

Arnica

Species (Family)

Arnica montana L. (Asteraceae/Compositae)
Arnica chamissonis Less. ssp. *foliosa* (Nutt.) Maguire
also allowed in German Pharmacopoeia.^(G52)

Synonym(s)

Leopard's Bane, Mountain Tobacco, Wolf's Bane

Part(s) Used

Flower

Pharmacopoeial and Other Monographs

BHP 1996^(G9)
BP 2001^(G15)
ESCOP 1997^(G52)
Martindale 32nd edition^(G43)
Mills and Bone^(G50)
PDR for Herbal Medicines 2nd edition^(G36)
Ph Eur 2002^(G28)

Legal Category (Licensed Products)

GSL, for external use only.^(G37)

Constituents^(1-3, G2, G22, G41, G52, G64)

Alkaloids Traces of non-toxic alkaloids tussilagine and isotussilagine⁽⁴⁾ but these are reportedly artefacts produced during extraction.⁽⁵⁾

Amines Betaine, choline and trimethylamine.

Carbohydrates Mucilage, polysaccharides including inulin.

Coumarins Scopoletin and umbelliferone.

Flavonoids Betuletol, eupafolin, flavonol glucuronides,⁽¹⁻³⁾ hispidulin, isorhamnetin, kaempferol, lacinatin, luteolin, patuletin, quercetin, spinacetin, tricetin and 3,5,7-trihydroxy-6,3',4'-trimethoxyflavone.

Terpenoids Sesquiterpene lactones of the pseudo-guaianolide-type, 0.2–0.8%.^(G52) Pharmacopoeial standard not less than 0.4%.^(G15, G28) Helenalin,⁽⁶⁾ 11 α ,13-dihydrohelenalin and their esters with acetic,

isobutyric, methacrylic, tiglic and other carboxylic acids.^(G52) Diterpenes including α -labd-13-ene-8 α ,15-diol.⁽⁷⁾

Volatile oils Up to 1%, normally about 0.3%. Thymol and thymol derivatives.

Other constituents Amino acid (2-pyrrolidine acetic), bitter principle (arnicin), caffeic acid, carotenoids, fatty acids, phyosterols, polyacetylenes, resin, tannin (unspecified).

Food Use

Arnica is listed by the Council of Europe as a natural source of food flavouring (category N2). This category indicates that arnica can be added to foodstuffs in small quantities, with a possible limitation of an active principle (as yet unspecified) in the final product.^(G16) In the USA, arnica is listed by the Food and Drugs Administration (FDA) as an 'unsafe herb',^(G22) and is only approved for food use in alcoholic beverages.^(G41)

Herbal Use^(G2-G4, G32, G43, G50, G52, G54)

Arnica is stated to possess topical counter-irritant properties. It has been used for unbroken chilblains, alopecia neurotica, insect bites, gingivitis, aphthous ulcers, rheumatoid complaints and specifically for sprains and bruises.^(G2, G7, G52, G64)

German Commission E approved external use for injuries and consequences of accidents, e.g. haematoma, dislocation, contusions, oedema due to fracture, rheumatoid muscle and joint pains, inflammation of oral and throat region, furunculosis, inflammation caused by insect bites and superficial phlebitis.^(G3, G4)

Arnica is mainly used in homeopathic preparations; it is used to a lesser extent in herbal products.

Dosage

Tincture of arnica flower (BPC 1949) 2–4 mL for external application only.

Preparations Ointments, creams, gels, compresses made with 5–25% v/v tinctures, 5–25% v/v fluid

extracts, diluted tinctures or fluid extract (1:3–1:10), decoctions 2.0 g drug/100 mL water.^(G3,G4)

Pharmacological Actions^(G50,G52,G56)

In vitro and animal studies

Antimicrobial activity Arnica has been reported to exhibit bactericidal properties against *Listeria monocytogenes* and *Salmonella typhimurium*.^(G41) Helenalin and related sesquiterpenes from arnica have antimicrobial activity against *Bacillus subtilis* and *Staphylococcus aureus*,⁽⁸⁾ *Corynebacterium insidiosum*, *Micrococcus roseus*, *Mycobacterium phlei*, *Sarcinia lutea* and *Proteus vulgaris*.^(G52) Antifungal activity against *Trichophyton mentagrophytes*, *Epidermaphyton* spp. and *Botrytis cinerea* is reported for helenalin.^(8,G52)

Antitumour activity The cytotoxicity of 21 flavonoids and five sesquiterpene lactones from *Arnica* spp. has been investigated *in vitro* in studies using GLC₄ (a human small cell lung carcinoma) and COLO 320 (a human colorectal cancer) cell lines.⁽⁹⁾ The most potent compound, helenalin, had an IC₅₀ value of 0.44 µmol/L against GLC₄ and 1.0 µmol/L against COLO 320 after 2 hours exposure.⁽⁹⁾ Some of the individual flavonols and flavones of arnica at non-toxic concentrations significantly reduced helenalin-induced cytotoxicity *in vitro*.⁽¹⁰⁾

Anti-inflammatory activity Moderate (29%) anti-inflammatory effect in the carageenan rat paw model has been reported for arnica.⁽¹¹⁾ Helenalin is a potent inhibitor in this test and in chronic adjuvant arthritis tests in rats.⁽¹²⁾ The α-methylene-γ-lactone moiety of sesquiterpenes is required for activity, and the potency of helenalin is enhanced by the presence of the 6-hydroxy group.⁽¹³⁾ The mode of action of sesquiterpene lactones as anti-inflammatory agents is at multiple sites. At a concentration of 5×10^{-4} mol/L, the compounds uncoupled oxidative phosphorylation of human polymorphonuclear neutrophils, elevated cyclic adenosine monophosphate (cAMP) levels of rat neutrophils, and rat and mouse liver cells, and inhibited free and total lysosomal enzyme activity.⁽¹²⁾ Human polymorphonuclear neutrophil chemotaxis was inhibited at 5×10^{-4} mol/L, whereas prostaglandin synthetase activity was inhibited at concentrations of 10^{-3} mol/L. Helenalin and 11α-13-dihydrohelenalin inhibited collagen-induced platelet aggregation, thromboxane formation and 5-hydroxytryptamine secretion in a concentration-dependent manner.⁽¹⁴⁾

Other activities Helenalin has potent activity in the hotplate tail flick analgesic test in mice.⁽¹³⁾

Helenalin has also been reported to possess immunostimulant activity *in vitro*,⁽¹⁵⁾ while high molecular weight polysaccharides have been found to exhibit immunostimulant activity *in vivo* in the carbon clearance test in mice.^(15,16)

Arnica contains an adrenaline-like pressor substance and a cardiotoxic substance.^(G24)

Clinical studies

A gel preparation of arnica flowers applied externally to the limbs of 12 male volunteers was more effective than placebo in the treatment of muscle ache.^(G50,G52) In a randomised, double-blind, placebo-controlled study, 89 patients with venous insufficiency received arnica gel (20% tincture) or placebo.^(G50) It was reported that arnica treatment produced improvements in venous tone, oedema and in feeling of heaviness in the legs.

Side-effects, Toxicity

Arnica is poisonous if taken internally. It is irritant to mucous membranes and ingestion may result in fatal gastroenteritis, muscle paralysis (voluntary and cardiac), increase or decrease in pulse rate, palpitation of the heart, shortness of breath, and may even lead to death.^(G33,G41) Helenalin is stated to be the toxic principle responsible for these effects.^(G33) Thirty millilitres of a 20% arnica tincture, taken by mouth, was reported to produce serious, but not fatal, symptoms.^(G41) The topical application of arnica has been documented to cause dermatitis.^(17,G51) Arnica is a strong sensitiser, with the sesquiterpene lactone constituents implicated as the contact allergens: they possess an α-methylene group exocyclic to a γ-lactone ring, which is recognised as an immunological prerequisite for contact allergy.^(17,18) Helenalin is also reported to possess cytotoxic activity and this has been attributed to its ability to alkylate with sulphhydryl groups.^(G33) Helenalin was not mutagenic in the *Salmonella typhimurium* assay.^(G52)

Contra-indications, Warnings

Arnica should not be taken internally except in suitable homeopathic dilutions.^(G42)

Externally, arnica is poorly tolerated by some people, precipitating allergic reactions in sensitive individuals.^(G42) It should only be applied to unbroken skin and withdrawn at the first sign of reaction.^(G7) Toxic allergic skin reactions have occurred following application of the tincture.^(G33)

Pharmaceutical Comment

The chemistry and pharmacology of arnica are well documented, but there is a paucity of clinical data. Anti-inflammatory properties associated with sesquiterpene lactones justify the herbal uses, although allergenic and cytotoxic properties are also associated with this class of constituents. Arnica is not suitable for internal use, although it is present in some homeopathic products. External use of arnica tincture, which is included as an ingredient in some cosmetics, hair shampoos and bath preparations, may cause an allergic reaction. The pyrrolizidine alkaloids tussilagine and isotussilagine, reportedly present in arnica, are non-toxic. Moreover, they are artefacts produced during the extraction process with methanol.

References

See also General References G2, G9, G11, G15, G16, G19, G22, G28, G29, G31, G32, G36, G37, G41, G42, G43, G48, G50, G51, G52, G54, G56 and G64.

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