Hops

Species (Family)

Humulus lupulus L. (Cannabinaceae/Moraceae)

Synonym(s)

Humulus, Lupulus

Part(s) Used

Strobile

Pharmacopoeial and Other Monographs

BHC 1992[G6]
BHP 1996[G9]
BP 2001[G15]
Complete German Commission E[G3]
ESCOP 1997[G52]
Martindale 32nd edition[G43]
PDR for Herbal Medicines 2nd edition[G36]
Ph Eur 2002[G28]

Legal Category (Licensed Products)

GSL[G37]

Constituents[G2,G6,G22,G41,G48,G49,G52,G64]

Flavonoids Astragalin, kaempferol, quercetin, quercitrin and rutin.

Chalcones Isoxanthohumol, xanthohumol, 6-isopentenylnaringenin, 3′-(isoprenyl)-2′,4-dihydroxy-4′,6′-dimethoxychalcone, 2′,6′-dimethoxy-4,4′-dihydroxychalcone.[1]

Oleo-resin 15-30%. Bitter principles (acylphloroglucides) in a soft and hard resin. The lipophilic soft resin consists mainly of α-acids (e.g. humulone, cohumulone, adhumulone, prehumulone, posthumulone), β-acids (e.g. lupulone, colupulone, adlupulone), and their oxidative degradation products including 2-methyl-3-buten-2-ol[2,3,G52] The hard resin contains a hydrophilic δ-resin and χ-resin.

Tannins 2–4%. Condensed; gallocatechin identified.[4]

Volatile oils 0.3–1.0%. More than 100 terpenoid components identified; primarily (at least 90%) β-caryophyllene, farnescene and humulene (sesquiter-monoterpene).

Other constituents Amino acids, phenolic acids, gamma-linoleic acids, lipids and oestrogenic substances (disputed).[5]

It has been stated that only low amounts of 2-methyl-3-buten- 2-ol, the sedative principle identified in hops, are present in sedative tablets containing hops.[2] However, it is thought that 2-methyl-3-buten-2-ol is formed *in vivo* by metabolism of the α-bitter acids and, therefore, the low amount of 2-methyl-3-buten-2-ol in a preparation may not indicate low sedative activity.[6] Interestingly, relatively high concentrations of 2-methyl-3-buten-2-ol were found in bath preparations, suggesting that high concentrations of 2-methyl-3-buten-2-ol may be achieved in both tea and bath products containing hops.[2]

Food Use

Hops are listed by the Council of Europe as a natural source of food flavouring (category N2). This category indicates that hops 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, hops is listed as GRAS (Generally Recognised As Safe).[G65]

Herbal Use[G2,G4,G6,G7,G8,G32,G43,G52,G54,G56,G64]

Hops are stated to possess sedative, hypnotic and topical bactericidal properties. Traditionally, they have been used for neuralgia, insomnia, excitability, priapism, mucous colitis, topically for crural ulcers, and specifically for restlessness associated with nervous tension headache and/or indigestion. The German Commission E approved use for mood disturbances such as restlessness and anxiety as well as sleep disturbances.[G3] Hops are used in combination with valerian root for nervous sleeping disorders and conditions of unrest.[G3]

Dosage

Dried strobile 0.5–1.0 g or by infusion; 1–2 g as a hypnotic.

Liquid extract 0.5–2.0 mL (1 : 1 in 45% alcohol).

Tincture 1–2 mL (1 : 5 in 60% alcohol).

Pharmacological Actions

In vitro and animal studies

Antibacterial activity, mainly against Gram-positive bacteria, has been documented for hops, and attributed to the humulone and lupulone constituents.[7] The activity of the bitter acids against Gram-positive bacteria is thought to involve primary membrane leakage. Resistance of Gram-negative bacteria to the resin acids is attributed to the presence of a phospholipid-containing outer membrane, as lupulone and humulone are inactivated by serum phospholipids.[7] Structure–activity studies have indicated the requirement of a hydrophobic molecule and a six-membered central ring for such activity.[8]

The humulones and lupulones are thought to possess little activity towards fungi or yeasts. However, antifungal activity has been documented for the bitter acids towards *Trichophyton*, *Candida*, *Fusarium* and *Mucor* species.[9] Flavonone constituents have also been documented to possess antifungal activity towards *Trichophyton* and *Mucor* species, and antibacterial activity towards *Staphylococcus aureus*.[10]

Antispasmodic activity has been documented for an alcoholic hop extract on various isolated smooth muscle preparations.[11] Hops have been reported to exhibit hypnotic and sedative properties.[G41] 2-Methyl-3-buten-2-ol, a bitter acid degradation product, has been identified as a sedative principle in hops.[2,3] 2-Methyl-3-buten-2-ol has been shown to possess narcotic properties in mice and motility depressant activity in rats, with the latter not attributable to a muscle-relaxant effect.[12] It has also been suggested that isovaleric acid residues present in hops may contribute towards the sedative action. In mice, hops extract administered intraperitoneally (100, 250, 500 mg/kg) 30 minutes prior to a series of behavioural tests, resulted in a dose-dependent suppression of spontaneous locomotor at doses of 250 mg/kg for up to one hour.[13] The time for mice to be able to remain on a rota rod was decreased by 59 and 65% at doses of 250 mg/kg and 500 mg/kg, respectively. The time of onset of convulsions and survival time after administration of pentylenetetrazole (100 mg/kg) was significantly lengthened. Hops extract (35 mg/kg, intraperitoneal administration) produced a dose-dependent increase in sleeping time in mice treated with pentobarbitol. An antinociceptive effect was noted by increased latency of licking forepaws in hotplate tests and hypothermic activity observed from a time-dependent fall of rectal temperature at a dose of 500 mg/kg.[13]

Hops have previously been reported to possess oestrogenic constituents.[5] However, when a number of purified components, including the volatile oil and the bitter acids, were examined using the uterine weight assay in immature female mice, no oestrogenic activity was found.[5]

Clinical studies

Clinical studies have generally assessed hops given in combination with one or more additional herbs. For example, hops has been reported to improve sleep disturbances when given in combination with valerian.[14]

Hops, in combination with chicory and peppermint, has been documented to relieve pain in patients with chronic cholecystitis (calculous and non-calculous).[15] A herbal product containing a mixture of plant extracts, including hops and uva-ursi, and alpha-tocopherol acetate was reported to improve irritable bladder and urinary incontinence.[16]

Side-effects, Toxicity

Respiratory allergy caused by the handling of hop cones have been documented;[17] a subsequent patch test using dried, crushed flowerheads proved negative. Positive patch test reactions have been documented for fresh hop oil, humulone, and lupulone. Myrcene, present in the fresh oil but readily oxidised, was concluded to be the sensitising agent in the hop oil.[G51] Contact dermatitis to hops has long been recognised[G51] and is attributed to the pollen.[G41] Small doses of hops are stated to be non-toxic.[G42] Large doses administered to animals by injection have resulted in a soporific effect followed by death, with chronic administration resulting in weight loss before death.[G39]

Contra-indications, Warnings

It has been stated that hops should not be taken by individuals suffering from depressive illness, as the sedative effect may accentuate symptoms.[G45,G49] The sedative action may potentiate the effects of existing sedative therapy and alcohol. Allergic reactions have been reported for hops, although only following external contact with the herb and oil. Reports of oestrogenic activity are inconclusive.[G52] It is claimed that hops are not oestrogenic,[G56] but hop flower is said to have oestrogenic-binding activity and physiological oestrogenic effects.[18] Concern has been expressed that herbs with oestrogenic effects, including hops, may stimulate breast cancer

growth and oppose action of competative oestrogen receptor antagonists such as tamoxifen.[18]

Pregnancy and lactation *In vitro* antispasmodic activity on the uterus has been documented. In view of this and the lack of toxicity data, the excessive use of hops during pregnancy and lactation should be avoided.

Pharmaceutical Comment

The chemistry of hops is well documented and is characterised by the bitter acid components of the oleo-resin. Documented pharmacological activities justify the herbal uses, although excessive use should be avoided in view of the limited toxicity data.

References

See also General References G2, G3, G5, G6, G9, G11, G15, G16, G22, G28, G29, G31, G32, G36, G37, G39, G41, G42, G43, G48, G49, G51, G52, G54, G56 and G64.

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