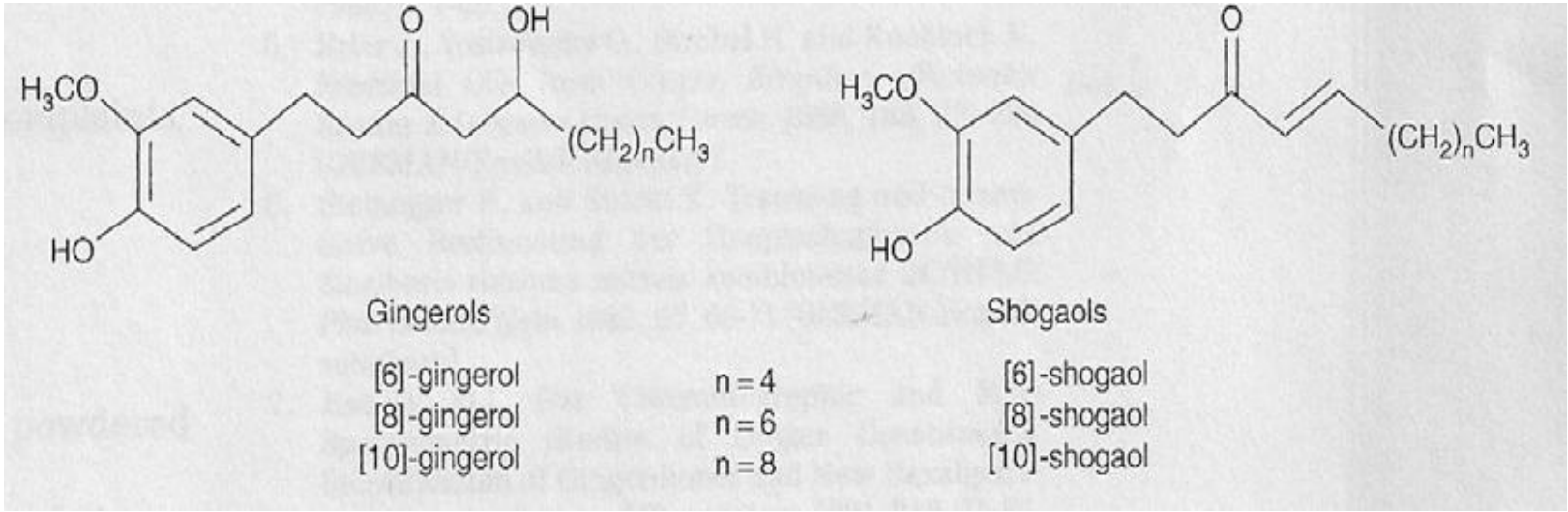
Cultivation and preparation : Ginger grows well at subtropical temperatures where the rainfall is at least 2m per annum. As the plant is sterile, it is grown by vegetative means. The cultivation of ginger is known to originate in China which then spread to India, South East Asia, West Africa and the Caribbean India is the biggest producer of ginger in the world. In India, it is cultivated in almost all the states. Some reports suggests that the climatic conditions of Orissa, West Bengal, North Eastern states and Kerala are more suitable for the growth of ginger in India .

The medicinal use of ginger is well known in India and its neighboring countries for more than 2000 years as one of the most versatile medicinal plants. Ginger has been using both as Ayurvedic and Chinese medicine for curing heart problems, treat stomach upset, diarrhea, and nausea . It is also used as a disguise the taste of medicines; promotes the release of bile from the gall bladder , decrease joint pain from arthritis, useful for the treatment of heart diseases and lungs diseases ; relief cough and cold, throat infection. Besides these it is used as curry powder, hot drinks like ginger beer, ginger wine, ginger tea. Ginger has been identified as an herbal medicinal product with pharmacological effect. Ginger suppresses prostaglandin synthesis through inhibition of cyclooxygenase- 1 and cyclooxygenase- 2. Many research has been showed that the ginger extract also have antimicrobial activity and anti-oxidant properties

Chemical Constituents : Volatile oil 1-4 % . More than 100 compounds are identified, most of them terpenoids mainly sesquiterpenoids (α-zingiberene, β-sesquiphellandrene, β-bisabolene, α- farnesene, ar-curcumene (zingiberol) and smaller amounts of monoterpenoids (camphene, β- phellandrene, cineole, geraniol, curcumene, citral, terpineol, borneol). The composition of the oil depends on the origin of the material.

The pungent principles, the gingerols (4-7.5 %) are a homologous series of phenols. The principal one of these is 6-gingerol. Gingerols with other chain-lengths, e.g., 8-gingerol and 10-gingerol, are present in smaller amounts. During drying and storage, gingerols are partly dehydrated to the corresponding shogaols which may undergo further reduction to form paradols, also present in stored ginger.


Zingiberene
ar-Curcumene
β-Sesquiphellandrene


O
OH
H3CO
HO
(CH2)nCH3
Gingerols
[6]-gingerol
[8]-gingerol
[10]-gingerol
n = 4
n = 6
n = 8
O
H3CO
HO
(CH2)nCH3
Shogaols
[6]-shogaol
[8]-shogaol
[10]-shogaol

Medicinal Uses : Traditional ayruvedic medicine

Ginger plays an important role in traditional Indian Ayurvedic medicine. It is also used as an ingredient in traditional Indian drinks. Fresh ginger is one of the main spices used for making dishes, both vegetarian and non vegetarian based foods. Indian traditional medicinal remedies especially for cough and asthma consists of juice of fresh ginger with a little juice of fresh garlic mixed with honey. It is also suggests 1-2 tea spoons of ginger juice with honey is a potent cough suppressant. Besides these ginger is very often used to cure many illness such as indigestion, tastelessness, loss of appetite, flatulence, intestinal, nausea, vomiting, allergic reactions, acute and chronic cough, common cold, fever, allergic rhinitis, sinusitis, acute chronic bronchitis, respiratory troubles, pain, headache, backache or any kind of muscular catch, painful tooth and swelled gum.

Gastrointestinal relief : Modern scientific research has revealed that ginger possesses numerous therapeutic properties including antioxidant effects, an ability to inhibit the formation of inflammatory compounds, and direct antiinflammatory effects. Ginger is very effective in preventing the symptoms of motion sickness, especially seasickness. Ginger reduces all symptoms associated with motion sickness including dizziness, nausea, vomiting, and cold sweating [18]. Some active components of ginger are reported to stimulate digestion, absorption, relieve constipation and flatulence by increasing muscular activity in the digestive tract.

Anti-Inflammatory Effects : Ginger contains potent anti-inflammatory compounds called gingerols. These substances are believed to explain why so many people with osteoarthritis or rheumatoid arthritis experience reductions in their pain levels and improvements in their mobility when they consume ginger regularly. One of the mechanisms by which ginger exerts its ameliorative effects could be related to inhibition of prostaglandin and leukotriene biosynthesis.

Possible Interactions : Ginger may interact with prescription and nonprescription medications. If you take any of the following medications, you should not use ginger without first talking to your health care provider.

Blood-thinning medications -- Ginger may increase the risk of bleeding. Talk to your doctor before taking ginger if you take blood-thinners such as warfarin (Coumadin), clopidogrel (Plavix), or aspirin.

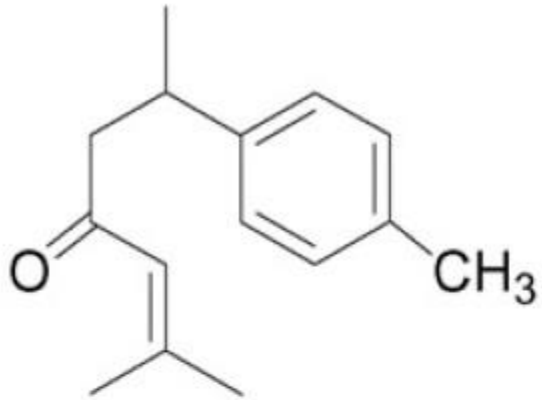
Diabetes medications -- Ginger may lower blood sugar. That can raise the risk of developing hypoglycemia or low blood sugar.

High blood pressure medications -- Ginger may lower blood pressure, raising the risk of low blood pressure or irregular heartbeat.

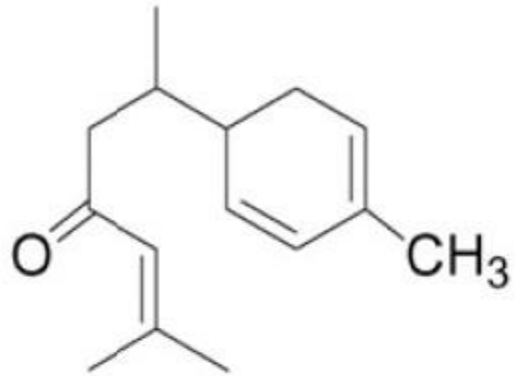
Curcumae rhizoma **turmeric** **zerdeçal**

Curcuma domestica **Zingiberaceae**

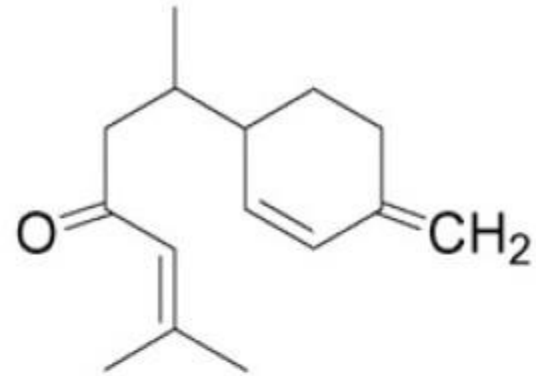
The rhizome of **turmeric** (= **curcuma**) is a main ingredient of **curry** powders, and has been the subject of many studies, mostly be scientists from India who have defined its pharmacological properties. The drug is rich in starch (45-55%), it also contains arabinogalactans (ukonans) and 2.5 to 6% of an essential oil with monocyclyc monoterpenes : hydrocarbons (zingiberene, β- and δ-curcumene) and mostly oxygenated derivatives (turmerone, S-(+)-ar-turmerone, curlone, α- and ϒ-atlantone). Note, in addition, the presence of monoterpenes. Sesquiterpenes (bisabolanes and germacranes) are also found in the oleoresin and the various extracts, which generally contain more ar-turmerone than the essential oil (steam distillation is thought to induce aromatization.



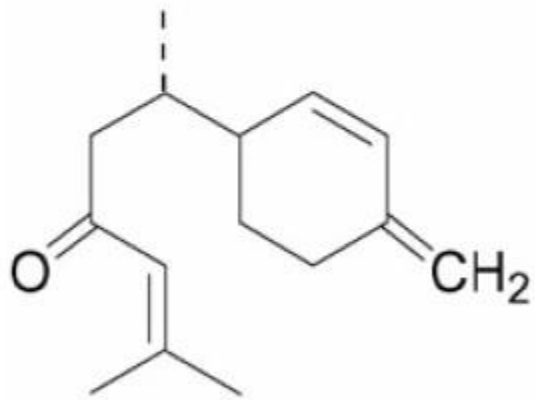
ar-turmerone



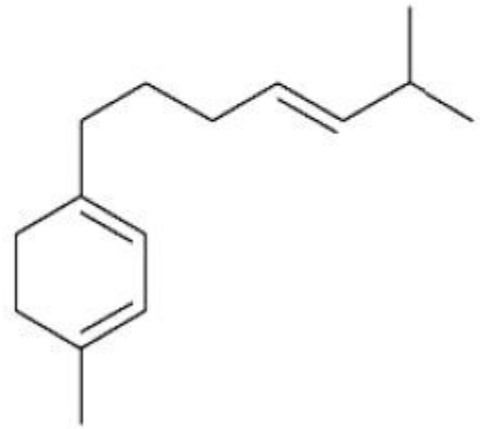
α-turmerone



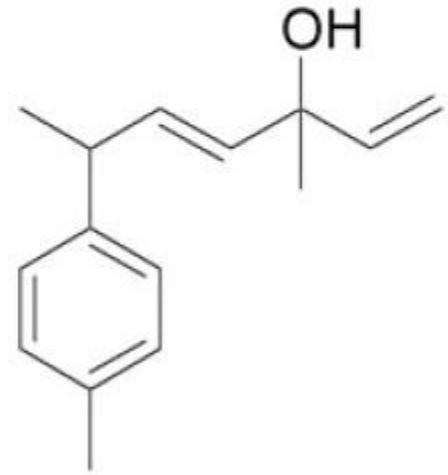
β-turmerone



Curlone

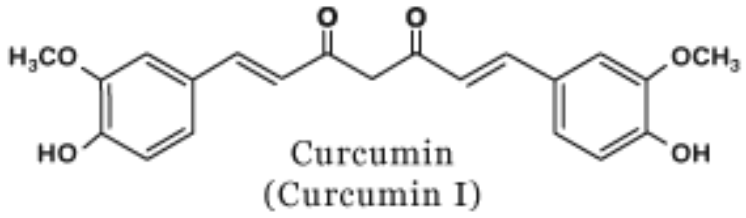


Zingiberene

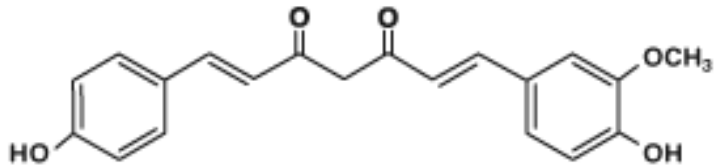


Curcumene

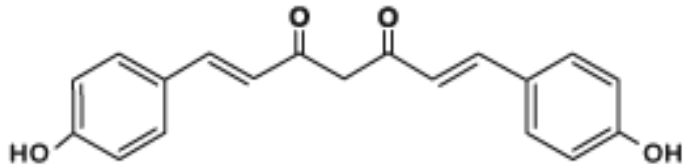
The coloring principles in the drug are **curcuminoids**. These molecules, structurally related to a diarylheptane, occue at a concentration that varies greatly with the cultivar and can reach 8%. The chief component (50-60%) is curcumin, it occurs together with related components.



Curcumin
(Curcumin I)



Demethoxycurcumin
(Curcumin II)



Bis-demethoxy
(Curcumi

Pharmacological Properties : The anti-inflammatory activity of curcumin has been demonstrated on acute inflammation. The drug has a definite action on the hepatic parenchima. Note also some activity on the stomach.

Uses : Pharmacy uses turmeric rhizomes as a constituent of pharmaceuticals with the following indications : traditionally used

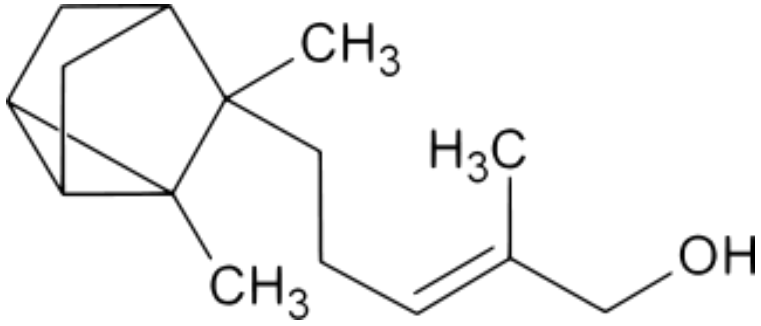
1. as a choleretic and cholagogue, 2. functional dyspepsia attributed to hepatic origin, 3. as an appetite stimulant. The German Commission E mongraph recognizes uses of the same type, but specifies that biliary tract obstruction is a contraindication.

Sandalwood **sandal ağacı odunu** **Santali lignum**

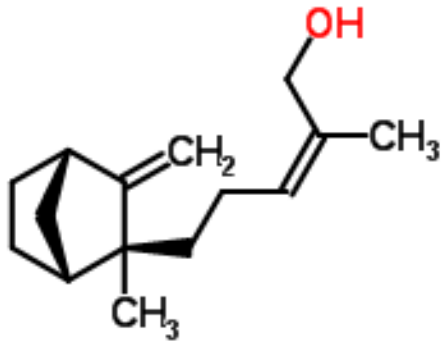
Santalum album **Santalaceae**

Sandalwood oil (Santali aetheroleum) is produced from the wood of several species of closely related trees in the genus *Santalum*. Sandalwood has a long history of use in naturopathic and ayurvedic medicine, as well as in cultural and religious rituals. The wood of the*Santalum species* have a rich and and long-lasting fragrance that has been valued for centuries. Sandalwood trees grow naturally throughout central and southeast Asia, Australia and the Pacific Islands. Harvesting generally involved cutting down the entire tree. The combination of their high-value and slow growth rate has caused Sandalwood trees to become a threatened species in some regions. Therefore, it is important to purchase Sandalwood products that have been produced by sources that utilize sustainable practices.

Sandalwood essential oil is composed largely of two closely related molecules, alpha-santalol and beta-santalol.
These molecules are the source of sandalwood's rich fragrance. Most sandalwood oil is composed at least 80-90% santalol.



α-santalol



β-santalol

Sandalwood essential oil may have antibacterial and/or anti-inflammatory properties that may help improve acne symptoms. Sandalwood is also commonly used in aromatherapy applications.

JUNIPER (ardıç) **JUNIPERI FRUCTUS**

Juniperus communis **Cupressaceae**

The drug contains from 5 to 20 ml/kg of an essential oil. It contains primarily hydrocarbons (pinenes, 10-80%), sabinene, 60%), cadinenes, limonene, camphene, terpin-1-en-4-ol,and myrcene), and also saccharides, flavonoids, flavan-3,4-diols and multiple diterpenes. The oil must be not less than 7.5 ml/kg.

Reputed to be an antiseptic the drug stimulates the excretion of water in animals : the possibility that terpineol is responsible for this action.

Juniper berry and juniper oil are reputed to be toxic; they irritate the renal epithelium and could cause hematuria.For this reason the German Comission E only lists on indication of the drug, namely dyspepsia; pregnanace and kidney inflammation (nephritis, pyelitis) constitute contraindications and package inserts must warn that prolonged used can cause side effects (dysuriai albuminuria, kidney pain).

Reference Books :

Main Book

Bruneton, J., Pharmacognosy, Phytochemistry, Medicinal Plants, TEC & DOC Editions, Paris 1999

Other Books

- Hänsel, R., Sticher, O., Pharmakognosie – Phytopaharmazie, Springer Medizin Verlag, Heidelberg 2010
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