Substances affecting water balance of organism

Water represents 50-70 % of body weight

Composition of liquids is regulated by intake and excretion of water and electrolytes, and by their compartmentalization between parts of organism

Disturbance:

- Accumulation of water and electrolytes → edem → hypertension → diuretics
- Excessive urine excretion – diabetes insipidus (insufficient secretion of vasopresin) → desmopresin
- Diseases from cold – hot infusions from dugs with perspiratory effect

Substances affecting water balance of organism

1. Diuretics:
   - Drugs containing essential oils
   - Purine bases
   - Cardioactive glycosides
   - Flavonoids
   - Saponins
   - Cyclitols

2. Limiting of excessive urine excretion
   - ADH arginin-vasopresin
   - Synthetic desmopresin

3. Diaphoretics – sweat-supporting preparations

pilokarpin

Tiliae flos, Verbasci flos, Sambuci flos, Violae tricoloris flos

Diuretics

According to the mechanism of effect and origin of active substances:
1. Osmotic
2. Xanthine derivatives
3. Plant
4. Synthetic

Mechanis of effect:
1. Interaction with specific memebrane proteins
2. Osmotic action (prevent water resorption in nephron)
3. Effect on hormonal receptors in kidney epithelium

OSMOTIC DIURETICS

MANNITOLUM – Mannitol (ČL 2005)

One of the mostly occurred hexitols in nature

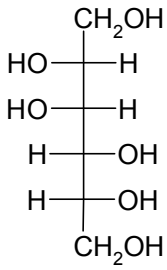
In organism is not metabolized and its non-toxic

Usage:

- To trigger forced diuresis during beginning of oliguria
- In neurosurgery as prevention of formation of brain edema
- Edemas refractory on other diuretics, for example of liver origin

Application form: infusion of 20-40 % solution

Contraindication: cardiac decompensation



D-mannitol
(alditol, polyhydroxyalkane)

MANNA

Fraxinus ornus L., manna ash (Oleaceae)
Mediterranean, south Italy

Manna – dried juice obtained by cutting of stem bark of trees.

White or yellow, rounded pieces.
Easily soluble in water, sweet taste

Contains mannitol, glucose, fructose, traces of resin

Usage:
- Material for isolation of mannitol
- Mild laxans in pediatrics

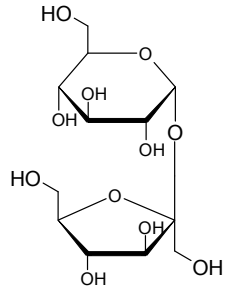
SACCHAROSUM – Sucrose (ČL 2005)

Sources:
- *Beta vulgaris* L., sugar beet (Chenopodiaceae)
- *Saccharum officinarum*, sugar cane (Poaceae)
- *Acer saccharophorum*, sugar mapple (Aceraceae)

During parenteral application is not metabolised and is not resorbed in tubules

Prevents formation of brain edem, lowers intracerebral pressure

Today used less than mannitol



β-D-fruktofuranosyl-α-D-glucopyranoside

Saccharosum – sucrose
Beta vulgaris Chenopodiaceae

Acer saccharoforum

Aceraceae

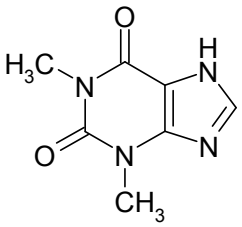
Saccharum officinarum
Poaceae

Mannitol
manna
Fraxinus ornus – manna ash
(Oleaceae)





Theophyllin



- **Pharmacology:**
  - Releases spasm of smooth muscles of bronchi and veins and this triggers relaxation.
  - Supports respiratory centre and therefore increases contractility of respiratory muscles.
  - Increases heart rate and contractility of myocardium
  - Increasing HCL production in stomach.
  - Weakly stimulates CNS.
- **Usage:**
  - Prevention and a treatment of acute respiratory distress caused by bronchoconstriction during *astma bronchiale* and chronic obstruction pulmonary disease at adult and children.
  - Diuretic
- **Mechanism of effect**
  - Competitive inhibition of adenosine receptors in CNS (stimulation of CNS, tachycardia, vasoconstriction of brain blood vessels, diuresis)
  - Inhibition of phosphodiesterase – accumulation of intracelular cAMP. Increased cAMP level causes lowering of smooth muscle tonus, increase of heart muscle contractility, increases glycogenolysis and lipolysis.
  - Inhibition of resorption Ca^{2+} in sarcoplasmatic reticule of muscular cells – increase of contractility at myocardium and skeletar muscles.
  - Competitive inhibition of benzodiazepine receptors in CNS and inhibition of reabsorption Na^{+} and Cl^{-} in proximal tubules of kidneys – increased diuresis.

PETROSELINI RADIX – parsley root (ČL 97)

Petroselinum crispum, parsley (Apiaceae). Mediterranean.

Biennial plant with spinle-shaped root. Fruit is diachene. For pharmaceutical purposes it is cultivated.

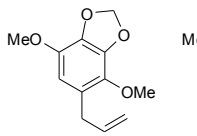
Drug: dried, spindle-shaped, across ringed root with characteristic aromatic odor.

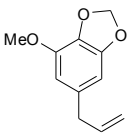
CC: 0,1-0,3 % of essential oil containing derivatives of phenylpropane (apiol, myristicine), terpens (cymol, phelandrene, pinene), flavonoid glycoside apiine and furanocoumarins (isoimperatorin, bergapten), polyines

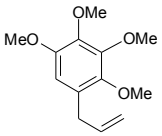
Usage: diuretic (maceration of 1 g), stomachic, carminative

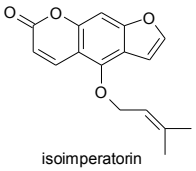
Cultivars with prevalent myristicine unacceptable

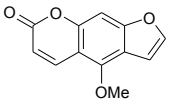
Myristicine increases the tonus of uterus (abortive). It increases also the blood perfusion of pelvic area (aphrodisiac).

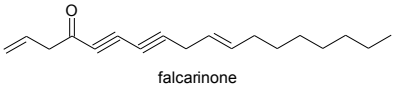

apiol

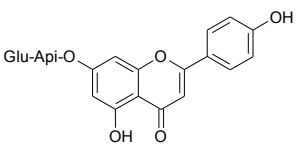

myristicine


1-allyl-2,3,4,5-tetramethoxybenzen


isoimperatorin


bergapten


falcarinone


Apiine


α-pinene

Apiol
- Irritation of kidney parenchyma - diuretic

Myristicine
- *Myristica fragrans* Myristicaceae
- Abortive, aphrodisiac
- Hyperaemia of pelvic area
- Increase of tonus and contraction of uterus

Furanocoumarins:
- Phototoxicity

Polyynes:
- Antibacterial
- Antiseptic

Flavonoids and monoterpenes:
- Diuretic

LEVISTICI RADIX – Libečkový kořen (ČL 2005)

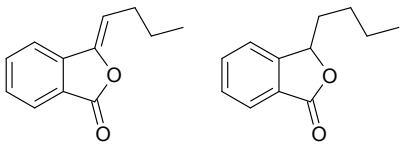
Levisticum officinale – lovage
(Apiaceae). Perennial plant with thick branched rhisome and long roots. For pharmaceutical purposes it is cultivated.

Drug: whole or cut dried rhisome and roots with yellow-brown color and spicy aromatic odor.

CC: at least 3,0 ml of essential oil/kg of cut drug
Composition: up to 70 % of phtalic acid lactones, furocoumarins, polyynes, sugars, starch

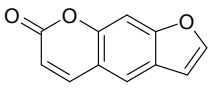
Usage: 2,0 g maceration → diuretic

Drug and essential oil: spicy concentrates (Vegeta), Liquors manufacturing.
Essential oil with insect repelling effect.

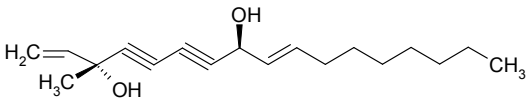


ligustilide

n-butylphtalide



psoralen



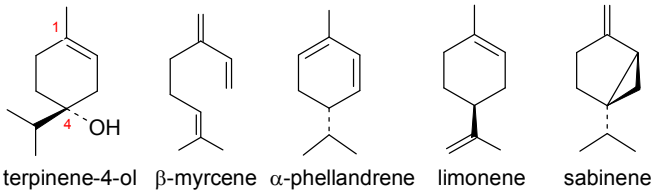
falcarindiol

Juniperi fructus
Juniperi lignum
Juniperus communis, juniper, Cupressaceae

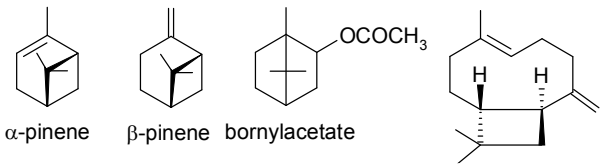
- Evergreen tree or shrub
- Mild strip of northern hemisphere
- CC:
  - 1-2% of essential oil (70 % of terpenes)
  - tannins
  - flavonoids
- Usage:
  - diuretic
  - antiseptic
  - digestive
  - liquors manufacturing

  Not suitable for long term usage, contraindaction in pregnancy

JUNIPERI ETHEROLEUM – juniperus essential oil (ČL 2005)



terpinene-4-ol β-myrcene α-phellandrene limonene sabinene



α-pinene β-pinene bornylacetate β-caryophylene

Usage of essential oil:

after separation of pinenes - diuretic

after separation of terpinene-4-olu - liquors manufacturing

externally - derivans

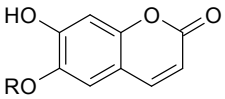
FRAXINI FOLIUM – common ash leaves (ČL 2005)

Fraxinus excelsior – common ash, *F. oxyphylla,* (Oleaceae). Shrubs or trees with egg-shaped, opposite, deciduous leaves. Flowers in panicles. Often cultivated.

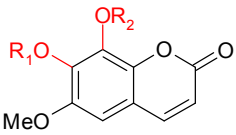
Drug: Dried leaves.

CC: Coumarine derivatives, hydroxyderivatives of cinnamic acid

Usage: 2,0 g maceration → diuretic, digestive, antiphlogistic



aesculine R = H
aesculetine R = Glc



fraxetine $R_1 = R_2 = H$
fraxine $R_1 = H$, $R_2 = Glc$
fraxidine $R_1 = CH_3$, $R_2 = H$

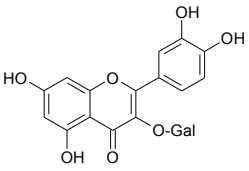
BETULAE FOLIUM – birch tree leaves (ČL 2005)

Betula pendula – silver birch,
B. pubescens – downy birch, white birch (Betulaceae).
Monoecious tree with pendant branches. Bark of older trees is silver-grey and smooth. For pharmaceutical purposes it is cultivated.

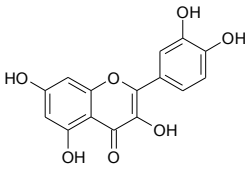
Drug: Whole dried leaves or their pieces. Leaf is stalked, sharply serrated, *ingerrimus* close to stalk.

CC: At least 1,5 % of flavonoids expressed as hyperoside. Phenolic acids, triterpenic acids, triterpenes, resins.

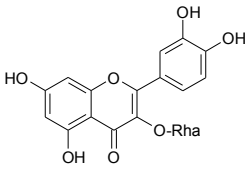
Usage: 1,5 g maceration → diuretic, saluretic (during urolithiasis); externally healing baths, washing of skin defects.



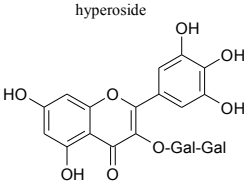
hyperoside



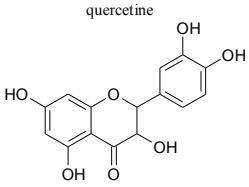
quercetine



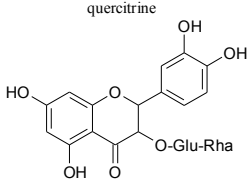
quercitrine



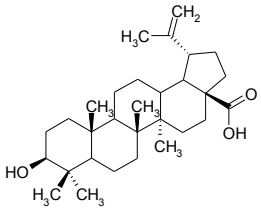
myricetine-3-*O*-digalactoside



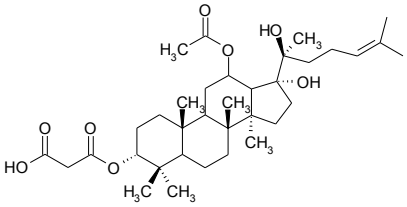
tetrahydroxyflavanonol



rutine



Betulinic acid (saponin of lupane type)
cytotoxic and antiviral activity



saponin of dammarane type

Further *Betula* species preparations

Betulae gemmae – leaf buds
diuretic, choleretic, desinficiens

Betulae pix – birch tar
Dry distillation of bark, dermatologic

Betulae sucus – birch sap
In spring stems are drilled into depth of 2 to 4 cm, hair tonic

ONONIDIS RADIX – restharrow root (ČL 2005)

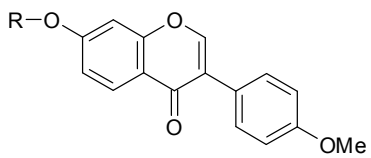
Ononis spinosa – spiny restharrow, *O. arvensis* (Fabaceae). Semi-shrub with lignifying rhisome and long roots. Aerial part with thorny projections. Dor pharmaceutical purposes it is cultivated.

Drug:
Whole or cut dried root, harvested in autumn. Very tought.

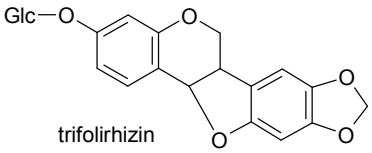
CC: isoflavonoids, triterpenes, essential oil (*trans*-anethol, carvone)

Usage: 1,5 g maceration → diuretic, antiphflogistic during urinary vesiculitis;
Do not use long-termed – estrogenic effect of isoflavonoids.

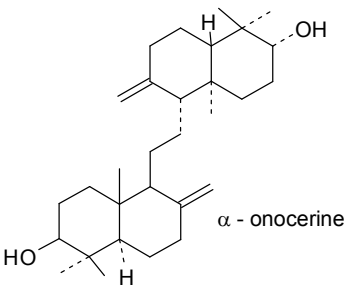
ONONIDIS RADIX – restharrow root (ČL 2005)



ononine R = Glc
formononetine R = H



trifolirhizin



α - onocerine

EQUISETI HERBA – horsetail aerial part (ČL 2005)

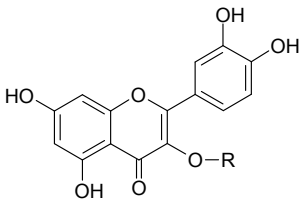
Equisetum arvense – horsetail (Equisetaceae).
Perennial, vascular, spore-forming plant. Creeping rhizome, spring non-green, spore-bearing haulms, summer green vegetative haulms. Verticils of scale-like leaves.

Drug: Whole or cut dried vegetative haulms.

CC: At least 0,3 % of total flavonoids expressed as isoquercitroside. Up to 10 % of silicic acid, ?saponine equisetonine? Traces of pyridine bases (nicotine, 3-methoxypyridine).

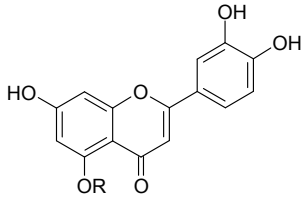
Usage: Component of diuretic mixtures. Maceration benefits healing of some types of pulmonary tuberculosis.

EQUISETI HERBA – horstail aerial part (ČL 2005)

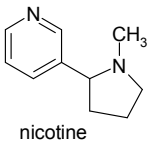


isoquercitroside R = β-D-Glc

R = β-D-Glc - 6-malonylester



luteoline



nicotine

equisetonine ⟶ equisteogenine + Fru + Ara

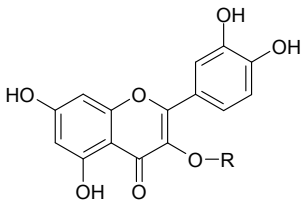
POLYGONI AVICULARIS HERBA – Nať rdesna ptačího (ČL 2005)

Polygonum aviculare – common knotgrass, birdweed (Polygonaceae). One-year plant with branched haulm and sessile egg-shaped integerrimus leaves, pinkish flowers. Weed.

Drug: Whole or cut dried flowering herb.

CC: At least 0,3 % of flavonoids expressed as hyperoside. Tannins, silicic acid, mucilage.

Usage: 1,5 g maceration → diuretic, expectorant, cholagogue, auxiliary treatment of diabetes mellitus



hyperoside R = Gal

avicularin R = Ara

SOLIDAGINIS VIRGAUREAE HERBA – wound wort aerial part (ČL 2005)

Solidago virgaurea – European goldenrod or woundwort (Asteraceae).

Perennial plant with direct haulm terminated with golden-yellow buch-like inflorescence. It grows in bright woods.

Drug: Whole or cut dried flowering aerial part.

CC: At least 1,0 % of flavonoids expressed as hyperoside (quercetine, rutine, quercitrine, isoquercitrine, kaempferol, astragallin, kaempferol-3-rutinoside)
1,5 % of saponins, catechine tannins, essential oil.

Usage: 0,5 g maceration → diuretic during inflammations of urine bladder and kidneys, urolithiasis. Antiphlogistic.

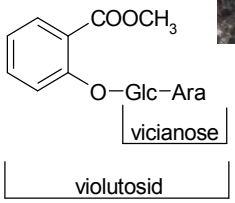
VIOLAE HERBA CUM FLORE – heartsease aerial part with flower (ČL 2005)

Viola tricolor agg. – heartsease (Violaceae). Annual to short-living perennial plant with yellowish-purplish flowers. Weed.

Drug: dried flowering aerial part

CC: Flavonoid glycosides from quercetine and apigenine, saponins, tannins, mucilage, phenolic glycoside violutosid, anthocyanins in flowers.

Usage: 1,5 g maceration → expectorant, diuretic



ORTHOSIPHONIS FOLIUM – java tea leaves (ČL 2005)

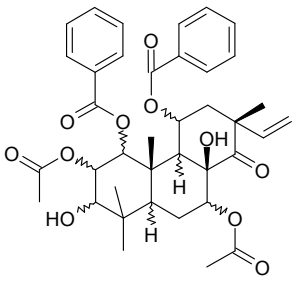
Orthosiphon stamineus – java tea (Lamiaceae). Semi-shrub of tropic America, Australia and southeast Asia.

Drug: Pices of dried leaces and tops of stems harvested before flowering period. During fermentation gets characteristic odor.

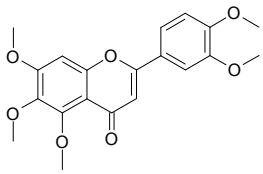
CC: Flavonoids, at least 0,05 % of sinensetine (3´,4´,5,6,7-pentamethoxyflavone), triterpenic saponins, derivatives of caffeic acid, essential oil

Usage: Maceration → diuretic saluretic, antiphlogistic of urinary and biliary tracts Antiuratic, hypolipidemic.

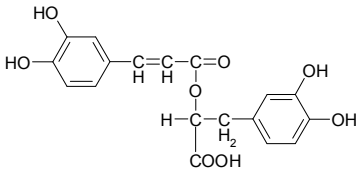
ORTHOSIPHONIS FOLIUM – content compounds



orthosiphol A



polymethoxylated flavones



rosmarinic acid

HERNIARIAE HERBA – rupturewort aerial part

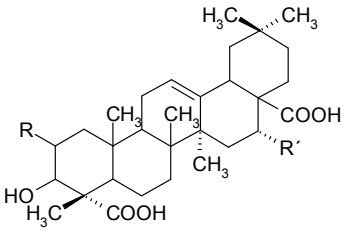
Herniaria glabra, *H. hirsuta* – rupturewort (Caryophyllaceae).

Perennial plant yellowish-green, haulms radial placed on the soil, paired leaves. Differ in presence of trichomes. Weed.

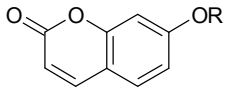
Drug: Dried flowering aerial part.

CC: 2,5-5 % of saponins derived from medicagenic and gypsogenic acids, flavonoids (hyperosid), coumarins (herniarin, umbelliferon), tannins.

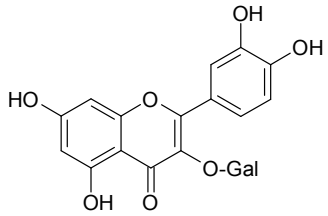
Usage: 1,5 g maceration → diuretic, spasmolytic, desinficient



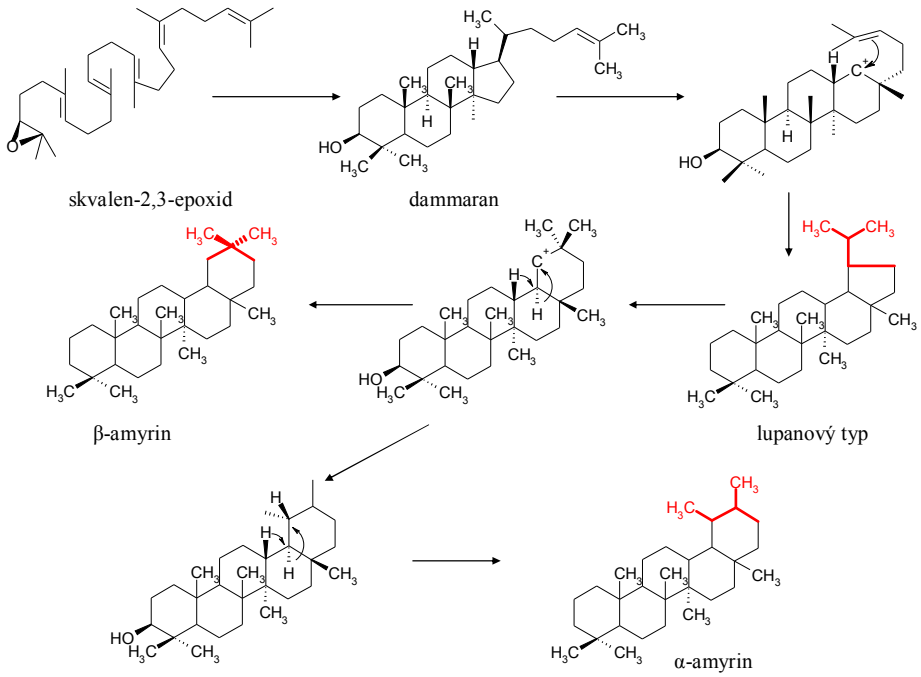
R	R´	
H	H	gypsogenic acid
OH	H	medicagenic acid
H	OH	16α-hydroxymedicagenic acid



H	umbeliferon
CH_3	herniarin



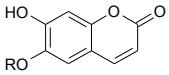
hyperoside



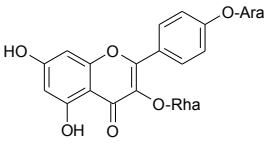
skvalen-2,3-epoxid — dammaran — lupanový typ — β-amyrin — α-amyrin

Pruni spinosae flos
Prunus spinosa Rosaceae

- Blackthorn, sloe
- CC: coumarine derivatives, flavonoids, tannins
- Usage: diuretic



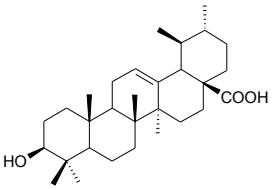
H aesculin
Glu aesculetin



kaempferol-3-rhamno-4´-arabinosid

Pruni africanae fructus/cortex
Prunus africana Rosaceae

- Red Stinkwood
- CC: fatty acids, phytosteroles, pentacyclic triterpenes
- Usage: inhibition of 5-lipoxygenase (antiinflammatory effect), effect on prostate gland epithelium (BHP), urologic



ursolic acid

SPECIES DIURETICAE (ČsL 4)

- Ononidis radix
- Levistici radix
- Betulae folium
- Juniperi fructus
- Liquiritiae radix aa 20,0
  M.f. species

TILIAE FLOS – Lipový květ (ČL 2005)

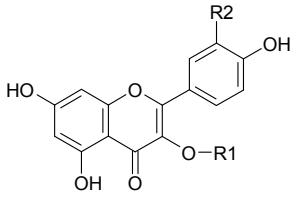
Tilia cordata – Small-leaved Lime, *T. platyphyllos* and their hybrids. Tall trees with rounded tree-crown. Leaves alternate, stalked, with heart-shaped, spiky, sharply serrated blade. Elongated membranous bract grows back to a stalk of inflorescence. Androgynous flowers, fruit is achene.

Drug: Whole dried inflorescence, harvested in the beginning of flowering period together with bract.

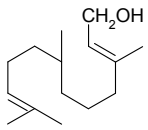
CC: Flavonoid glycosides from quercetine, hesperidine and kaempferol. Essential oil, organic aromatic acids, mucilage, sugars.

Usage: 1,5 g maceration → diaphoretic, antiphlogistic, diuretic. Externally gargle. Cosmetics.

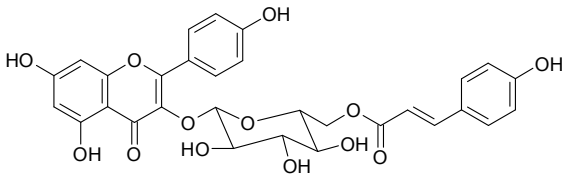
TILIAE FLOS – content compounds



quercitrin, R1 = Rha, R2 = OH
isoquercitrin, R1 = Glc, R2 = OH
astragalin, R1 = Glc, R2 = H



farnesol

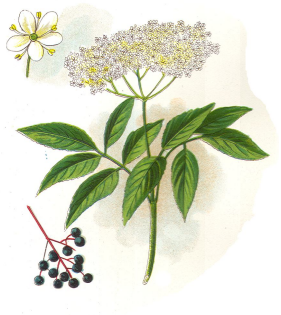


tiliroside

SAMBUCI NIGRAE FLOS – Elderberry flower (ČL 2005)

Sambucus nigra – elderberry (Adoxaceae).

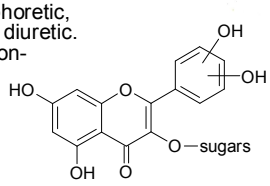
Tree or shrub with bright brown, longitudinaly ruptured bark. Inflorescence is cyme. Infructescence is formed by rounded drupes. Ruble site plant.



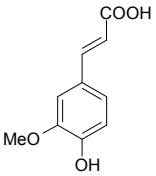
Drug: Dried flower

CC: Flavonoids (at least 0,80 % expressed as isoquercitrosid), tannins, organic acids, mucilage, essential oil.

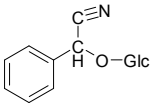
Usage: 1,5 g maceration → diaphoretic, mild spasmolytic, laxant and diuretic. Aromatizing component of non-alcoholic beverages.



rutosid
hyperosid
isoquercitrosid



ferulic acid



sambunigrine

SAMBUCI FRUCTUS – elderberry fruit

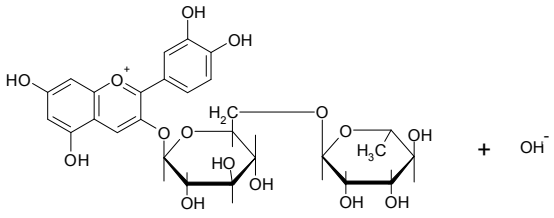
Drug: dried drupes removed from infrutescence. Astringent sweet-and-sour taste.

CC: anthocyanine pigments, sugars, organic acids, carotenoids, tannins, essential oil, vitamin C.

Usage: diaphoretic, diuretic.

For isolation of sambucine (cyanidine-3-rutinosid) – during xerophtalmia

Source of food pigments



sambucine