Terpenoids 2

Medicinal plants and raw materials containing acyclic monoterpenes

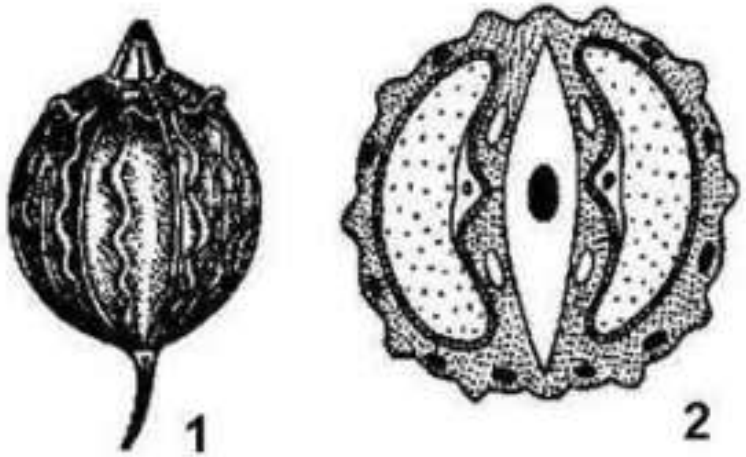
Coriander fruit – ***CORIANDRI FRUCTUS***
Coriander - ***Coriandrum sativum L.***
Family Apiaceae (Umbelliferae)

Coriander is native to regions spanning from Southern Europe and Northern Africa to Southwestern Asia.
It is a soft plant growing to 50 cm (20 in) tall. The leaves are variable in shape, broadly lobe at the base of the plant, and slender and feathery higher on the flowering stems.
The flowers are borne in small umbels, white or very pale pink, asymmetrical, with the petals pointing away from the center of the umbel longer (5–6 mm) than those pointing toward it (only 1–3 mm in long). The fruit is a globular, dry schizocarp 3–5 mm in diameter

Flowers of *Coriandrum sativum*

Area of distribution. Originally from the eastern Mediterranean region, it is cultivated worldwide.

Description. The drug consists of the dried, ripe, more or less spherical (diameter 3–5 mm) fruits (cremocarps or double achenes), which have mostly not split into the mericarps. The ridges first become visible on drying: 10 wavy, inconspicuous primary ridges and 8 straight, more conspicuous secondary, ridges. The odour is spicy and aromatic; the taste is spicy and characteristic.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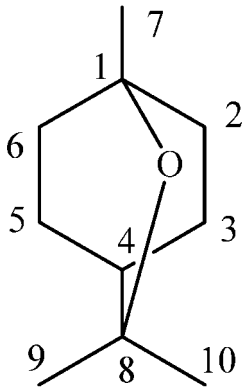
Constituents. Up to 1% essential oil with 60–70% linalool, 20% monoterpene hydrocarbons (pinene, limonene, γ-terpinene,



1,8-Cineole (**1**)

p-cymene, etc.); camphor (3–6%); geraniol and geranyl acetate (1–3%). Responsible for the fetid smell of the unripe fruit and of the herb are aldehydes (0.07–0.4%). Other constituents of the drug are fatty oil (about 20%), as well as proteins (about 15%), carbohydrates and small amounts of flavonoids, furocoumarins, caffeic acid derivatives (particulary chlorogenic acid) and triterpenes.

Uses. Because of the essential oil, as a stomachic, [illegible] spasmolytic, and carminative, which also has bactericidal and fungicidal properties; also for sub-acid gastritis, diarrhoea, and dyspepsia of various origins. Coriander is employed more especially as a spice, e.g. in bread, in order to make it more wholesome when fresh, in certain kinds of curry powders, and in gingerbread, and as an ingredient in liqueurs, e.g. Danziger.

Contraindications. Unknown.

Drug interactions. Unknown.

Side effects. Powdered coriander, and more particularly the oil, is known to give rise to allergic reactions. 5- and 8-methoxypsoralen and imperatorin and other photoactive compounds are present in various parts of the plant, including the fruit.

Drug: As a component of carminative and laxative remedies, in the form of alcoholic distillates and drops, often in combination with other essential-oil drugs, such as anise, caraway, and fennel. It is a component of Carminativum Babynos®. Coriander essential oil is a component of Gastricard ® N drops and of ointments.

Medicinal plants and raw materials containing monocyclic monoterpenes

PEPPERMINT LEAVES - FOLIA MENTHAE PIPERITAE
OLEUM MENTHAE PIPERITAE
Peppermint - Mentha piperita L.
Family Lamiaceae

Peppermint was first described in 1753 by Carl Linnaeus from specimens that had been collected in England; he treated it as a species, but it is now universally agreed to be a hybrid. It is a herbaceous, rhizomatous, perennial plant that grows to be 30–90 cm (12–35 in) tall, with smooth stems, square in cross section. The rhizomes are wide-spreading and fleshy, and bear fibrous roots. The leaves can be 4–9 cm long and 1.5–4 cm broad. They are dark green with reddish veins, with an acute apex and coarsely toothed margins. The leaves and stems are usually slightly fuzzy.

The flowers are purple, 6–8 mm long, with a four-lobed corolla about 5 mm diameter; they are produced in whorls (verticillasters) around the stem, forming thick, blunt spikes.

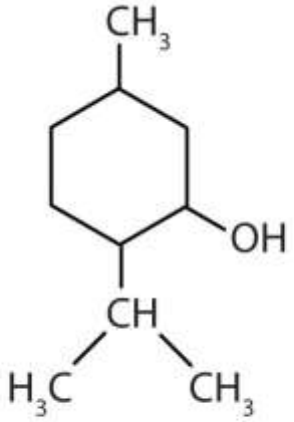
Flowering season lasts from mid- to late summer. The chromosome number is variable, with 2n counts of 66, 72, 84, and 120 recorded. Peppermint is a fast-growing plant; once it sprouts, it spreads very quickly.

Peppermint flowers

Area of distribution. Entirely from cultivation (for genetic reasons, only through vegetative multiplication by means of runners (stolons)). Nowadays, exports come mainly from Bulgaria, Greece, Spain, and a few other Balkan countries; a small amount of the drug is produced in southern Germany. Northern Europe and the USA also export the leaf.

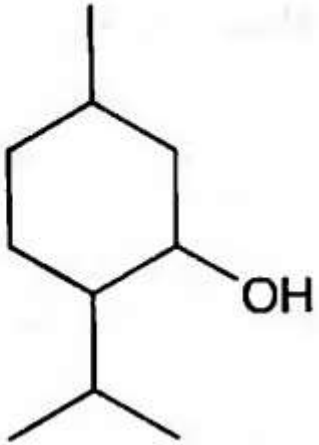
Description. The drug consists of the whole or cut, ovate to lanceolate leaves, which are thin and brittle, 3–9 cm long, with a pinnate and often violet tinged venation and a sharply serrate margin. When examining with a magnifying glass the glands can be recognized as yellow dots.

Constituents. 0.5–4% essential oil (menthol and menthol esters (especially the acetate and isovalerianate), menthone, menthofurane and other monoterpenes and small amounts of sesquiterpenes, 3.4–4.5% lamiaceae-tannins, rosmarinic acids and others, caffeic acid derivatives are also present. Flavonoid content varies considerably (sometimes up to 17%). Triterpenes have also been detected. The yield of oil depends on the age of the plants.



Menthol

Uses. It is used as a spasmolytic carminative, and cholagogue when mixed with other herbal drugs, also as a sedative. The action is mainly, but not entirely, due to the content of the essential oil, the direct action of which on organs with the smooth-muscle tissue causes a stronger spasmolysis than some of its individual components. Peppermint tea brings about a considerable increase in the production of bile, the effect is due to the essential oil, but presumably the flavonoids also play a part.



mentol

Peppermint tea is indicated in acute and chronic gastritis and enteritis, in colicky disorders of the gastrointestinal tract, and in flatulence, as well as in chronic cholecystopathies. It is used as a sedative. It is free from of harmful side effects on prolonged use provided that it is not used to excess. Drugs are Corvaldin, Corvalol, Validol, Valokormid, Zelenin's drops — spasmolytic, hypotensive, sedative, analgesic; Ingalipt, Cameton, Camphomen — anti-inflammatory, antiseptic; Mint tablets — anti-nausea; liniment Bom-benge, Boromentol, Gevcamen, Menovazin, — analgesic, anti-inflammatory.

SAGE LEAVES - FOLIA SALVIAE
Common Sage - Salvia officinalis L.
Family Lamiaceae

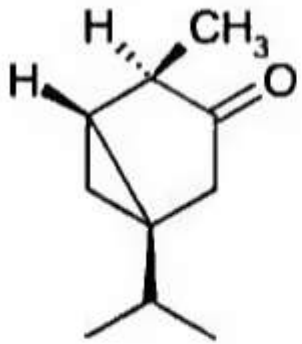
Sage, is a perennial, evergreen subshrub, with woody stems, grayish leaves, and blue to purplish flowers. It is a member of the mint family Lamiaceae and native to the Mediterranean region, though it has been naturalized in many places throughout the world. It has a long history of medicinal and culinary use, and in modern times it has been used as an ornamental garden plant. The common name "sage" is also used for closely related species and cultivars.

Cultivars are quite variable in size, leaf and flower color, and foliage pattern, with many variegated leaf types. The Old World type grows to approximately 60 cm tall and wide, with lavender flowers most common, though they can also be white, pink, or purple. The plant flowers in late spring or summer. The leaves are oblong, ranging in size up to 65 mm long by 25 mm (1 in) wide. Leaves are grey-green, rugose on the upper side, and nearly white underneath due to the many short soft hairs. Modern cultivars include leaves with purple, rose, cream, and yellow in many variegated combinations

Area of distribution. Native in the Mediterranean region, especially in the Adriatic; cultivated to some extent in various European countries. Imports of the drug come from Albania and former Yugoslavia.

Description. The petiolate 3–10 cm long and up to 3 cm wide, oval, oblong-ovate, to lanceolate leaves are densely pubescent on both surfaces; they have a distinctly crenulate margin and deeply depressed venation, which is very prominent on the lower surface, and a lamina, which is rounded and sometimes singly or doubly auriculate at the base. The odour is intensely spicy and aromatic; the taste is spicy, bitter, and astringent.

Constituents. The characteristic components of sage, to which its traditional uses can be attributed, are the volatile oil and tannins. It contains 1–2.8% of volatile oil (α- and β-thujones, 1,8-cineole, borneol, camphor, caryophyllene, linalyl acetate and various terpenes). Others include phenolic — caffeic, chlorogenic, ellagic, ferulic, gallic and rosmarinic acids; flavonoids; diterpenes, including carnosic acid and derivatives; triterpenes: oleanolic acid and derivatives and hydrolysable and condensed tannins 3–8%.



alpha-Thujone
((-)-thujone)

1,8-Cineole

Uses. Sage is stated to possess carminative, antispasmodic, antiseptic, astringent and antihidrotic properties. Traditionally, it has been used to treat flatulent dyspepsia, pharyngitis, uvulitis, stomatitis, gingivitis, glossitis (internally or as a gargle/mouthwash), hyperhidrosis, and galactorrhoea. The drug is Salvin.

Contraindications. Sage oil is reported to be a moderate skin irritant and is not recommended for use in aromatherapy.

EUCALIPTUS LEAVES - EUCALYPTI FOLIA
Eucalyptus globulus Labill.
Eucalyptus cinerea F. Muell ex Benth.

EUCALYPTI VIMINALIS FOLIA
Eucalyptus viminalis Labill.

Family Myrtaceae

Eucalyptus is a genus of over seven hundred species of flowering trees, shrubs or mallees in the myrtle family, Myrtaceae. Along with several other genera in the tribe Eucalypteae, including *Corymbia*, they are commonly known as eucalypts.[3] Plants in the genus *Eucalyptus* have bark that is either smooth, fibrous, hard or stringy, leaves with oil glands,
and sepals and petals that are fused to form a "cap" or operculum over the stamens. The fruit is a woody capsule commonly referred to as a "gumnut".

Most species of *Eucalyptus* are native to Australia, and every state and territory has representative species. About three-quarters of Australian forests are eucalypt forests. Wildfire is a feature of the Australian landscape and many eucalypt species are adapted to fire, and resprout after fire or have seeds which survive fire.

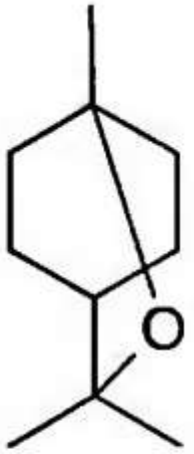
A few species are native to islands north of Australia and a smaller number are only found outside the continent. Eucalypts have been grown in plantations in many other countries because they are fast growing and have valuable timber, or can be used for pulpwood, for honey production
or essential oils.

Plant. A large tree with a smooth bark, very pale or ash-grey, up to 3–20 m high. Branchlets are quadrangular, glaucous. Leaves of young trees and first leaves of young shoots are opposite, sessile, oval-oblong, with a cordate base, farinaceous-glaucous; older leaves are dangling, spirally arranged, lanceolate-falcate, up to 30 cm long. Flowers are with very short pedicels, mostly umbellate, sometimes 2–3 in a fascicle. The calyx tube is double: outer tube drops early, smooth; inner tube is semipersistent and warty. Stamens are about 1.5 cm long. The fruit is turbinate, angular, 2.0–2.5 cm in diameter.

Area of distribution. Indigenous to Australia, cultivated in subtropical regions of the world, including Africa, South America (e.g. Argentina, Brazil and Paraguay), Asia (e.g. China, India and Indonesia), southern Europe and the United States of America.

Description. The leaf is lanceolate-falcate, bifacial, 8–30 cm long, 2–7 cm wide; the petiole is twisted, strongly wrinkled, 2–3 cm, occasionally 5 cm, in length; apex, when present, is acute or acuminate; base is unequal, obtuse or somewhat rounded, margin is uneven, revolute; ventral and dorsal surfaces are greyish-green to pale yellowish-green, coriaceous, glaucous, glabrous, glandular-punctate, with numerous small, rounded, brown dots of cork; venation is pinnate-reticulate, veins of the first order are running to a short distance from margin where they are anastomosed and form a vein nearly parallel with the margin.

Constituents. Dried leaves contain 1–3% (v/w) essential oil (fresh leaves contain 0.4–1.6%), the major constituent of which is 1,8-cineole (54–95%). In addition, there are moderate amounts of other monoterpenes, including β-pinene (2.6%), *p*-cymene (2.7%), aromadendrene, cuminaldehyde, globulol and pinocarveol. Gas chromatography and gas chromatography-mass spectroscopy of the oil indicated the presence of more than 70 components, 48 of which were identified. The concentration of α-terpineol was estimated to be 28%. The leaves are rich in tannins and ellagitannins, and also contain 2–4% triterpenes (ursolic acid derivatives), a series of phloroglucinol-sesquiterpene-coupled derivatives (macrocarpals B, C, D, E, H, I and J) and flavonoids (rutin, quercetin, quercitrin and hyperoside).



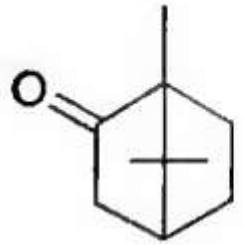
1,8-Cineole (eucalyptol)

Uses. As an expectorant for symptomatic treatment of mild inflammation of the respiratory tract and bronchitis. Also for symptomatic treatment of asthma, fever and inflammation of the throat. Treatment of cystitis, diabetes, gastritis, kidney disease (unspecified), laryngitis, leukorrhoea, malaria, pimples, ringworm, wounds, ulcers of the skin, urethritis and vaginitis. Drugs are Volatile oil — bactericidal; infusion, tincture, Ephcamon, Gevcamen, Alorom, Cameton, Ingalipt, Pektussin, tea Elecosol — bactericidal, anti-inflammatory, astringent; Chlorophyllipt — antistaphylococcal.

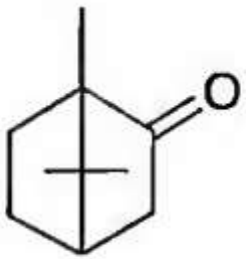
Medicinal plants and raw materials containing bicyclic monoterpenes

CAMPHOR is a ketone obtained from *Cinnamomum camphora* (natural camphor).

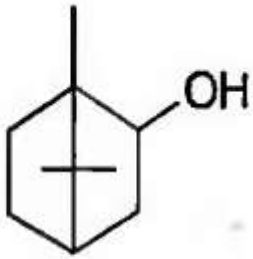
Natural camphor occurs as a crystalline product in clefts in the woody stems and roots and, to a greater extent, dissolved in the volatile oil. The wood is chipped and distilled with steam, and 1 lb (453.6 g) of crude camphor is obtained from 9 to 18 kg of chips. The crude camphor is then freed of oil by centrifugation and pressing and finally re-sublimed and pressed into the familiar cakes.



(+)-Camphor

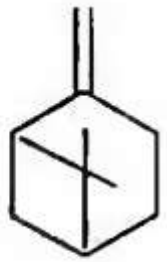


(-)-Camphor



Borneol

α-Pinene



β-Pinene

Camphor is a strong-smelling white substance used in various medicines, prepared from the wood by distillation in steam. The specific rotation of natural camphor is between +41° and +43°.

Semisynthetic camphor ((-)-isomer) is made from borneol obtained from fir tree.

Synthetic camphor is made from pinene, the principal constituent of turpentine oil. Synthetic camphor is the optically inactive racemic form.

A number of complex methods have been used for producing synthetic camphor, but all are based on (1) converting pinene into bornyl esters, which are (2) hydrolysed to isoborneol, and (3) finally oxidised to camphor.

Uses. Camphor (natural camphor only) oil solution for injection as analeptic, semi-synthetic and synthetic camphor is a topical antipruritic, rubefacient, and anti-infective used at 1 to 3% in medicines applied on the skin.

CAMPHOR TREE WOOD — *CINNAMOMI LIGNUM*

Camphor tree — *Cinnamomum camphora* (L.) J. Presl, Fam. *Lauraceae.*

The plant is a large evergreen tree indigenous to eastern Asia, but naturalized in the Mediterranean region, Sri Lanka, Egypt, South Africa, Brazil, Jamaica, Florida, and California. From 1900 until World War II about 80% of the world's supply of natural camphor (about 4 million kg per year) was produced in Taiwan where the tree occurs naturally in abundance and is also extensively cultivated.

Camphor tree contains volatile chemical compounds in all plant parts, and the wood and leaves are steam distilled for the essential oils.

COMMON JUNIPER FRUITS – JUNIPERI COMMUNIS FRUCTUS
Common juniper - Juniperus communis L.
Family Cupressaceae

Common juniper, is a species of small tree or shrub in the cypress family Cupressaceae. An evergreen conifer, it has the largest geographical range of any woody plant, with a circumpolar distribution throughout the cool temperate Northern Hemisphere.

Juniperus communis is very variable in form, ranging from 10 metres —rarely 16 m —tall to a low, often prostrate spreading shrub in exposed locations. It has needle-like leaves in whorls of three; the leaves are green, with a single white stomatal band on the inner surface. It never attains the scale-like adult foliage of other members of the genus. It is dioecious, with male and female cones (both of which are wind pollinated) on separate plants.

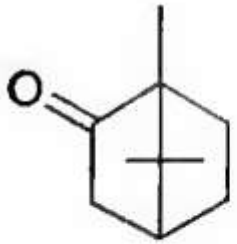
The male cones are yellow, 2–3 millimetres long, and fall soon after shedding their pollen in March–April. The fruit are berry-like cones known as juniper berries. They are initially green, ripening in 18 months to purple-black with a blue waxy coating; they are spherical, 4–12 mm diameter, and usually have three (occasionally six) fleshy fused scales, each scale with a single seed. The seeds are dispersed when birds eat the cones, digesting the fleshy scales and passing the hard, unwinged seeds in their droppings.

Area of distribution. In dry woods of Europe, United States and Canada, Asia and Northern Africa.

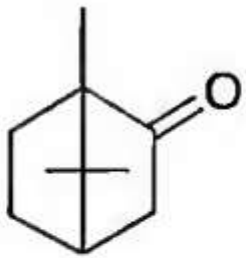
Juniperus sabina L.

Description. Subglobular berry, 5 to 10 mm in diameter, externally smooth, shining, purplish black to red purple, occasionally reddish brown or sometimes, usually covered with a blue-grey bloom; at the summit a 3-rayed furrow marks the cohesion of the three fleshy bracts forming the pericarp; internally exhibiting a yellowish brown to dusky yellow flesh containing many large schizogenous cavities; seeds are usually 3, triangular ovate, hard, brown, on the surface of which are large uneven oil glands; the odour is aromatic upon crushing; the taste is sweet, pleasant, terebirithinate, slightly bitter.

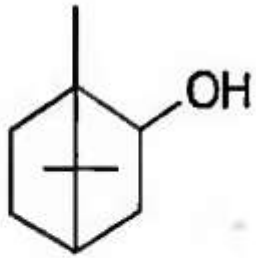
Constituents. From 0.3 to 1.5% of a volatile oil contain the terpenes camphene and α-pinene, β-pinene, sabinene, a sesquiterpene called cadinene; terpene alcohols borneol, terpineol; limonene, resin, fixed oil, up to 30% of dextrose, etc. A crystalline substance deposits in the oil at low temperatures known as juniper camphor. Juniper yields not less than 0.5 ml of the volatile juniper oil from each 100 g of drug.



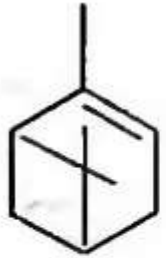
(+)-Camphor



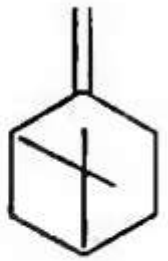
(-)-Camphor



Borneol



α-Pinene



β-Pinene

Uses. Juniper is stated to possess diuretic, antiseptic, carminative, stomachic and antirheumatic properties. Traditionally, it has been used for cystitis, flatulence, colic, and applied topically for rheumatic pains in joints or muscles. The diuretic activity of juniper has been attributed to the volatile oil component, terpinen-4-ol, which is reported to increase the glomerular filtration rate. Terpenin-4-ol is no longer thought to be irritant to the kidneys.

VALERIAN RHIZOMES WITH ROOTS –
VALERIANAE OFFICINALIS RHIZOMATA CUM RADICIBUS
Valerian - Valeriana officinalis L.
Family Valerianaceae

Valerian (*Valeriana officinalis*) is a perennial flowering plant native to Europe and Asia.

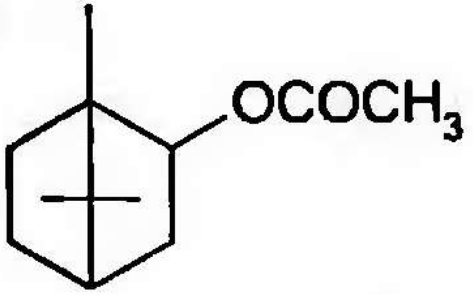
Plant. A tall perennial herb, which underground portion consists of a vertical rhizome bearing numerous rootlets and one or more stolons. The aerial portion consists of a cylindrical hollow, channelled stem attaining 2 m in height, branched in the terminal region, bearing opposite exstipulate, pinnatisect, cauline leaves with clasping petioles. The inflorescence consists of racemes of cymes, which flowers are small, white, or pink. The fruits are oblong-ovate, 4-ridged, single-seeded achenes.

Area of distribution. *Valeriana officinalis* is an extremely polymorphous complex of subspecies with natural populations dispersed throughout temperate and sub-polar Eurasian zones. The species is common in damp woods, ditches, and along streams in Europe, and is cultivated as a medicinal plant, especially in Belgium, England, eastern Europe, France, Germany, the Netherlands, Russia.

Description. Rhizome is erect, entire or usually cut into 2–4 longitudinal pieces, 2–5 cm long, 1–3 cm thick; externally dark brown, sometimes crowned by the remains of stem bases and scale leaves, and bears occasional, short, horizontal branches (stolons), and numerous rootlets; fracture is short and horny. Internally, whitish, with an irregular outline, occasionally hollow and exhibiting a comparatively narrow ark traversed, here and there, by root-traces, and separated by a dark line, the cambium, from a ring, small xylem bundles surrounding a central pith. Roots are numerous, slender, cylindrical, usually plump; 2–12 cm, but mostly 8–10 cm long, 0.5–2 mm in diameter; externally, greyish brown to brownish yellow, longitudinally striated, with fibrous lateral rootlets; brittle; internally, showing a wide bark and a narrow central stele. The odour, is characteristic, penetrating valeric acid-like, becoming stronger on aging; the taste is sweetish initially, becoming camphoraceous and somewhat bitter. The rhizomes, roots, and stolons are carefully dried at the temperature below 40 °C.

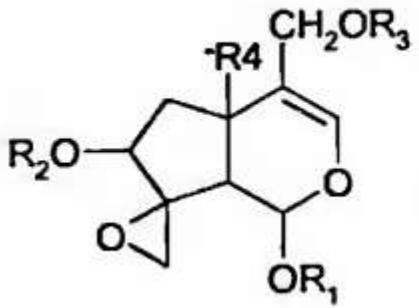
Constituents. The chemical composition of *Radix Valerianae* varies greatly depending on the subspecies, variety, age of the plant, growing conditions, and type and age of the extract. The volatile oil (ranges 0.2–2.8%) contains bornyl acetate and bornyl isovalerate as the principal components.

Other significant constituents include β-caryophyllene, valeranone, valerenal, valerenic acid, and other sesquiterpenoids and monoterpenes.

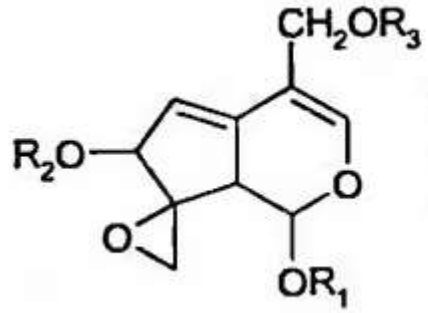


Bornyl acetate

The second important group of constituents (0.05–0.67% range) is a series of non-glycosidic bicydic iridoid monoterpene epoxy-esters known as the valepotriates. The major valepotriates are valtrate and isovaltrate (which usually represent more than 90% of the valepotriate content). Smaller amounts of dihydrovaltrate, isovaleroxy-hydroxydihydrovaltrate, 1-acevaltrate or others are present. The valepotriates are rather unstable owing to their epoxide structure, and losses occur fairly rapidly on storage or processing,



R_1=isovaleryl, R_2=acetyl, R_3=isovaleryl, R_4= H, didrovaltrate
R_1=isovaleryl, R_2=acetyl, R_3=2-(isovaleryl-oxy)-isovaleryl, R_4=OH, isovaleryloxyhydroxydidrovaltrate
Isovaleryl = $(CH_3)_2CH=CH_2CO$-)



R_1=isovaleryl, R_2=isovaleryl, R_3=acetyl, valtrate
R_1=isovaleryl, R_2=acetyl, R_3=isovaleryl, isovaltrate
R_1=isovaleryl, R_2=*beta*-acetoxyvaleryl, R_3=acetyl, acevaltrate

Uses. Sedative and hypnotic properties have been described for certain valerian rhizome/root preparations following preclinical and clinical studies. However, the available scientific evidence is strong; also it remains unclear precisely which of the constituents of valerian are responsible for the sedative and hypnotic properties observed. Attention had focused on the volatile oil, and then the valepotriates and their degradation products as the constituents, respectively. However, it appeared that the effects of the volatile oil could not account for the whole action of the drug, and the valepotriates, which degrade rapidly, are unlikely to be present in finished products in significant concentrations. Current thinking is that the overall effect of valerian is due to several different groups of constituents and their varying mechanisms of action. Therefore, the activity of different valerian medicines will depend on their content and concentrations of several types of constituents. One mechanism of action is likely to involve increased concentrations of the inhibitory transmitter GABA in the brain. Increased concentrations

of GABA are associated with a decrease in the CNS activity and this action may, therefore, be involved in the reported sedative activity. Valerian is stated to possess sedative, mild anodyne, hypnotic, antispasmodic, carminative and hypotensive properties. Traditionally, it has been used for hysterical states, excitability, insomnia, hypochondriasis, migraine, cramp, intestinal colic, rheumatic pains, dysmenorrhoea, and specifically for conditions presenting nervous excitability. Modern interest in valerian is focused on its use as a sedative and hypnotic. A Community Herbal Monograph adopted by the European Medicines Agency's Committee on Herbal Medicinal Products states the following therapeutic indications for valerian root: traditional use, for support of mental relaxation and to aid natural sleep; well-established use, for the relief of mild nervous tension and difficulty in falling asleep. Drugs are Infusion, liquid extract, extract in tablets, tincture, Cardiophyt, Valocormid, Cardiovalen, Doppelherz Vitalotonik; Herbion Drops for the Heart; Persen; Sanason.


Thank you
for your attention