Pharmacognosy lab exercise 9

Herbs, flowers

Absinthii herba CzPh 2017

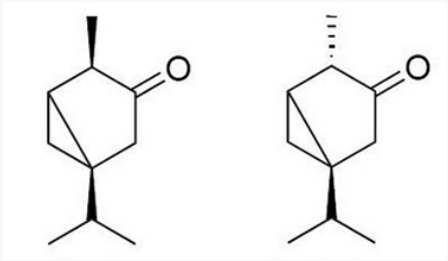
- Mother plant: ***Artemisia absinthium,*** **Asteraceae** (Common wormwood)

Absinthii herba CzPh 2017

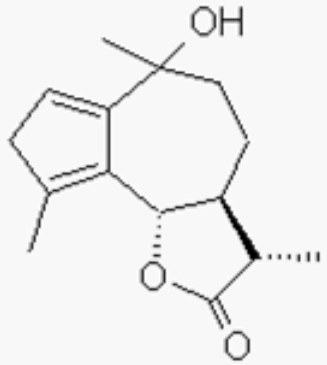
- Macroscopy: ground leaves from greyish to greenish, silver-grey felt-like, leaf-stalked, leaf segments from rounded to lanceolate, stem green-grey, felt-like, usually with 5 wrinkles, flowers yellow, target-like, *involucrum* grey felt-like, aromatic odour and very bitter spicy taste.

Absinthii herba CzPh 2017

- Content compounds: **essential oil** (thujone, thujole), **bitter substances** – sesquiterpenic lactones (artemisin, artabsin, absinthin), flavonoids, polyalkyns



α-thujone β-thujone
(*Thuja, Artemisia, Salvia, Tanacetum*)

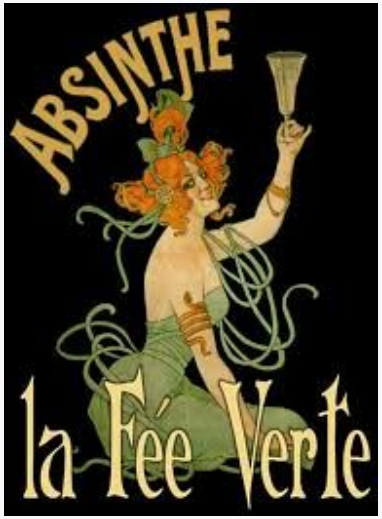


artabsin

Thujon - neurotoxic (GABA receptors inhibitor)

- Usage: amare, digestive, choleretic, spasmolytic

Absinthii herba CzPh 2017



- **Absinthism** – syndrome connected to absinth drinking (thujon)
  - Hallucinations, insomnia, convulsions
  - Van Gogh, E. A. Poe, Ch. Baudelaire

- **Rise and fall of absinth:** 20. century – increasing popularity (consumption increased 15-fold only in France between 1875 - 1913)

- 1915 – banned without any scientific proof of thujon content
  - "the trouble with alcohol lies not in the consumed amount but in the quality of consumed alcohol"

- **Thujon content:** pre-ban absinth 25,4 mg/l (samples from 1895-1910)

  post-ban absinth 7,6 mg/l (samples from 1915-1988)

  modern absinth 26,9 mg/l (samples from 2003-2006)

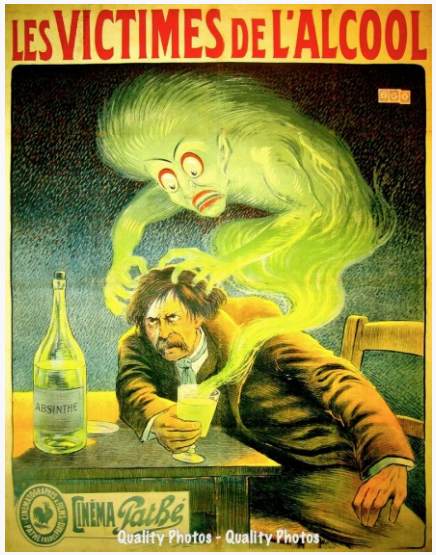
Padosch SA, Lachenmeier DW, Kröner LU. *Absinthism: a fictitious 19th century syndrome with present impact.* Substar
Abuse Treatment, Prevention, and Policy 2006 1:14. https://www.alandia.de/absinthe-blog/absinthe-prohibition/

Absinthii herba CzPh 2017

- **ADI (acceptable daily intake) for thujon** based on scientific data :

  0.11 mg/kg of body weight per day = 2-20 cups of wormwood tea

- **Where do the roots of absinthism lie?**
  - Drinking of poor-quality absinth (samples from 19. century are from high-quality production)
  - Addition of wormwood essential oil or other additives just before consumption (copper salts, antimony chloride)
  - Combination with other psychotropic substances
  - Drinking of such high amounts of absinth and other alcoholic beverages that ethanol was responsible for the symptoms of absinthism



https://www.ebay.com/itm/Green-Fairy-Causes-Madness-8-5x11-Photo-Print-Anti-Absinthe-Propaganda-Poster-/254472052339

Absinthii herba CzPh 2017

- **1988 EU regulation of thujone content in food and beverages**:
- 0.5 mg/kg in food prepared with *Artemisia* species, excluding those prepared with sage and non alcoholic beverages
- 10 mg/kg in alcoholic beverages not prepared with *Artemisia* species
- 25 mg/kg in food prepared with sage
- 35 mg/kg in alcoholic beverages prepared with *Artemisia* species

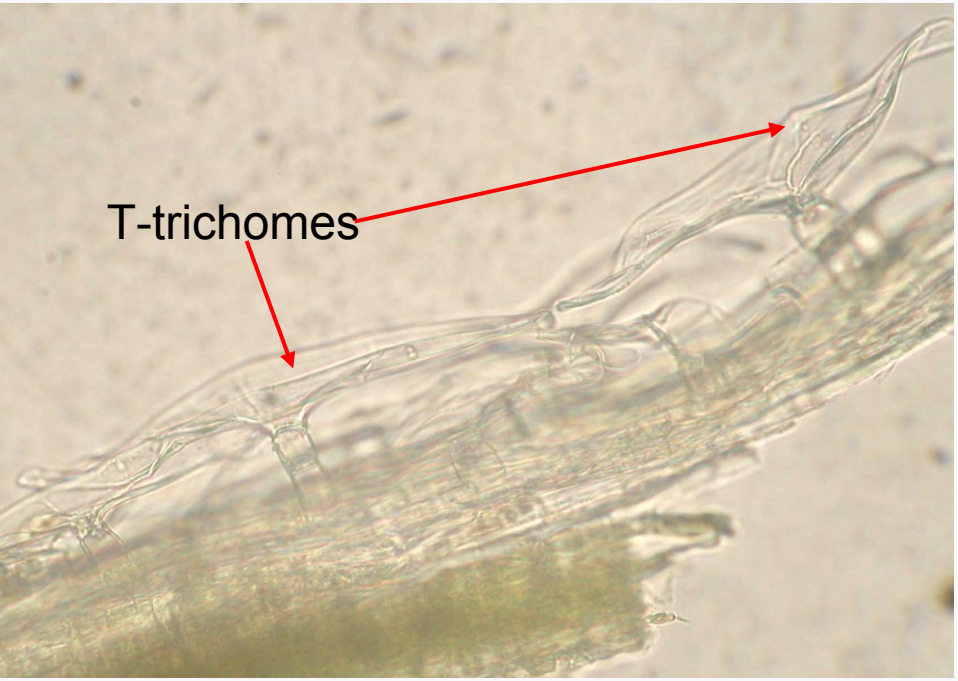
More about absinth and Absinthii herba:

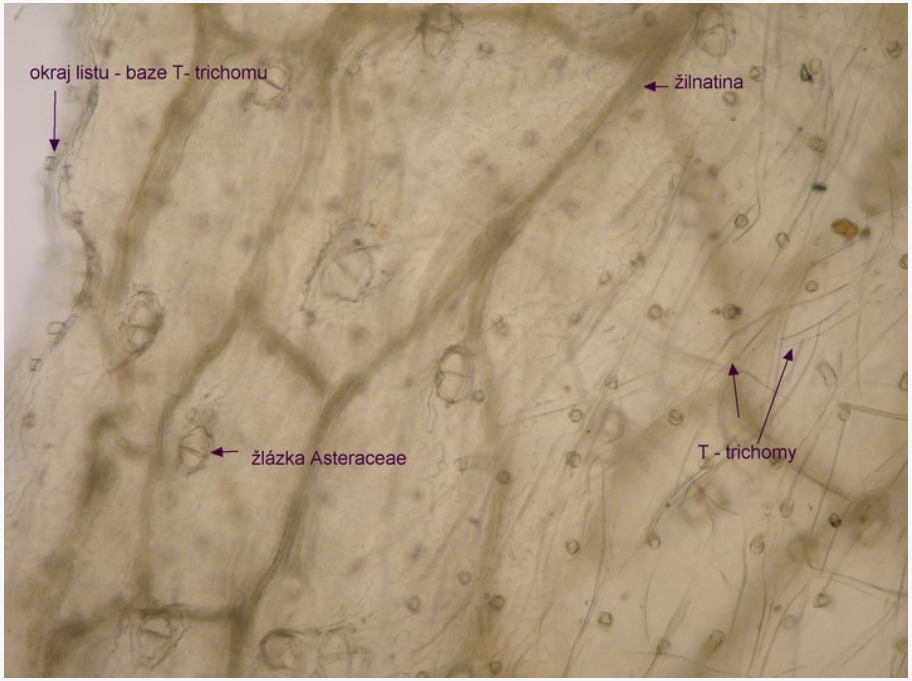
- 10.1136/bmj.319.7225.1590
- https://www.absinthes.com/absinthe-encyclopedia/thujone/thujone-and-absinthe-scientific-research/poison-on-line/
- https://www.ema.europa.eu/en/medicines/herbal/absinthii-herba

(https://en.wikipedia.org/wiki/Thujone#cite_note-EU2008-29)

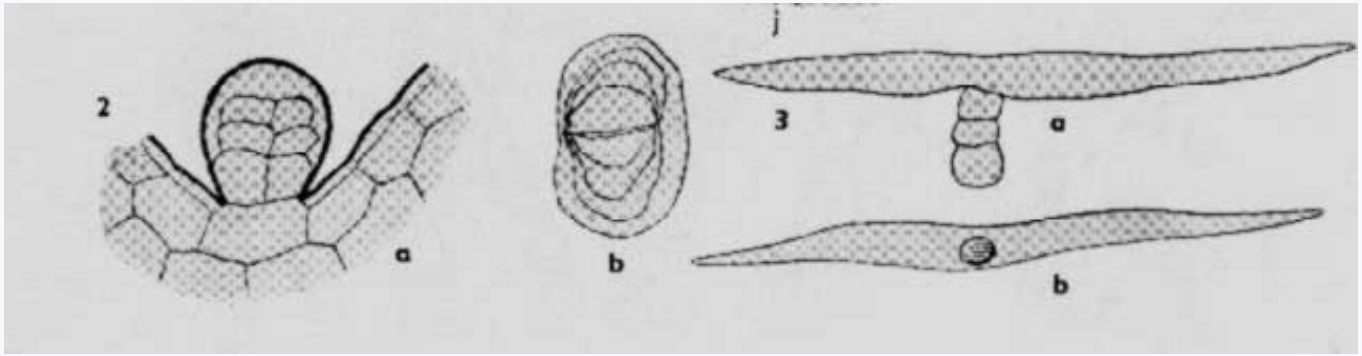
Absinthii herba CzPh 2017

- Microscopy: **leaf** – upper and lower skin layer with characteristic T - trichomes, glandules of *Asteraceae* type (squamous division), cells of lower skin layer wavy trunk-like





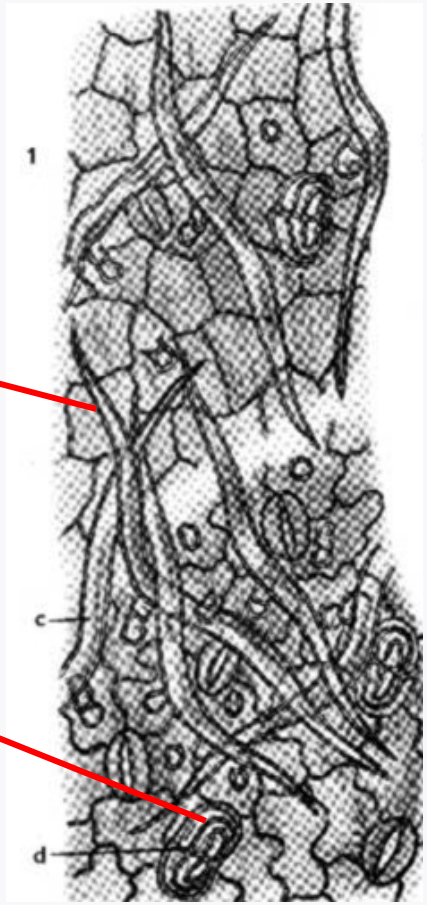
Absinthii herba CzPh 2017



Asteraceae glandulae

T-trichomes

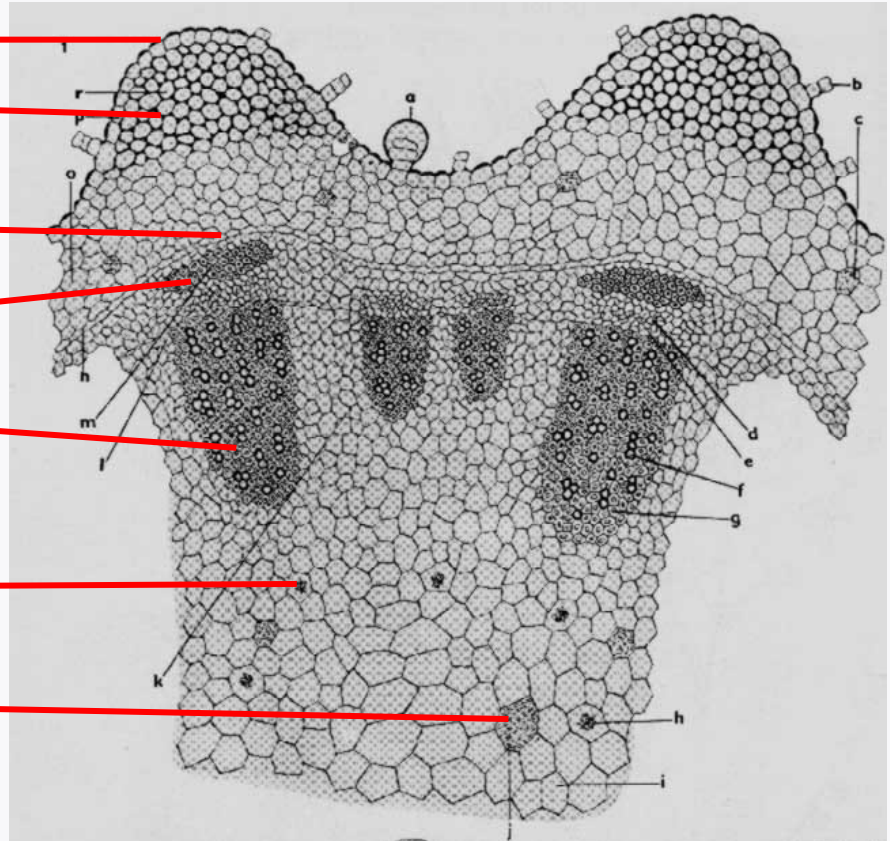
glandules



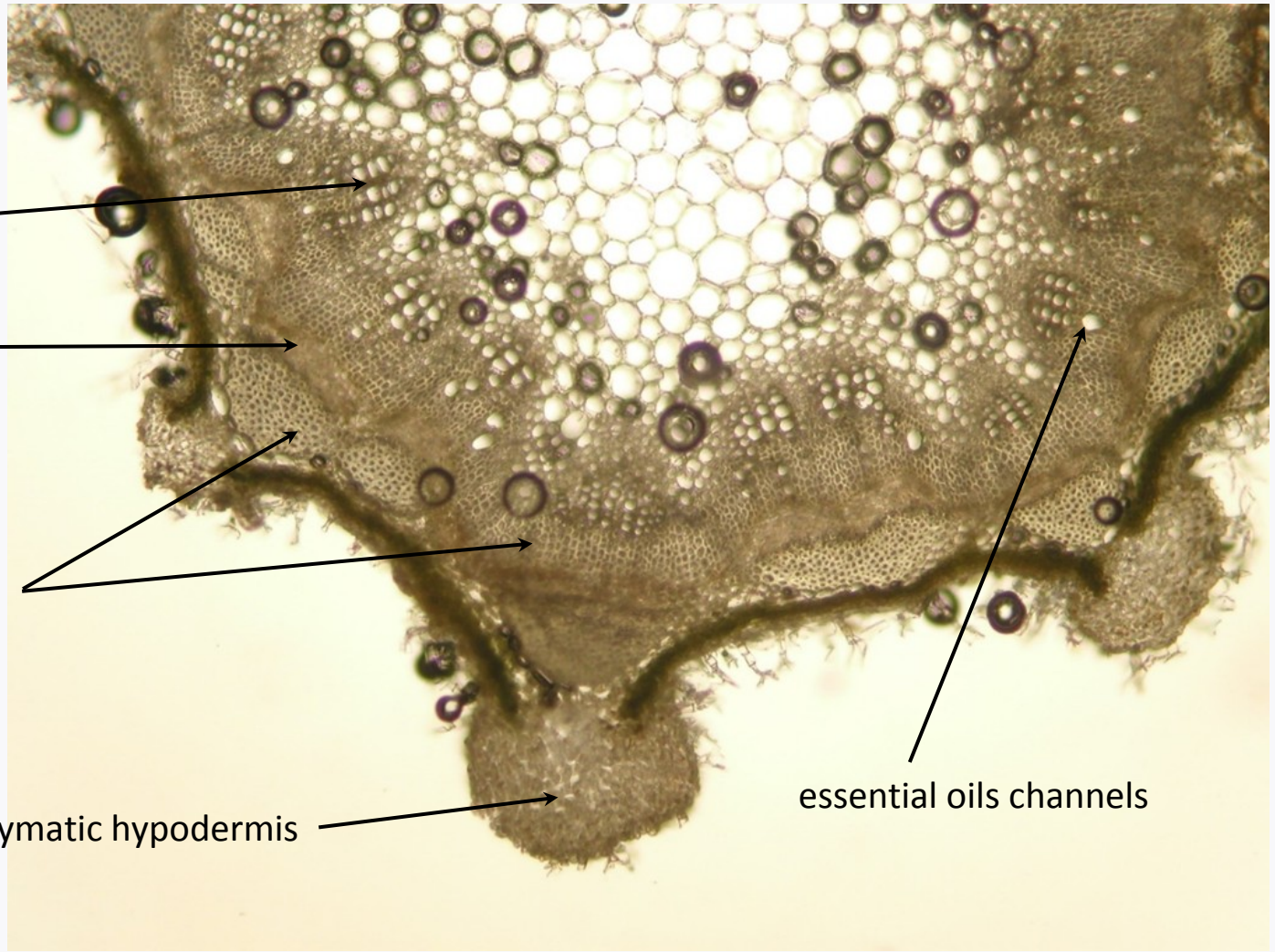
Absinthii herba CzPh 2017

- Microscopy: **Stem transversal section** – surface glandules, schisogennic channel with essential oil in parenchyma, collenchyma in ribs (ridges), endodermis, aggregates of sclerenchyma, sieve-tubes, cambium, vessels with libriform, medullar rays, aggregates of calcium oxalate, collateral vascular bundle

skin layer
collenchyma
endodermis
phloem
xylem
crystal aggregate
channel with essential oil



Absinthii herba CzPh 2017



Convallariae herba

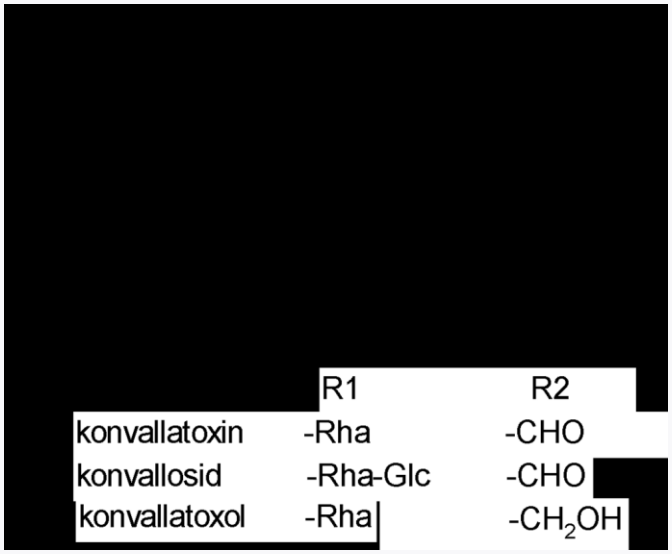
- Mother plant: ***Convallaria majalis*, Ruscaceae (Liliaceae)**

  Lily Of The Valley

Convallariae herba

- Macroscopy: leaves entire, elliptic, parallel veined; flowering stem bearing a one-sided raceme (to 4-9” long) of nodding, bell-shaped, sweetly fragrant, white flowers without odour, taste firstly sweet then sharp bitter

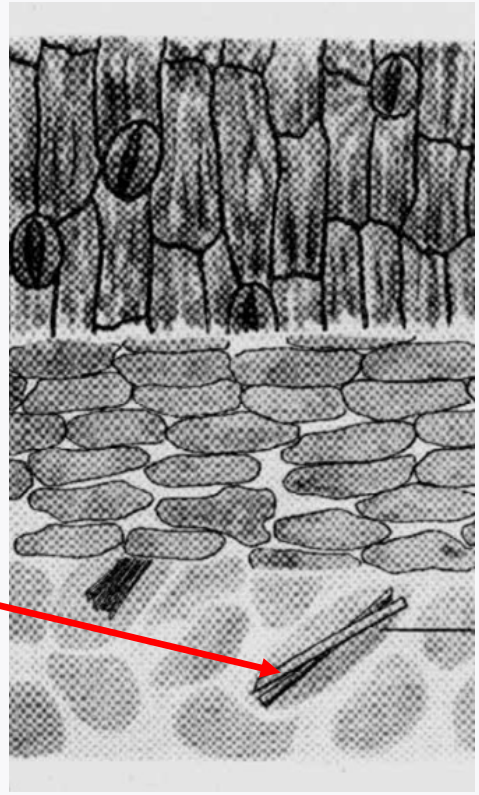
- Content compounds: **cardioglycosides – cardenolides** (0.2 - 0.3% - convallatoxin, convallatoxol), saponins, flavonoids



- Usage: cardiotonic

Convallariae herba

- Microscopy: epidermal cells of leaves rod-like elongated, parallel with *venatio*, sporadic stomata without accompanying cells, non-differentiated palisade and spongeous parenchyma, raphides of calcium oxalate



Equiseti herba CzPh 2017

- Mother plant: ***Equisetum arvense, Equisetaceae*** (Horsetail)

Equiseti herba CzPh 2017

- Macroscopy: tough, fragile stems, articular, poly-costate, branched to simpler verticillate branches, without taste and odour

- Content compounds: **flavonoids, silicic acid** (or soluble silicates), organic acids, traces of alkaloids (nicotine)

- Usage: diuretic, skin disorders

Equiseti herba CzPh 2017

- Microscopy: **transversal section:** characteristic ribs/ridges reinforced by sclerenchyma and incrusted with silicic acid, between ribs located valleys/grooves, ***valecular* cavities** between ribs, under endodermis in ribs located ***carinal* cavities**, upon them collateral vascular bundles

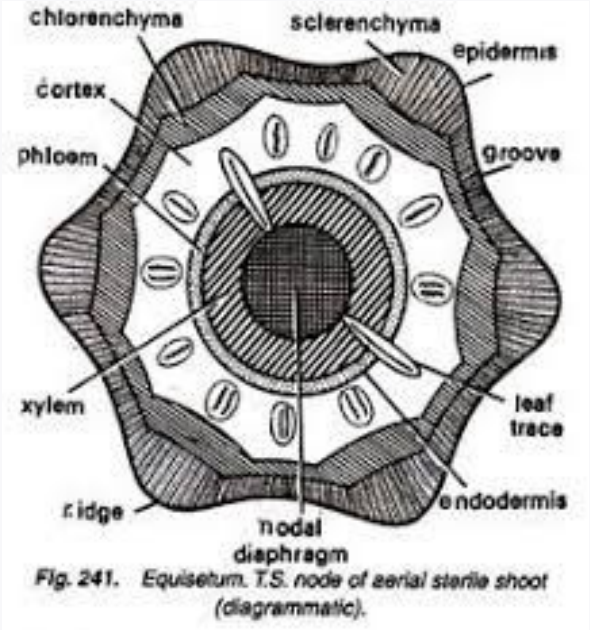
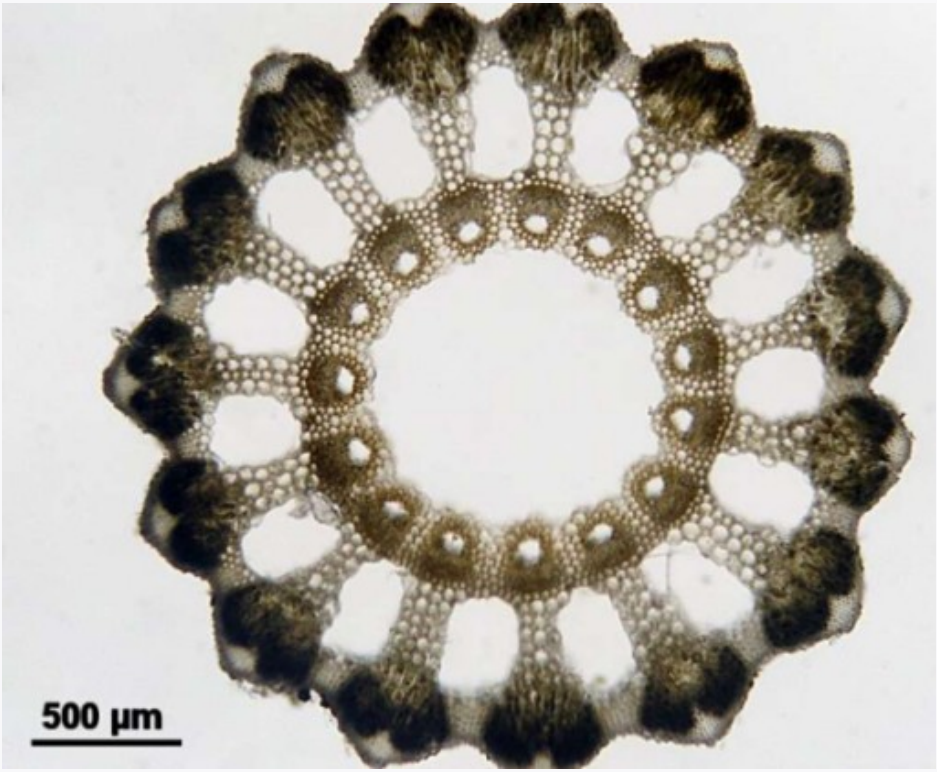


Fig. 241. *Equisetum*. T.S. node of aerial sterile shoot (diagrammatic).



Equiseti herba CzPh 2017

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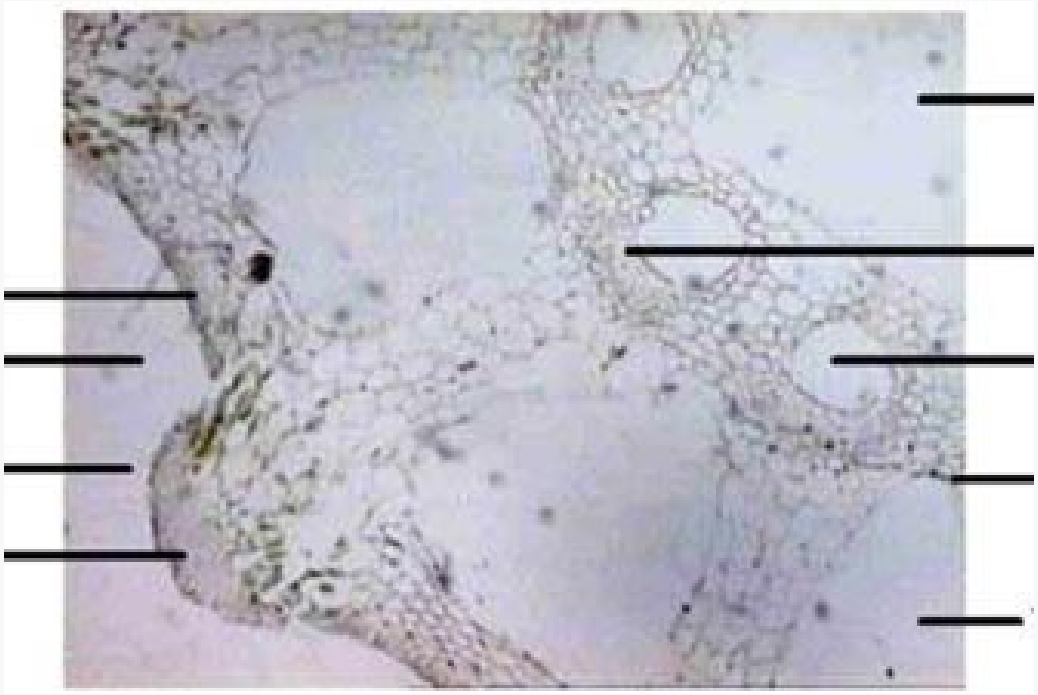


Equiseti herba CzPh 2017

Microscopy:

sclerenchyma

epidermis

rib

collenchyma

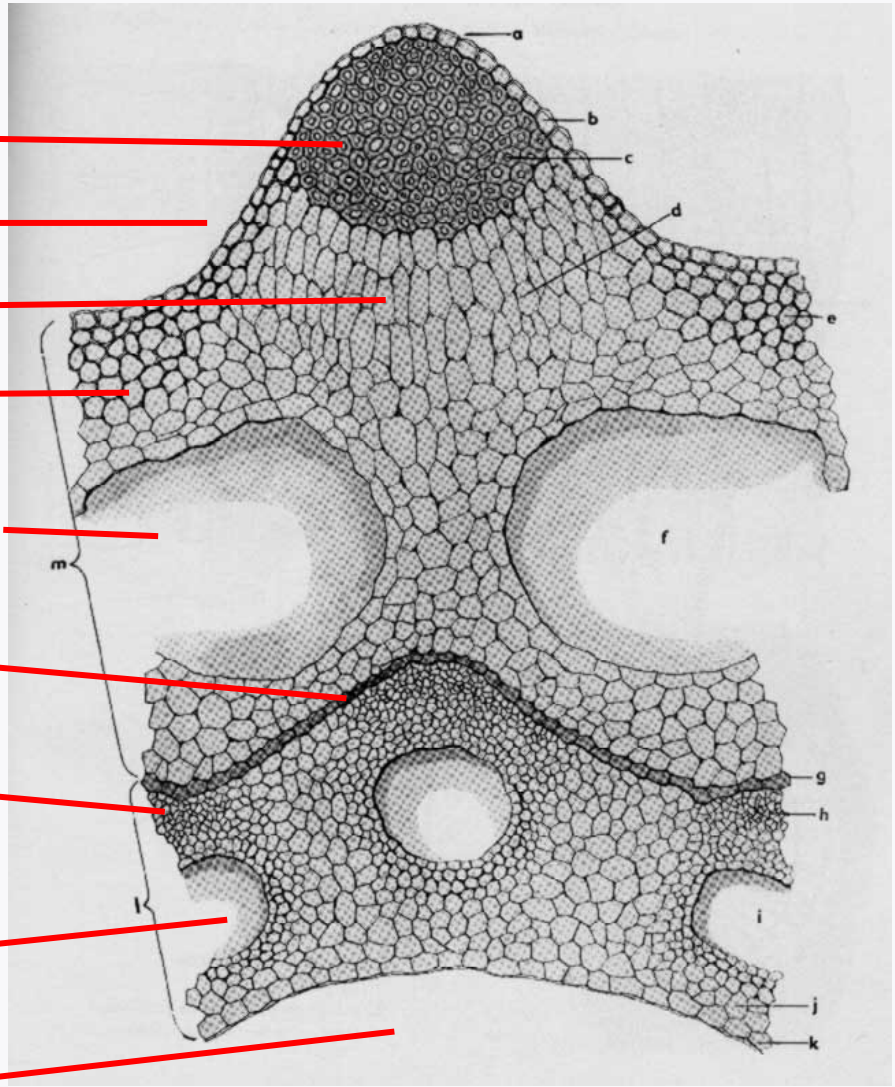
valecular cavity

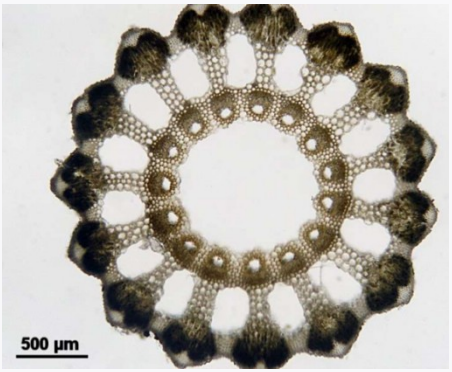
endodermis

vascular bundle
collateral

carinal cavity

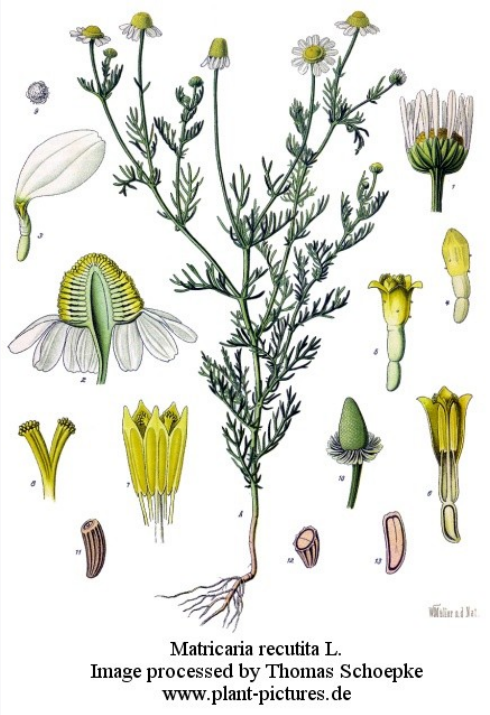
central cavity





Matricariae flos CzPh 2017

- Mother plant: ***Chamomilla recutita*** **syn.** ***Matricaria recutita,*** **Asteraceae,** Chamomile, *χαμαίμηλον*
  - Matricariae etheroleum CzPh 2017
  - Matricariae extractum fluidum CzPh 2017



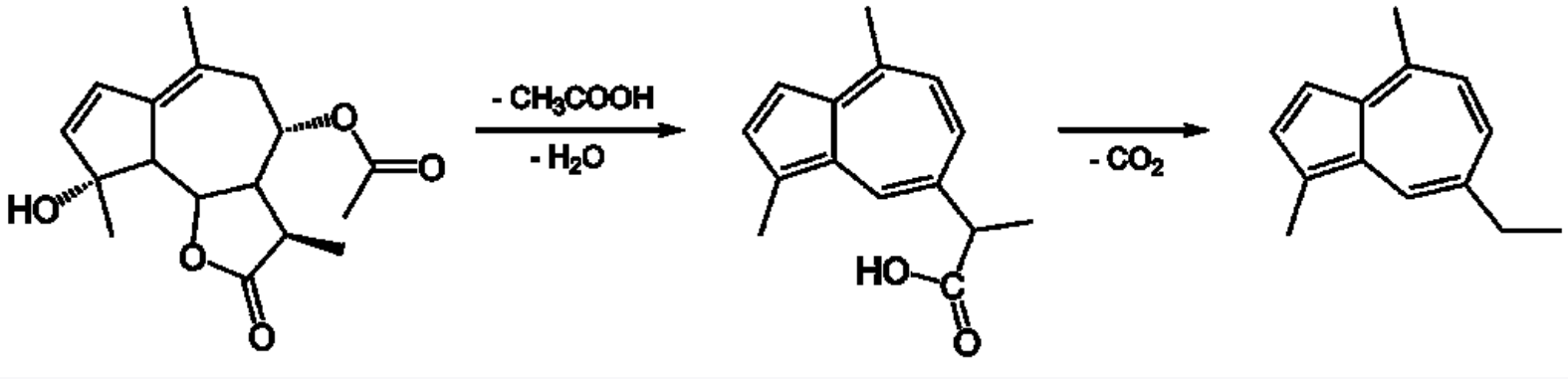
Matricaria recutita L.
Image processed by Thomas Schoepke
www.plant-pictures.de

Matricariae flos CzPh 2017

- Macroscopy: *anthodium* (flower heads) with hollow semi-globular *receptacle*, circumferential pistillate flowers with ray florets corolla, inner disc florets are duplicitous and yellow, several rows of green bracts, strong aromatic odour and taste

Matricariae flos CzPh 2017

- Content compounds: **essential oil** – sesquiterpens (0.6-2.4%; chamazulene, guaiazulen, bisabolole), **bitter substances** (matricin), **mucilage, flavonoids** (apigenin), coumarins



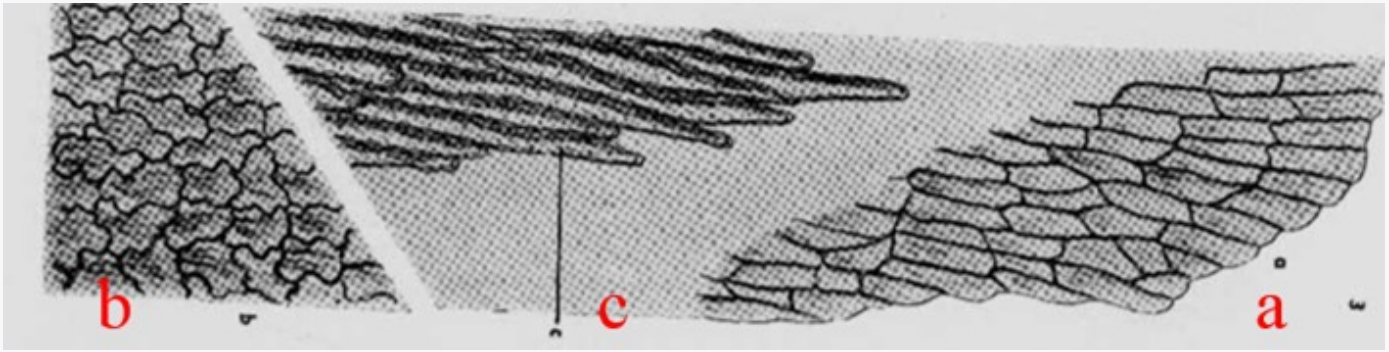
matricin (proazulene) chamazulene

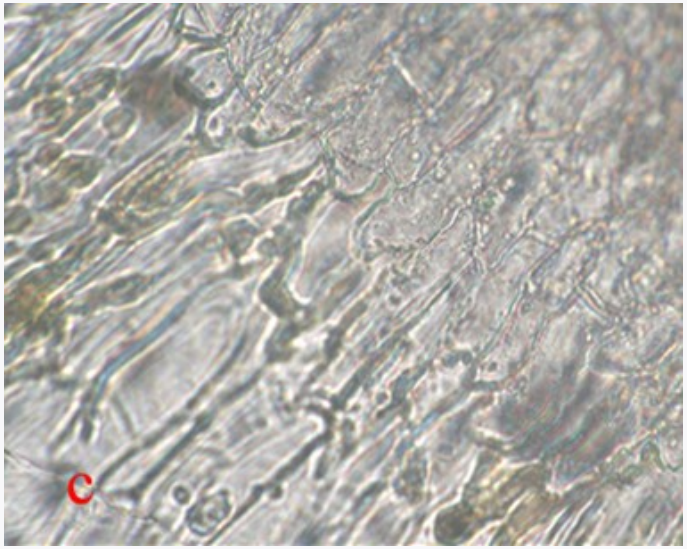
- Usage: internally- antiphlogistic, spasmolytic, carminative, stomachic, diaphoretic, mild sedative

externally- healing effect, promotes epithelization (wounds, burns)

Matricariae flos CzPh 2017

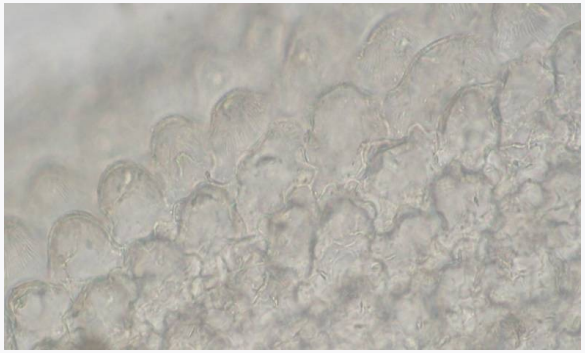
- Microscopy: inner (a) and outer (b) epidermis of *involucrum* (rosette of bracts surrounding an inflorescence) with sclereids (c)



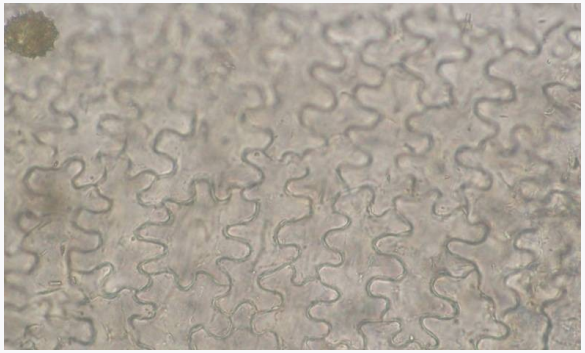


Matricariae flos CzPh 2017

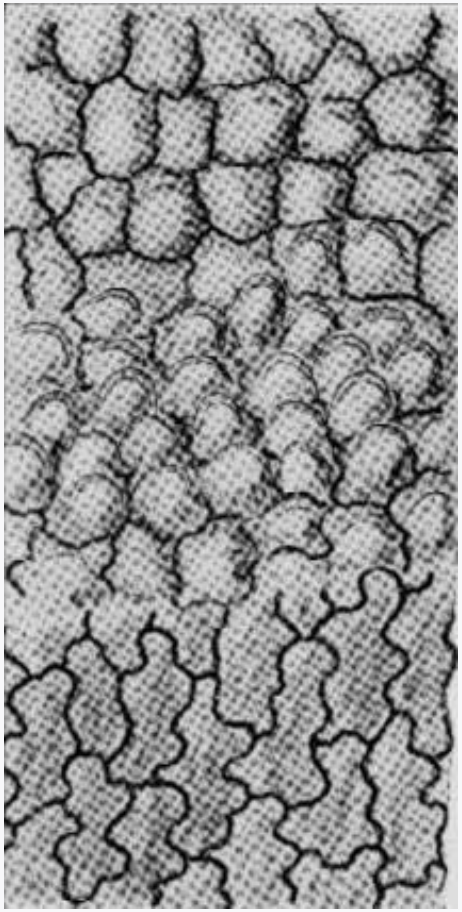
- Microscopy: Ray florets – inner epidermis wavy deformed



inner epidermis - transversal section



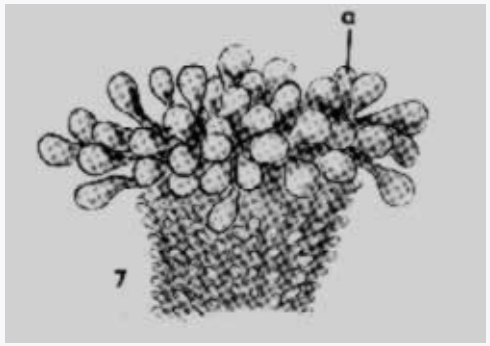
outer epidermis - aerial view

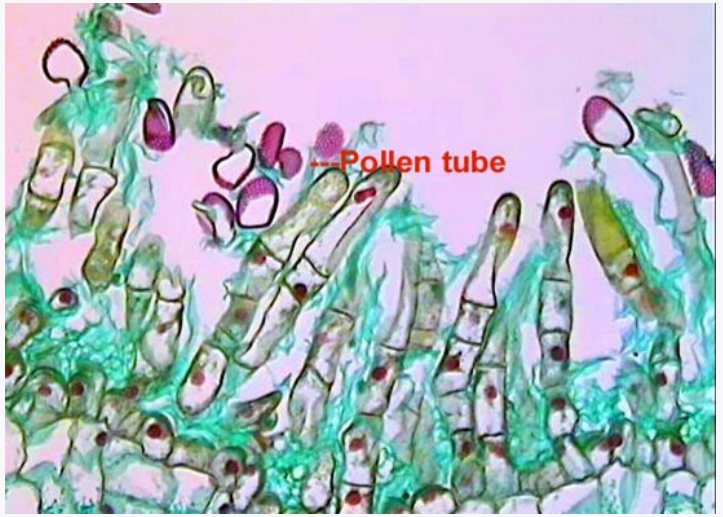


Matricariae flos CzPh 2017

- Microscopy:

stigma with papillas





single tube flower

Verbasci flos CzPh 2017

- Mother plant: ***Verbascum densiflorum, V. phlomoides, V. tapsus,*** **Scrophulariaceae** (Mullein)

Verbasci flos CzPh 2017

- Macroscopy: flat, pipe-like corollas 5-petalled (three lower corners bigger), yellow, 5 stamen, weak honey-like odour, sweet taste, mucilaginous

- Content compounds: **saponins** (verbascosaponin with aglycone verbascogenine), **mucilage**, **flavonoids** (apigenin, luteolin), **iridoids** (aucubine, catalpol)

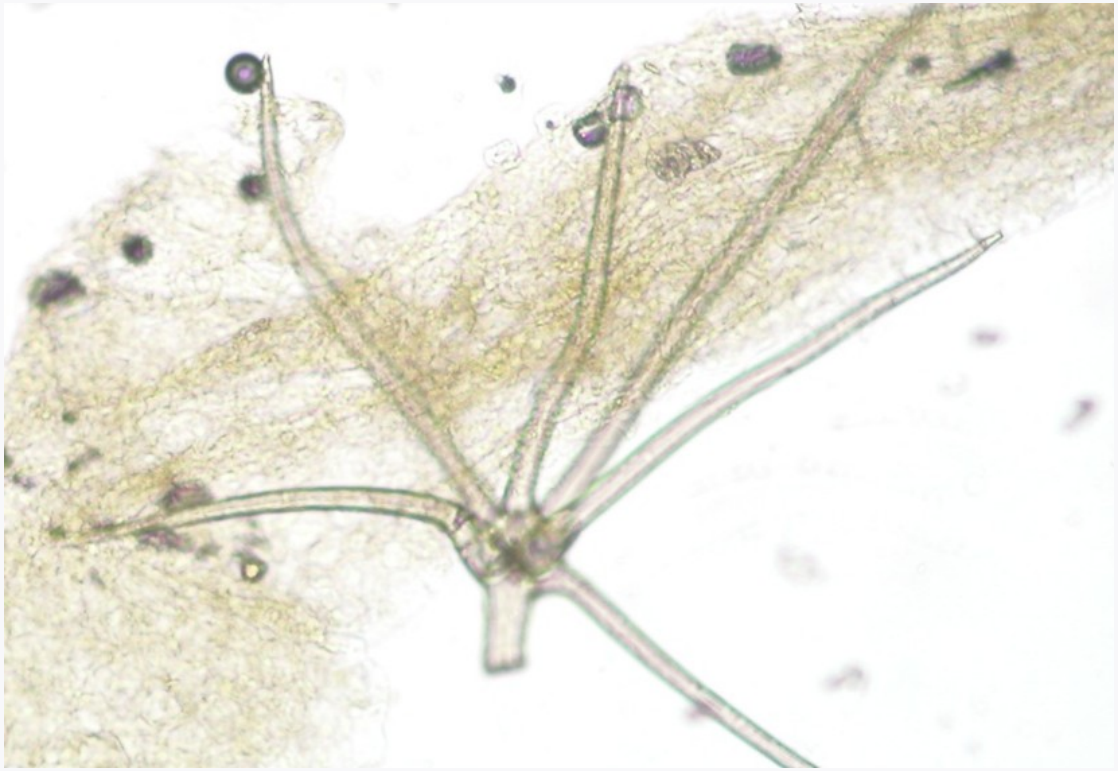
- Usage: expectorant, mucilaginose, antiphlogistic, diaphoretic, mild diuretic

Verbasci flos CzPh 2017

- Microscopy:

stamen - lower smooth, upper with one-cell club-like trichomes

epidermis – big branched covering trichomes (candelabra-like), glandular trichomes



Verbasci flos CzPh 2017

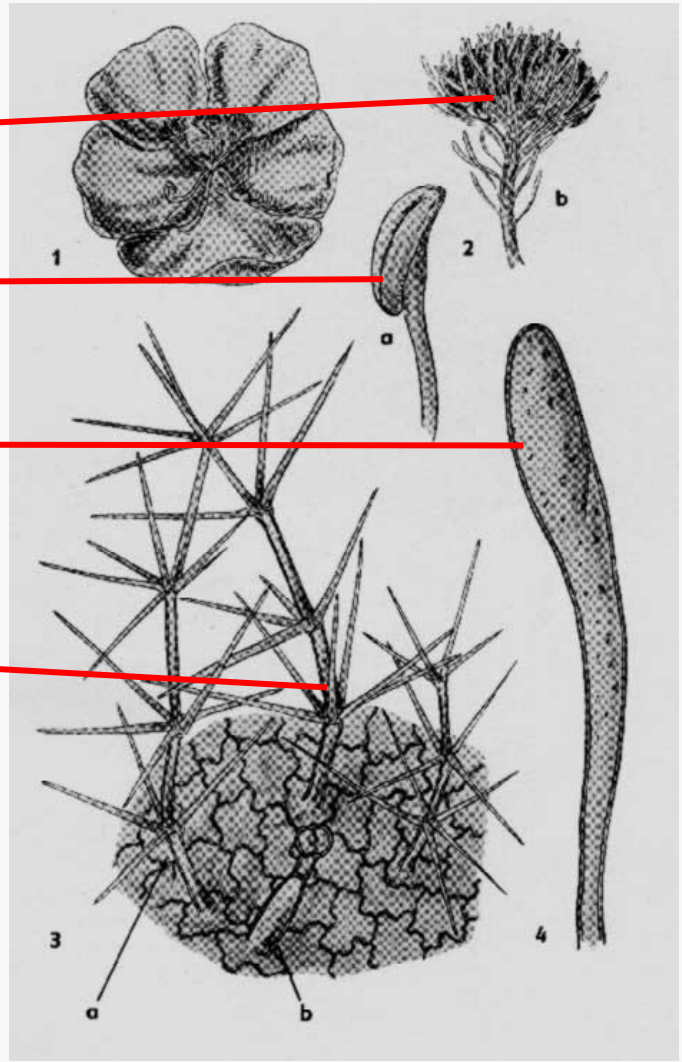
- Microscopy:

upper stamen

lower stamen

club-like trichome

candelabra-like trichome



MACROSCOPY

Arnicae flos CzPh 2017

- Mother plant: ***Arnica montana,* Asteraceae** Leopard´s bane, Mountain Arnica
  - Arnicae tinctura CzPh 2017

Arnicae flos CzPh 2017

- Macroscopy: flower heads: ray florets creamy white, circular head yellow disc florets are androgynous, ovary cylindrical, smoothly hairy, aromatic odour, sharp spicy taste

- Content compounds: **sesquiterpenic lactones** (**helenalin**, dihydrohelenalin), flavonoids, carotenoids, polyphenolic compounds (cynarin), essential oil, triterpenic saponins (arnidiole), polyacetylene type substances

- Usage: only external – antiphlogistic, antirheumatic, derivans
- (internally – cardiotonic, elevates blood pressure)

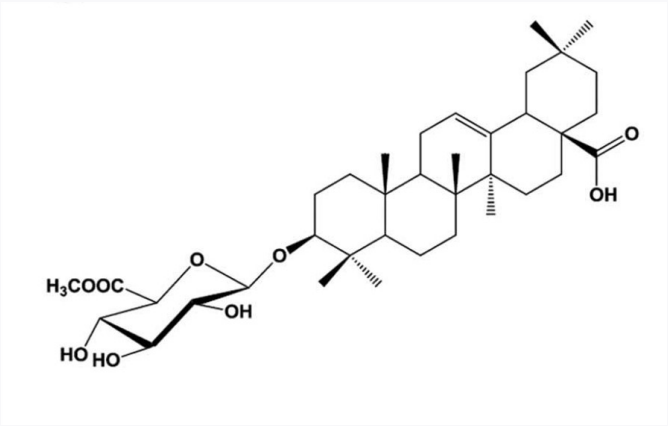
Calendulae flos CzPh 2017

- Mother plant: ***Calendula officinalis,* Asteraceae,** Pot Marigold

Calendulae flos CzPh 2017

- Macroscopy: yellow flower head, circumferential ray florets, in disc tubular florets, bracts in two rows, weak odour, bitterish acrid taste

- Content compounds: **glycosides of oleanolic acid (calendulosides)**, **flavonoids, essential oil**, carotenoids and xantophylls, triterpenic alcohols (arnidiole, faradiole)



calenduloside E

- Usage: antiphlogistic

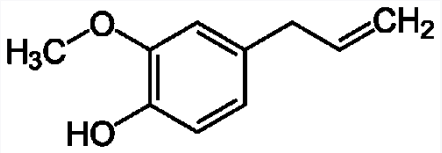
Caryophylli flos CzPh 2017

- Mother plant: ***Syzygium aromaticum (Eugenia caryophyllus),*** **Myrtaceae,** Cloves
- Caryophylli floris etheroleum CzPh 2017

Caryophylli flos CzPh 2017

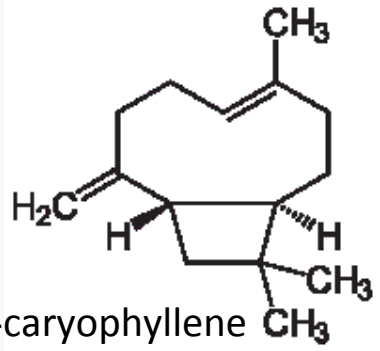
- Macroscopy: long calyx, terminating in four spreading sepals, and four unopened petals which form a small ball in the center, strong aromatic odour and taste

- Content compounds: **essential oil** (eugenol, caryophyllene), flavonoids, phenolic acids, oil, tannins, triterpenes



eugenol

- Usage: essential oil displays antiseptic and anaesthetic properties, antioxidant; analgesic and antirheumatic effect



β-caryophyllene

Farfarae flos

- Mother plant: ***Tussilago farfara,*** **Asteraceae,** Coltsfoot

Farfarae flos

- Macroscopy: flower heads with short stalk, ray florets in several lines, tubular florets with feathers in disc, bracts in one row, felt-like, reddish, without odour, mucilaginous bitterish taste

- Content compounds: **mucilage**, flavonoids, tannins, xanthophylls, traces of pyrrolizidine alkaloids (tussilagine, senkirkin)

- Usage: mucilaginose, expectorant, mild astringent and spasmolytic

Lamii albi flos

- Mother plant: ***Lamium album,*** **Lamiaceae,** White Deadnettle

Lamii albi flos

- Macroscopy: corolla without calyx, petals fused into an upper lip and a lower lip , upper lip dished, side corners 2-3 toothed, creamy white colour, weak honey-like odour, bitterish taste

- Content compounds: **flavonoids**, essential oil, tannins, triterpenic saponins, phenolic acids, mucilage, iridoid glycosides

- Usage: mucilaginose, expectorant, sedative; externally as astringent, antiphlogistic

Lavandulae flos CzPh 2017

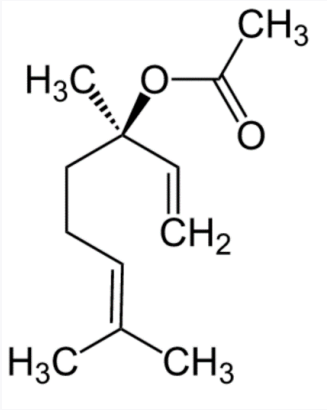
- Mother plant: ***Lavandula angustifolia (L. officinalis),*** **Lamiaceae,** Lavender
- Lavandulae etheroleum CzPh 2017

Lavandulae flos CzPh 2017

- Macroscopy: small flowers with grey-blue poly-costate pubescent calyx and two-labiate corolla, aromatic odour, bitter taste

- Content compounds: **essential oil** (monoterpens - linalyl-acetate, linalool, cineol, camphor), tannins, rosmarinic acid, flavonoids, coumarins, **anthocyanins**, bitter substances

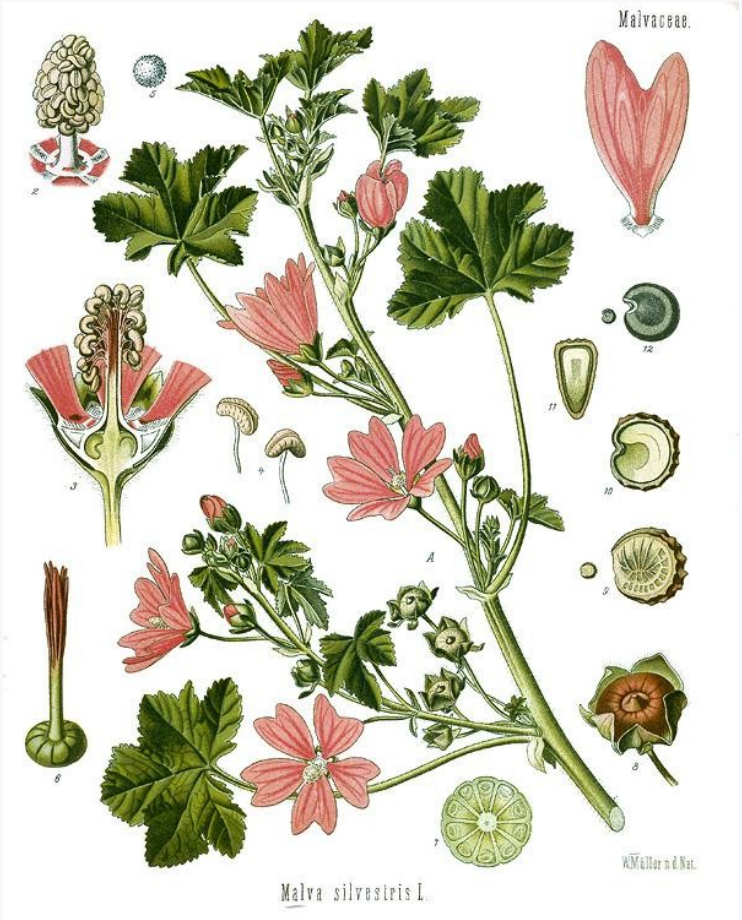
- Usage: nervinum, sedative, cholagogue, spasmolytic; externally antiseptic, derivans



linalyl-acetate

Malvae sylvestris flos
CzPh 2017

- Mother plant: ***Malva sylvestris*, Malvaceae,** Common Mallow

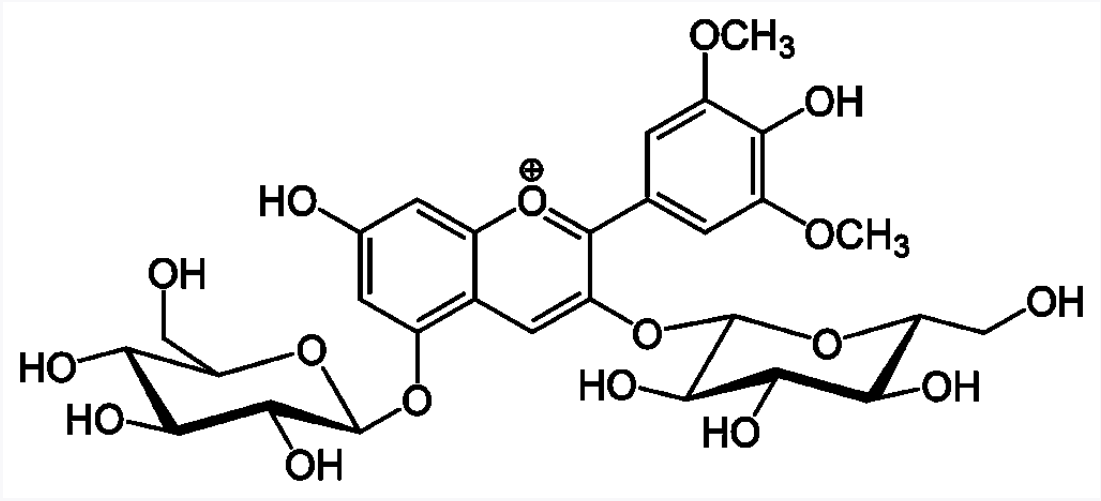


Malvae sylvestris flos
CzPh 2017

- Macroscopy: flowers located axillary, *petals* dark-purple (5), opposite-oval, with dark veining, calyx 5-cornered, ovary rounded, without odour, taste mucilaginous

Malvae sylvestris flos
CzPh 2017

- Content compounds: **mucilage** (more than 10%), tannins, essential oil, **anthocyanins** (malvin)

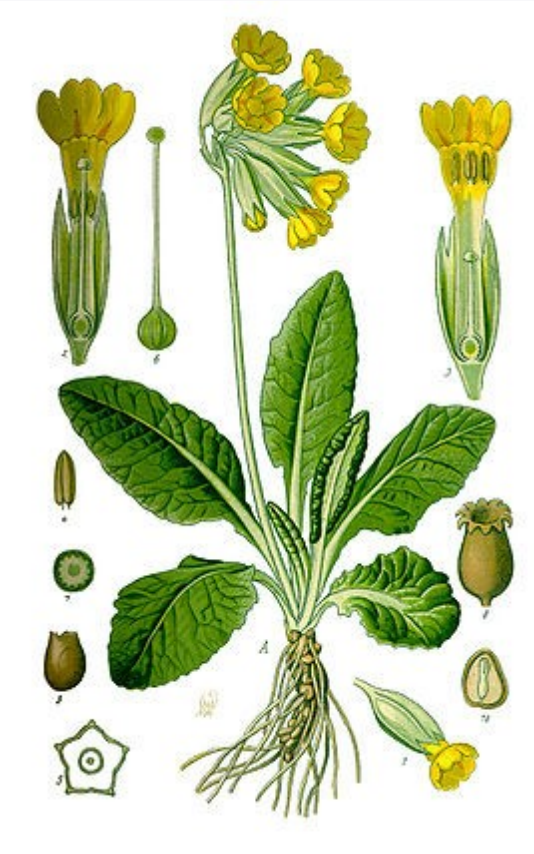


malvin
(= malvidin-3,5-diglucoside)

- Usage: mucilaginose, mild astringent, dye

Primulae flos

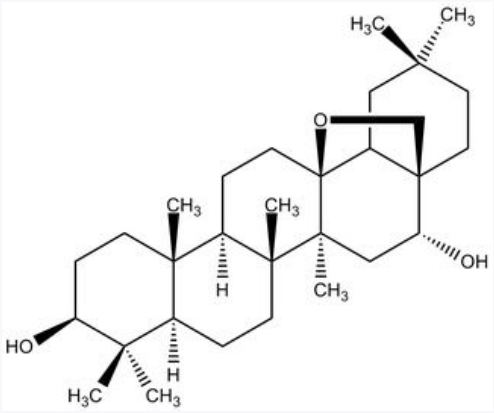
- Mother plant: ***Primula veris*, *P. elatior*, Primulaceae,** Primrose



Primulae flos

- Macroscopy: flowers with yolk-yellow *corolla* and spoon-like concave *petals* (*veris*) or sulphur-yellow flowers with flat *petals* with deeper corners (*elatior*), honey-like odour, sweetish taste

- Content compounds: **triterpenic saponins**, phenolic glycosides, flavonoids, carotenoids, essential oil



protoprimulagenine

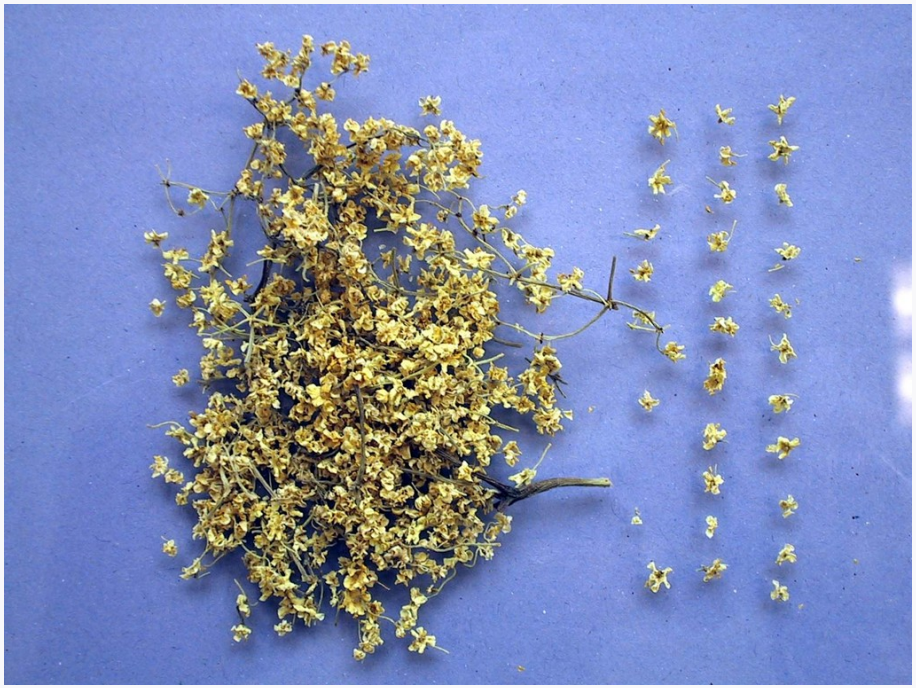
- Usage: expectorant – secretolytic, mild diuretic

Sambuci nigrae flos
CzPh 2017

- Mother plant: ***Sambucus nigra*, Adoxaceae (Sambucaceae),** Black Elderberry

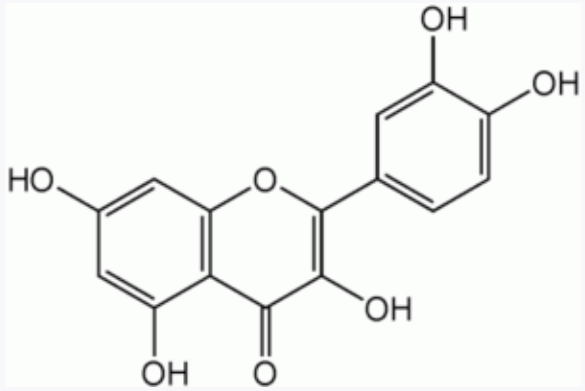
Sambuci nigrae flos
CzPh 2017

- Macroscopy: small flowers white to yellowish, 5-toothed calyx and deeply 5-cornered corolla with many stamina, strong characteristic odour, mucilaginous taste

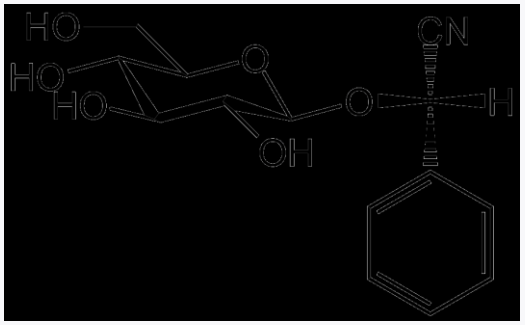


Sambuci nigrae flos
CzPh 2017

- Content compounds: **flavonoids** (quercetin glycosides – rutin, hyperoside, isoquercitrin), essential oil, phenolic acids + esters, triterpenic saponins, mucilage, traces of sambunigrine



quercetin



sambunigrin

- Usage: diaphoretic, diuretic

Tiliae flos CzPh 2017

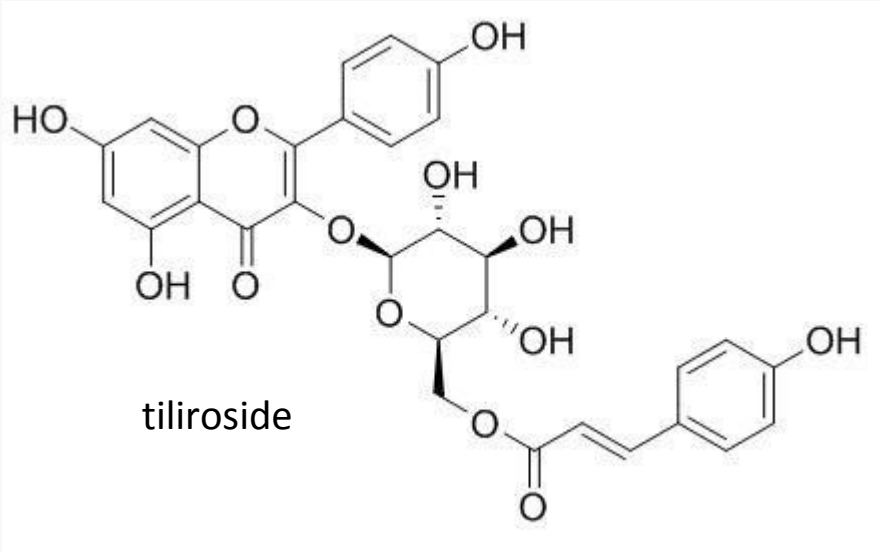
- Mother plant: ***Tilia cordata, Tilia platyphyllos, Tilia x vulgaris,*** **Tiliaceae,** Lime

Tiliae flos CzPh 2017

- Macroscopy: whole small yellow-green hermaphrodite flowers in clusters of five to eleven with a leafy yellow-green subtending bract, characteristic odour, sweet mucilaginous taste

Tiliae flos CzPh 2017

- Content compounds: **flavonoids** (glycosides of quercetin and kaempferol + esters with acids such as **tiliroside**), mucilage, tannins, phenolic acids (caffeic, chlorogenic), essential oil

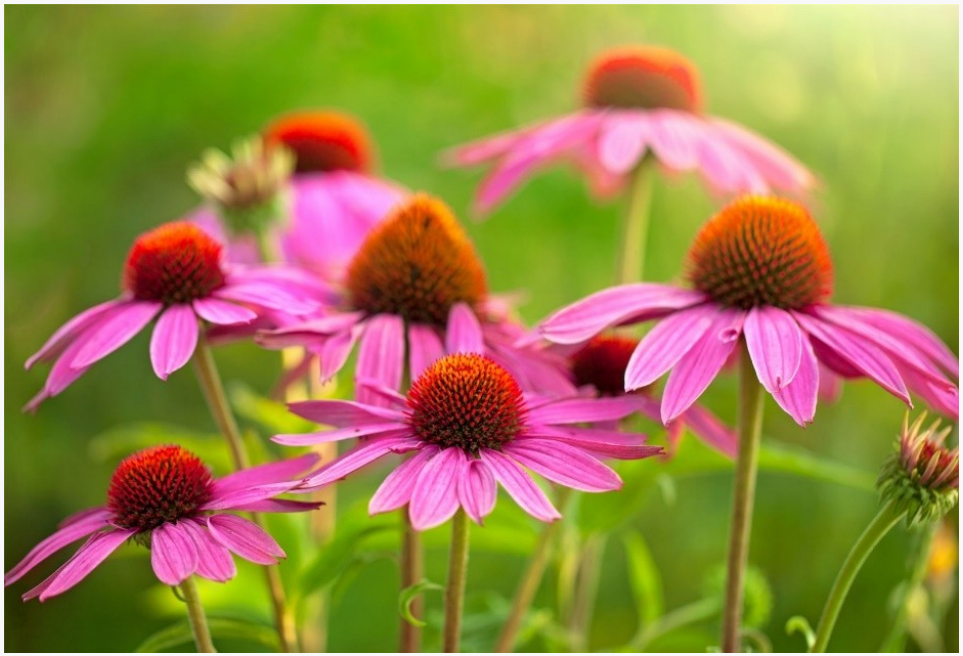


tiliroside

- Usage: diaphoretic, diuretic, mucilaginose

Echinaceae flos

- Mother plant: ***Echinacea purpurea*, Asteraceae,** Purple Coneflower
  - Echinaceae angustifoliae radix CzPh 2009
  - Echinaceae pallidae radix CzPh 2009
  - Echinaceae purpureae radix CzPh 2009
  - Echinaceae purpureae herba CzPh 2017

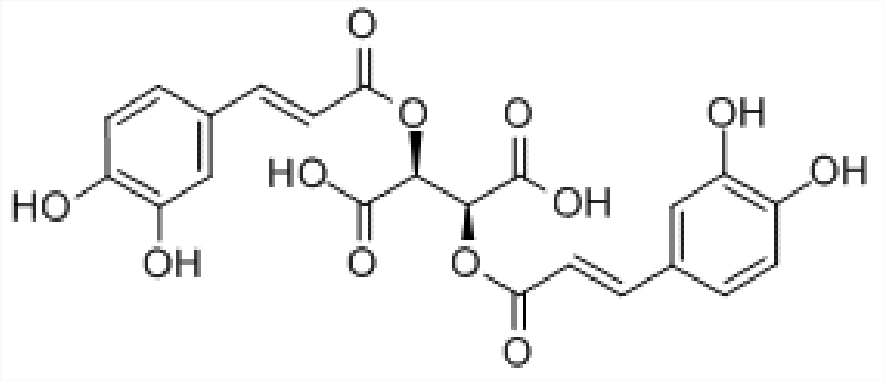


Echinaceae flos

- Macroscopy: flower heads with strongly concaved *receptacle*, ray florets are purple, sterile, down directed, tubular florets are androgynous, greenish

Echinaceae flos

- Content compounds: **essential oil** (mono- and sesquiterpens), **polyphenols** (esters of caffeic acid – cichoric and caftaric acid), polysaccharides, anthocyans



cichoric acid

- Usage: stomachic, antitussic, immunomodulation