Polyplant Moisturizing

Polyplant Moisturizing is a complex of vegetable extracts containing the following plants, Arnica, Ivy, Mallow, Cucumber, Wall Pellitory, Elder tree, and Lime Tree.

Arnica

![Arnica Image]

**BOTANY**

*Arnica montana* L. known also as arnica, is a member of the Compositae (Asteraceae) family. It is an aromatic herbaceous perennial. The leaves, arranged in a basal rosette, are alternate, large (5-17 x 2.5-5.5 cm), hairy, elliptic or obovate, with inconspicuous petioles, entire margins and acrodromous veins.

The stem bears two small opposite leaves, and a large (5-8 cm diameter) solitary inflorescence, also called flower head. Occasionally, two or three flower heads grow clustered in a cyme. The inflorescence involucrum is composed of two rows of narrow lanceolate bracts. The flowers are yellow or orange. The fruit is a brown achene 6-10 mm long with a pappus of simple bristles. Flowers appear during the summer.

Arnica is native to the centre and south of Europe, central Asia and North America. It grows in sunny mountainous areas, especially in the Alps, on plains and peaty areas, preferentially on acidic, sandy and humus-rich soils. Wild arnica is harvested from Europe to Southern Russia. The main producers are Yugoslavia, Spain, Italy and Switzerland.

Flowers are the part used of arnica.
CHEMISTRY

Sesquiterpene lactones
The main components of arnica flowers are guaianolide-type sesquiterpene lactones (0.2-0.8%), especially helenalin, 11a,13-dihydro-helenalin, chamissonol and their corresponding esters with short chain fatty acids (acetic, isobutyric, 2-methyl-butanoic, isovaleric, α- methacrylic and tiglic acids).

Fig.1. Helenalin (left) and dihydrohelenalin (right).

Sesquiterpene lactones are a large group of substances of about 3000 known structures. The botanical distribution of sesquiterpene lactones is rather sporadic. Some can be found in Fungi and Briophyte, some in Angiospermae, most of them in Asteraceae. In these later plants, lactones are often found in the secretory hairs of the leaves, stems and inflorescence bracts. They can also be found in achenes and, very seldom, in the underground organs (Bruneton J., 2001).

Different structures of sesquiterpene lactones exist, although all of them are related to the cyclo-decadienyl cyclation product of 2E, 6E-farnesyl pyrophosphate. It is generally accepted that the main skeletons come from the cyclation of the cyclo-decadienyl cation via germacranoles, although experimental evidence is scarce (Bruneton J., 2001).

The terpene alcohols arnidiol and faradiol are also found in arnica.

Flavonoids
Flavonoids provide between 0.2 and 0.6 % of the flower heads composition. They are mainly heterosides of hispidulin, patuletin, kaempferol, quercetin, astragalin, isoquercitrin, quercetol-3-gluco-galacturonide, 7-O-glucosyl-luteolin, spinacetin, and others. The flavonoids, together with the carotenoids (α and β-carotene, zeaxanthin, epoxide derivatives (xanthophyllepoxide, etc.), give arnica flower heads their yellow-orange color.

Phenol acids
Cinnamic acid and its derivatives (caffeic acid, chlorogenic acid, cynarin).

Essential oil
Arnica flower heads also contain essential oil (0.2-0.4%), composed of 40-50% fatty acids, approximately 9% n-alkanes and thymol derivatives, as well as further monoterpenes and sesquiterpenes (including α-phelandrene, myrcene, humulene, α-cadinene and caryophyllene oxide).

Other active principles
Tannins, arnicin (crystallizable, with a complex structure and bitter taste), coumarins (umbelliferone, scopoletin), high molecular weight polysaccarides, phytosterin (arnisterin), choline (0.1%), betaine, inulin, manganese salts, traces of pyrrolizidine alkaloids (tussilagine and isotussilagine) and fatty acids (oleic, palmitic and lauric acids).
TRADITIONAL USES

Arnica is often used as an ointment to treat contusions, bruises and hematoma. One part of arnica tincture diluted with four parts of water is a classical remedy for contusions, bruises, sprains and injuries (not for open wounds). The tincture, further diluted (a teaspoonful in a glass of warm water), may be used as a gargle for tonsillitis, sore throat and mouth mucosa inflammation. Arnica may also be used internally as an abortive, lipid lowering substance, antifungal, hypertensive and cardiac stimulant. It produces a mild sedative antispasmodic effect on blood vessels, very helpful to treat coronary and vascular diseases.

Ivy

BOTANY

_Hedra helix_ L. Common name _Ivy_. This climbing, perennial, woody plant belongs to the Araliaceae family. This family of plants has characteristic adventitious roots with tiny adhering discs, which allow the plants to climb. Sterile stems bear three- to five-lobed leaves, which vary from triangular-ovate to kidney-shaped, glossy dark-green blades with light-green veins. The leaves on fertile flowering stems are rhomboid-lanceolate. Flowers are small, greenish colored, arranged in umbels; they appear in autumn, in at least 10-years-old plants. Fruits are black berries, about 6 mm in diameter, with fleshy pulp enclosing 2 to 5 seeds. Ivy is native to Europe. It is widely spread in temperate regions, especially in Asia (from India to Japan) and north of Africa. It grows in fences, conifer forests, rocky soils and walls. In garden cultivation, more than 40 foliage forms can be found.

Leaves are the part used of ivy.

CHEMISTRY

**Flavonoids**
Rutin, kaempferol-3-rutinoside.

**Saponins**
Hederin with its sub-units, hederacosides A and C, hederagenin, glucopyranosyl-hederagenin, cauloside F.

**Polyphenolic acids**
Caffeic and chlorogenic acids.

**Other active principles**
Traces of alkaloids (emetine), polyacetylenes (falcarnione; falcarinol), phytosterols (sitosterol, stigmasterol, spinasterol, campesterol), sesquiterpenes (germacranene, β-elemene), iodine.
TRADITIONAL USES

In external use, ivy is applied on wounds that take too long to heal, inflammations, parasitical conditions (lice, scabies, pyoderma) and aching areas. In Mexico, abscesses are usually treated with hot poultices of boiled ivy leaves. Sweating hands are treated by scrubbing ivy leaves and then sprinkling vegetable sulfur powder on them, for several days. Small bandages soaked with vinegar, in which a large ivy leaf has been left to macerate for 24 hours, are usually applied on callosities. Ivy is also used in gels, ointments and creams for cosmetic uses.

Mallow

![Mallow flower](image)

BOTANY

*Malva sylvestris* L., common name mallow, is an annual or biannual plant, semi-woody at the base, which belongs to the Malvaceae family. The stems – erect, hairy and branched – grow up to one meter tall. The leaves are alternate and hairy, long-petioled, with toothed margins and palmate veins. The flowers are large (2.5 to 4cm diameter) blue or purple, with five slender petals, arranged in bunches at the axils of leaves. Flowering occurs in spring and summer. The fruit is a yellowish achene cetum

Mallow occurs spontaneously in almost the whole of Europe, North of Asia and Africa. This plant grows on roadsides, embankments, slopes, forest clearings, walls and modified soils, due to the penetration ability of its thin roots. It requires temperate-warm climates or mountain conditions. In America (from Mexico to Argentina and Chile), mallow is adventitious. The main producers are central European countries.

Flowers are the part used of mallow.
CHEMISTRY

Mucilage
10-16%. Mallow contains uronic mucilages. Upon hydrolysis, they generate D-galacturonic acid, D-glucose, D-galactose, L-rhamnose and L-arabinose.

Phenolic compounds

- Anthocyanosides
  7%. Malvin and its genin malvidin.
- Flavonoids
  Derivatives of gossypetine and hypoletin.
- Phenolic acids
  p-coumaric acid, chlorogenic acid and caffeic acid
- Tannins

TRADITIONAL USES

The genus name *Malva* comes from the Greek word *malazos* = «soft», in reference to the emollient properties of this plant. The species name *sylvestris* derives from the Latin *silva* = «forest», in reference to the habitat, where it usually grows.

Mallow flowers are usually prepared as an infusion – alone or in combination with eucalyptus, borage or balm mint – to treat bronchial catarrh, cough and as a diuretic. In some regions, teaspoonfuls of mallow water extract are usually added to the feeding bottles of nursing babies to relief cough.

Cucumber

BOTANY

*Cucumis sativus* L. is an annual herb from the Curcubitaceae family. This plant has a canopy of large green leaves over the fruits; the fruits grow on lateral sprouts that emerge from the leaves axils. Since this plant bears tendrils, it may grow either creeping or climbing a trellis. The thick and thorny stems have nodes, each bearing a tendril and a leaf.

The fruit, cucumber, is a vegetable with a dark green or yellowish peel (depending on the cultivar) cylindrical and elongated shape and about 30 cm long. The pulp is white and watery, with small flat seeds all along the fruit.

The part used of cucumber is the fruit.
Carbohydrates
- Mono and oligosaccharides
  Main sugars in food vegetables are glucose and fructose (0.3-4%) as well as saccharose (0.1-12%). Small amounts of other sugars can also be found (Belitz & Grosch, 1997).
- Polysaccharides
  Starch is widely spread in vegetables as a reserve carbohydrate. Other polysaccharides found in vegetables are cellulose, hemicellulose and pectin (Belitz & Grosch, 1997).

Organic acids
The main acids in vegetables are citric and malic acids (Belitz & Grosch, 1997).

Phenol compounds
P-hydroxybenzoic acid, hydroxycinnamic acid, flavones and flavonols are widely spread compounds in vegetables (Belitz & Grosch, 1997).

Vitamins
Cucumber is a vegetable rich in vitamin C and vitamin B (Musmade & Desai, 1998).

Table 1 summarizes the vitamin content in cucumber.

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<thead>
<tr>
<th>Vitamins</th>
<th>Content (mg/100 g dry weight)</th>
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</thead>
<tbody>
<tr>
<td>Ascorbic acid</td>
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<tr>
<td>Thiamin</td>
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</tr>
<tr>
<td>Riboflavin</td>
<td>0.04</td>
</tr>
<tr>
<td>Nicotinic acid</td>
<td>0.2</td>
</tr>
<tr>
<td>Folic acid</td>
<td>0.02</td>
</tr>
</tbody>
</table>

Table 1. Vitamin content in cucumber (mg/ 100 g fresh weight).
(Belitz & Grosch, 1997)

Minerals
Table 2 shows the mineral content in cucumber. Potassium is by far, the most abundant component in this fraction, followed by calcium, sodium and magnesium. The most important anions are phosphate, chlorine and carbonate (Belitz & Grosch, 1997).

<table>
<thead>
<tr>
<th>Minerals</th>
<th>Content (mg/100 g fresh tissue)</th>
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<tbody>
<tr>
<td>K</td>
<td>141</td>
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<tr>
<td>Na</td>
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<td>Ca</td>
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<tr>
<td>Mg</td>
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<td>Fe</td>
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<tr>
<td>Cl</td>
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</tr>
<tr>
<td>F</td>
<td>0.02</td>
</tr>
<tr>
<td>J</td>
<td>0.003</td>
</tr>
</tbody>
</table>

Table 2. Minerals in cucumber (mg/100 g fresh tissue).
(Belitz & Grosch, 1997)
Aromatic substances
The following aldehydes are essential components of cucumber aroma: trans-2,cis-6-nonadienal and trans-2-nonenal. Linoleic and linolenic acids are precursors to these and some other aldehydes (cis-3-hexenal, trans-2-hexenal, trans-2-nonenal) (Belitz & Grosch, 1997). These aromatic substances are the main cause of the astringent flavor of cucumber (Musmade & Desai, 1998).

Bitter principles
Cucumber has a characteristic bitter principle called cucurbitin, which is a tetracyclic triterpene (Musmade & Desai, 1998).

TRADITIONAL USES
Cucumber pulp, macerated in alcohol and subsequently distilled, is used to prepare an ointment for external applications that refresh and smooth dry skin. Applied as poultice, cucumber pulp is beneficial for throat-related illnesses. Emulsion of cucumber seeds is used to treat hemorrhoids, rash, abscesses and other skin eruptions. Cucumber juice is an excellent treatment for skin rash, inflammation, etc., when applied as a lotion or used to wash the affected zone. Furthermore, it works wonderfully to smooth the skin and erase skin spots, freckles and wrinkles, thus rejuvenating the skin.

Wall Pellitory

BOTANY
Parietaria officinalis L. Family Urticaceae. It is commonly known as wall pellitory. The plant is a perennial, which is heavily branched, bushy, leafy and grows to 70 cm. It has a reddish hard stem and narrow pwtiolate, ovate-lanceolate or elliptical, long-acuminate leaves 2.5 to 5 cm long. The stem and the under surface of the leaf ribs are softly pubescent. The upper surface of the leaves is almost glaborous and the ribs sunken. The small, green, sessile flowers grow in axillary racemes and bloom the whole summer. The bracteoles are free and are shorter than the calyx. The filaments of the stamens are strangely jointed and so elastic that when they are touched before the flower has opened, they uncoil from their rolled up position and distribute the pollen. The achaenes are black.

Stems and leaves are the part used of wall pellitory.
CHEMISTRY

Tannins
Tannins are phenolic, water-soluble compounds with a molecular weight between 500 and 3,000 that, besides taking part in the classical reactions of phenols, precipitate alkaloids, gelatin and other proteins. At present, there is a better understanding of the chemical structure of these polyphenols, which are composed of proanthocyanidols (which yield anthocyanosides in acid medium at high temperature) and polyesters of the gallic and ellagic acids (Bruneton J., 2001).

Flavonoids
Lato sensu, flavonoids are pigments almost universally present in vegetables. Almost always water-soluble, they are responsible for the colour of flowers, fruits and sometimes leaves. All flavonoids – more than 4,000 – come from a common biosynthetic origin. Due to this structural homogeneity, a large number of substances are included under this name (Bruneton J., 2001).

Mucilages
Mucilages are osidic macromolecules, more or less soluble in water, that form gel or colloidal solutions (water retention agents).

Other active principles
Mineral salts (sulphurated compounds, potassium nitrate, calcium oxalate), glycosides, glycolic acid, glyceric acid.

TRADITIONAL USES

In traditional medicine, wall pellitory has been used as diuretic. Externally, it has been used thanks to its emollient and vulnerary properties that are useful to treat wounds and to prevent infections. Mucilages and tannins are some of the active principles implicated in these activities. This plant also helps to reduce inflammation and to relieve pain of tendons and ligaments.

Elder tree

BOTANY

_Sambucus nigra_ L. is a small tree or shrub, member of the Caprifoliaceae family. Common name elder tree. This plant grows 4-10m tall; the bark is gray, with wide grooves, where the inner white surface can be observed; the deciduous leaves are opposite, pinnate, with 5-7 toothed leaflets; the flowers are small, white, aromatic, clustered in corymbs or large cymes, with black berries bearing three seeds inside. Elder tree is native to Europe, Western Asia and Northern Africa and has been introduced into other regions. This plant grows in fences, forests and in the outskirts of cool areas, up to 1000m altitude; it requires humid, nitrogen-rich soils; its many varieties may be also cultivated as ornamental plants.

Flowers are the part used of _S.nigra_.

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CHEMISTRY

Flavonoids
Up to 2%, mainly: rutoside, isoquercitrin, hyperoside, astragalin, quercetin and kaempferol.

Phenolic acids
Chlorogenic acid (3%), caffeic acid, ferulic acid and p-coumaric acid.

Other active principles
Tannins, pectins, mucilages, amines (ethylamine, isobutylamine), choline, vitamin C, triterpenes (2%; α- and β- amyrin, ursolic acid and oleanic acid), essential oil (0.3%) and phytosterols.

TRADITIONAL USES

This species has been long used for medicinal purposes. Elder tree used to be much prized by rural Europeans, especially during the XIII and XVIII centuries. This plant was habitually called “the medicine of peasants” because of the beneficial properties of the infusion on the respiratory system. Elder tree flowers are prepared as an infusion to treat flu, sinusitis, edema, children’s asthma, conjunctivitis, rheumatism, colds and as a sudorific agent.

Lime tree

BOTANY

*Tilia platyphyllos* Scop. (=*Tilia grandifolia* Ehrh.) is commonly known as Large Leaved Lime or Large Leaved Linden. It is a deciduous tree that belongs to the Tiliaceae family. This tree grows between 15 and 40 meters tall. The trunk is straight and robust; the leaves are cordate at the base and sharply acuminate to the apex, margins serrate, with petioles and palmate veins on the underside. Flowers are pentamericous, aromatic, yellow, clustered in erect or drooping cymes composed of 2 to 10 flowers; the sepals easily detach from the flower, the petals are narrow, spatulate, with fine veins; the stamens are generally clustered in groups of 5. The inflorescence axis bears a yellowish-green, membranous, leaf-like bract, welded approximately to the middle of the mid-vein. Flowers appear during the summer. The fruit is a globose achene with the appearance of an indehiscent capsule, with five ribs. Most of the *Tilia* species are native to boreal-temperate regions.

Flowers are the part used of *Tilia platyphyllos*. 
CHEMISTRY

Flavonoids
Lime Tree inflorescences contain 1% flavonoids, particularly heterosides with quercetin (rutoside, hyperoside, quercitroside and isoquericitroside) and with kaempferol (tiliroside, astragalin)

Mucilage
Mucilage can be found in about 3-10% proportions. The main polysaccharides are those of the arabinogalactan type.

Condensed tannins
Tannins can be found in a 2% proportion.

Other active principles
Phenylcarboxylic acids (derivatives of the cinnamic and benzoic acids: caffeic, chlorogenic and p-coumarinic acids), traces of essential oil (0.02%), gum, manganese salt, amino acids (alanine, cysteine, cystine, isoleucine, leucine, phenylalanine and serine), saponin, tocopherol and proanthocyanidin.

TRADITIONAL USES

Lime Tree inflorescences have traditionally been used to prepare infusions with mild sedative properties on the central nervous system. Lime Tree has also been attributed choleretic, antispasmodic and vasodilator properties, which have been used to treat migraine and hepatobiliar conditions.

COSMETIC PROPERTIES

Transepidermal water loss (TEWL) regulatory activity
This activity is due to the carbohydrate content of Polyplant Moisturizing. These actives are broadly used in the cosmetic field.

Carbohydrates are active principles extensively used in cosmetics. Monosaccharides are hygroscopic, namely they adsorb water thus contributing to keep a healthy moisture level in the horny layer. Oligosaccharides have the same property. These active compounds build hydrogen bonds, prevent massive water loss and reduce dehydration. Additionally, some of these compounds make a protective coat on the skin, thus preventing and slowing down transepidermal water loss.

Mucilages are hygroscopical substances, namely they absorb and retain water. Because of their large size, these substances remain on the stratum corneum surface, where they have moisturizing and filmogenic effects that remarkably improve the skin biomechanical properties.

Then, Polyplant Moisturizing is recommendable to formulate cosmetic products with moisturizing activity.
**Vessel-protection and venotonic activities**

This activity of Polyplant Moisturizing is mainly due to its content in flavonoid, anthocyanosides and saponins.

Flavonoids are used in the treatment of blood vessels disorders such as varices, chronic venous insufficiency (CVI), low capillary resistance, etc. Their protective effect is due to their high affinity for proline-rich proteins, such as collagen and elastin. Since these proteins are structural components of veins, their degradation weakens the blood vessels, thus inducing edema and swelling of the lower limbs. Oral administration of flavonoids has been observed to effectively improve the capillary resistance in animal models.

On the other hand, anthocyanosides have been successfully employed to treat several vascular conditions: capillary fragility (couperosis) and chronic peripheral vein insufficiency. Up to the moment, their capillary protective action has been attributed to their tendency to improve the tonicity and resistance of the capillary walls and to their specific affinity to bind compounds in the elastic fibbers (collagen and elastin) thus making them more resistant to the degrading actions of elastase and collagenase (Muñoz O. et al., 2003).

Ivy saponins have demonstrated *in vitro* anti-elastase and anti-hyaluronidase activities, useful for the protection and for the treatment of vein insufficiency. Saponins inhibit the hyaluronidase activity in a non-competitive, dose-dependent way. In this respect, hederagenin showed $IC_{50}=280.4\ \mu M$, while α-hederin and hederacoside C showed very low activity (Alonso, J., 2004).

Thus, Polyplant Moisturizing is recommendable to formulate cosmetic products with stimulating activity on general blood circulation.

Finally, we should mention the reference publications *Plants in cosmetics. Vol. I* (Council of Europe, 1994) and *Plants in cosmetics. Vol.II* (Council of Europe, 2001). The first one includes monographies of arnica, ivy, mallow, cucumber and lime tree. The second one includes a monograph of elder tree. The cosmetic effects attributed to them are the following:

**Arnica Montana**

Monograph dedicate to the glycolic extract, oil tincture, and hydroalcoholic extract of the arnica flowers, which mentions the following cosmetic effects and recommends the following maximum concentrations:

- tonic and stimulant.
  - up to 10% hydroalcoholic tincture and oily extract.
  - up to 2% glycolic extract to formulate scalp simulation products, massage oils and emulsions, as well as bath and shower gel to be used after exercise, and body massage products.

- other possible effects: anti-edema, anti-ecchymoses, revulsive and antiseptic.

**Hedera helix**

Monograph on the dry hydroalcoholic extract and the glycolic extract of the leaves and roots of *Hedera helix* L., which attributes them the following cosmetic effects.

- tonic, astringent, lenitive
  - up to 3% of the dry extract
  - up to 10% of the glycolic extract
  - in creams, lotions, body massage gels

- other possible effects: astringent, micro-circulation protection, anti-edema, antiseptic
Malva sylvestris
Monograph on the hydroalcoholic mild extract and the glycolic extract of *M. sylvestris* flowers and leaves, which mentions the following cosmetic effects:

- calming, soothing, demulcent
  up to 10% of the glycolic extract
  up to 2% of the mild extract in sensitive and delicate skin products, bath and shower products, mouth wash
- other possible effects: anti-irritation, emollient and vessel-protection

Cucumis sativus
Monograph on the fresh juice extracted from *Cucumis sativus* L. fruits, where the following cosmetic effects are attributed to it:

- refreshing, emollient, lenitive, anti-itching
- A further possible effect is astringency

Tilia spp.
Monograph on the hydroalcoholic dry extract, glycolic extract and oil tincture obtained from the flowers of *Tilia spp.*, that attributes them the following cosmetic effects:

- soothing, calming, relaxing and refreshing.
  Up to 10% of the extract included in products for baby care, sensitive skin care, bath and shower gel, personal hygiene and sensitive-skin shampoo.
- other possible effects attributed to them are: mild sedative, anti-inflammatory, emollient and vaso-protective.

Sambucus nigra
Monograph on the *Sambucus* extract, and the hydroalcoholic extract and the distilled water of *S. nigra* flowers and fruits, which attributes them the following cosmetic properties:

- (distilled water)
  Eye contour lotions and sensitive skin products (as a vehicle). To reduce the intensity of freckles and sun-spots on the skin (traditional use).
- (extract)
  Dry-skin products, to refresh the skin, “pre-sun” products, mouth-wash and gargles.
  Mild tonic, astringent, refreshing, calming, protective, moisturizing, coloring (fruits)
- Other possible effects are: diaphoretic, diuretic, granulation-promoting agent, anti-inflammatory, vein astringent agent and anti-hemorrhoid (traditional use).

COSMETIC APPLICATIONS

<table>
<thead>
<tr>
<th>Action</th>
<th>Active</th>
<th>Cosmetic Applications</th>
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</thead>
<tbody>
<tr>
<td>TWEL regulation</td>
<td>Carbohydrates</td>
<td>-Moisturizing</td>
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<td>-Decongestant</td>
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<td>-Anti-ageing</td>
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<tr>
<td>Vessel-protection and</td>
<td>Flavonoids Anthocyanosides</td>
<td>-Blood flow activator</td>
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<tr>
<td>venotonic</td>
<td>Saponins</td>
<td>-Decongestant</td>
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</table>
RECOMMENDED DOSE

The recommended dose is between 0.5% and 5.0%.

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Mallow

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Elder tree

Websites:
Lime tree


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