



chewing gum, and tea, primarily as a stimulant; also in weight loss formulations (DUKE 3, TYLER 1).

Traditional Medicine. Guarana paste is used by South American natives mainly as a stimulant, astringent, in treating chronic diarrhea. The seeds, grated into water are also used for fevers, heart problems, headache (associated with menstrual or

rheumatic conditions), rheumatism, lumbago, migraine, and reduction of heat stress; diuretic (DUKE 2; DUKE 3).

COMMERCIAL PREPARATION

Guarana seeds, guarana paste and extracts.

Regulatory Status. Has been approved for food use (§172.510).

REFERENCES

See the General References for arctander; duke 2; duke 3; fema; furia and bellanca; stahl; terrell; tyler 1; uphof.

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HAWTHORN

Source: Crataegus laevigata (Poir) DC (syn. C. oxyacantha L.), C. monogyna Jacq., C. pinnatifida Bge., C. pinnatifida var. major N.E. Br., C. cuneata Sieb. et Zucc. and other Crataegus spp. (Family Rosaceae).

Synonyms. Bei shanzha or northern Chinese hawthorn (C. pinnatifida), nan shanzha or southern Chinese hawthorn (C. cuneata).

GENERAL DESCRIPTION

The genus *Crataegus* includes approximately 280 species primarily from northern temperate zones in East Asia (20), Europe (20) and Eastern North America (200+).

C. laevigata is a spiny shrub; leaves mostly smooth obovate, three to five lobed, serrulate; flowers white to pink with red anthers; fruit globose or ellipsoid, deep red; found in woods from northwest and central Europe, from England to Latvia, west to the Pyrenees and northern Italy; naturalized in eastern North America and India. Many smooth-leaved or slightly pubescent species in Europe have been treated as C. oxyacantha, a synonym for the official European source, resulting in much confusion in the botanical and pharmacy literature.

C. pinnatifida, C. pinnatifida var. major, and C. cuneata are source plants for the Chinese drug shanzha (dried hawthorn fruit). Crataegus pinnatifida is distributed in northeast China, Shanxi, and Jiangsu provinces. Crataegus pinnatifida var. major ("northern shanzha") is distributed in north and northeast China; supply mostly cultivated, in Shangdong, Henan, and Hebei. Crataegus cuneata "Southern shanzha," is grown the Changjian Valley in Guangdong and Guangxi (TUCKER 3, JIANGSU).¹

The part used is the dried fruits (China);

or flowering tops, leaves, or fruits (Europe).

CHEMICAL COMPOSITION

C. laevigata and C. monogyna contain flavonoids, including hyperoside (hyperin), quercetin, vitexin, vitexin-4'-L-rhamno-Dglucoside, vitexin-4'-L-rhamnoside, vitexin-4'-7-di-p-glucoside, rutin, quercetin-3rhamno-galactoside, and others; 1-4 pentacyclic triterpenes (0.5-1.4% in fruits), including oleanolic acid, ursolic acid, acantolic acid, neotegolic acid, 2-α-hydroxyoleanolic acid (crataegolic acid); 15 xanthine derivatives such as adenosine, adenine, guanine, and uric acid;1 amines, including dimethylamine, trimethylethylamine. amine, isobutylamine, isoamylamine, ethanolamine, β -phenylethylamine, choline, acetylcholine, O-methoxyphenethylamine, tyramine, and others; 1.6 proanthocyanidins; plus β -sitosterol, chlorogenic acid, caffeic acid, (+)-catechin, (-)-epicatechin, vitamins B₁, B₂, and C; calcium, iron, phosphorus, fructose, traces of an essential oil; and others (LIST AND HÖRHAMMER).1

PHARMACOLOGY OR BIOLOGICAL ACTIVITIES

Described activities of hawthorn and its preparations include cardiotonic, hypotensive, antiarrhythmic, antilipemic, antibacterial, stomachic, and analgesic. Pharmacological studies report enhanced coronary blood flow and myocardial perfusion; 7.8 improvement of cardiac muscle contractility; increased left ventrical output velocity; lowering of blood pressure; an antiarrhythmic effect; increased myocardium tolerance to oxygen deprivation under hypoxic conditions; stimulation of revascularization after myocardial ischemia (ESCOP 2).

Various clinical studies reveal increased cardiac performance and output; decrease in peripheral vascular resistance; decrease in pulmonary arterial and capillary pressures; reductions in blood pressure at rest and during exercise; and improved metabolic parameters (ESCOP 2).

Compounds associated with cardiotonic activity include hyperoside, vitexin, vitexin-2'-rhamnoside, oligomeric procyanidins, and (-)-epicatechin. The flavonoids and oligomeric procyanidins have a tonic effect on the cardiac muscles, are negatively chronotropic and dromotropic, and also show the bradycardiac effect commonly noted for *Crataegus* (LIST AND HÖR-HAMMER).

Similar activity has been reported for *C. pinnatifida*; also, oral administration of the fruit extract facilitates the clearance of serum cholesterol but does not prevent absorption (WANG).

Hawthorn extract or decoction is antibacterial against *Shigella flexneri*, *S. son*neni, *Proteus vulgaris*, and *Escherichia coli* (WANG).

Free-radical scavenging activity of *C.* pinnatifida water extracts have been reported.¹³

No toxic effects, contraindications, or drug interactions are known (ESCOP 2). A single case of immediate-type hypersensitivity to *C. monogyna* has been reported.¹⁴

USES

Medicinal, Pharmaceutical, and Cosmetic. Various drug preparations (oral or parenteral as i.m. or i.v. injections) are used in Europe for declining cardiac performance, corresponding to stages I and II of the New York Heart Association (NYHA) classification, senile heart conditions not requiring digitalis, and mild stable forms of angina pectoris, and mild forms of dysrythmia. Flowering tops are used in sleep-inducing preparations (ESCOP 2).

Food. Fruits of various hawthorn species have served as food in Europe, Asia, and at least a dozen species were used by American Indian groups. Candied fruits

slices, jam, jelly, and wine available in major American Chinatowns.

Health Food/Herb Teas. Fruits (or flowers) used in tea, tablets, capsules, tinctures, etc.¹

Traditional Medicine. In traditional Chinese medicine hawthorn fruits (dried, stirfried, or charred) are used to stimulate digestion. promote function stomach, and stimulate blood circulation in epigastric distension, diarrhea, abdominal pain, amenorrhea, abdominal colic, indigestion, enteritis, acute bacillus dysenhypertension, hyperlipemia, coronary heart disease. Charred fruits are used to promote digestion in stagnation of undigested meat, diarrhea, and with inadequate discharge from the bowels (TU). Up to 500 g of the fruits are eaten to treat tapeworm infections; externally as a wash for lacquer sores, itching and frost bite.

In European tradition the fruits, flowers, leaves or a combination thereof reportedly used as astringent, antispasmodic, cardiotonic, diuretic, hypotensive, and antisclerotic (STEINMETZ).

American Indian groups reportedly used a poultice of the leaves for boils, sores, ulcers; root decoction a gastrointestinal aid, diuretic, and to increase circulation (MOERMAN).

COMMERCIAL PREPARATIONS

Crude, and extracts (e.g., powdered, solid, and liquid); tablets and parenteral dosage forms with at least 5 mg of flavones (calculated as hyperoside), or 10 mg total flavonoid fraction (total phenols, calculated as hyperoside), or 5 mg oligomeric procyanidins (calculated as epicatechol).

Regulatory Status. Undetermined in the United States. Subject of a positive German therapeutic monograph, ¹⁵ and a proposed European Union monograph (ESCOP 2).

REFERENCES

See the General References for blumenthal; csir II; escop 2; hsu; list and hörhammer; jiangsu; mabberly; martindale; moerman; steinmetz; tu; tucker 3; tyler 1; wang; weiss; wren.

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HENNA

Source: *Lawsonia inermis* L. (syn. *L. alba* Lam.) (Family Lythraceae).

Synonym. Egyptian privet.

GENERAL DESCRIPTION

A shrub with opposite leaves and very fragrant flowers; up to about 6 m high; generally considered a native of Africa and Asia; widely cultivated in tropical regions of the world (e.g., Egypt, Sudan, China, India, Florida, and the West Indies). Part used is the dried leaf. Major producing countries include Sudan, Egypt, and India.

CHEMICAL COMPOSITION

Contains 0.55-1.0% lawsone (2-hydroxy-

1,4-naphthoquinone); 1.2 1,4-naphthoquinone; 5–10% gallic acid and tannin; about 11% sugars; resin; and others (LIST AND HÖRHAMMER). 2.3

Two xanthones (laxanthone-I and laxanthone-II) and a substituted coumarin named lacoumarin (5-allyloxy-7-hydroxy-coumarin) have also been isolated from the whole plant and are probably present in the leaves ^{4,5}

Lawsone is the major active principle (coloring and pharmacological) in henna. It is not present in the bark, stem, or root of the henna plant. Its concentrations in the leaves vary with climatic conditions; hot localities yield henna with higher lawsone content than temperate areas. There has been a report indicating lawsone to be a degradation and autoxidation product of primary glycosides called hennosides A, B, and C.

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PHARMACOLOGY OR BIOLOGICAL ACTIVITIES

Henna leaves (but not the seeds) have been reported to exhibit antifertility activity in female rats.⁷

Lawsone has various biological activities, including antifungal (fungicidal and fungistatic) activities toward Alternaria, Aspergillus, Absidia, Penicillium, and other species, being effective at 0.1% (1000 ppm) concentrations; 8,9 antibacterial activities toward Brucella, Neisseria, Staphylococcus, Salmonella, Streptococcus, and others, with a concentration of 0.005-0.02% (50-200 μ g/mL) being effective against the first two groups; 1.3.10 antitumor activities (e.g., against sarcoma 180 in mice and Walker 256 carcinosarcoma in rats); 10 and antispasmodic properties as well as weak vitamin K activity.1.2

In addition to the antibacterial properties of lawsone, other fractions from a henna extract containing gallic acid and 1,4-naphthoquinone have also exhibited antibacterial activities.³

An ethanol extract containing luteolin, β -sitosterol, and lawsone has claimed antiinflammatory, anti-hyaluronidase, and analgesic activity. ^{11,12}

USES

Medicinal, Pharmaceutical, and Cosmetic. Henna is used in numerous hair care products (e.g., dyes, conditioners, rinses, etc.). Prolonged use of henna on the hair would turn the hair orange red, unless henna is mixed with other dyes such as indigo and logwood to obtain different shades. To obtain a long-lasting color, the henna preparation must be rendered slightly acid (ca., pH 5.5) by adding a weak acid (e.g., citric, boric, or adipic).

Traditional Medicine. Leaves have been extensively used for centuries in the Middle East, the Far East, and northern Africa as a dye for nails, hands, hair, clothing, and others; they are also used in treating skin problems, headache, jaundice, amebiasis, enlargement of the spleen, and cancers, among others. ^{1,13}

Others. Lawsone can be used as an acid-base indicator for the titration of strong acids with weak bases.¹⁴

COMMERCIAL PREPARATIONS

Mainly the crude.

Regulatory Status. Has been approved for use as a color additive exempt from certification, to be used in cosmetics (hair) only (§73.2190).

REFERENCES

See the General References for balsam and sagarin; Jiangsu; Lust; Martindale; Merck; Morton 2; Rose; Terrell; Uphof; Wren.

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HONEY

Source: Sugar secretions collected in honeycomb by honeybees (*Apis* spp.).

Synonyms. Purified honey, mel depuratum, clarified honey, strained honey, etc.

GENERAL DESCRIPTION

Sugar secretions collected and stored in honeycomb by *Apis mellifera* L., and other *Apis* species (Family Apidae). A thick, syrupy, transparent liquid, honey is extracted from bee hives, then strained through a sieve and allowed to sit in settling tanks for 24 h to allow air bubbles to rise to the surface. Depending on pasturage source, color varies from amber to reddish brown to black.

CHEMICAL COMPOSITION

Honey consists chiefly of dextrose and levulose (70–80%) with smaller amount of water, sucrose (2–10%), dextrin, wax, proteins, volatile oil, minerals, acids, and coloring and flavoring components, based on derivative plant source; contains vitamin B_1 , vitamin B_2 , vitamin C, nicotinic acid, and formic acid (CSIR I; MARTINDALE).

PHARMACOLOGY OR BIOLOGICAL ACTIVITIES

Antibacterial, generally attributed to production of locally high osmolality due to water activity of honey; antimicrobial activity may be produced enzymatically by liberating hydrogen peroxide. Individual source plants may also contribute to antimicrobial activity. A recent assessment of 26 honeys in New Zealand found that of Leptospermum scoparium to have high antibacterial activity against Escherichia coli and Staphylococcus aureus; weaker against Streptococcus pyogenes, and Salmonella typhimurium.¹

Spores of *Clostridium botulinum*, responsible for infant botulism, are often contained in honey, which may germinate in adults without adverse effects, but may cause serious illness in infants. In 1976, of 43 cases of infant botulism in California, 13 involved honey (*Clostridium botulinum* found in 13% of 60 tested samples). It has been recommended that honey not be given to infants under 1 year old.²

USES

Medicinal, Pharmaceutical, and Cosmetic. Demulcent and sweetener in cough mixtures; in China as pill binder.

Honey is used as a fragrance ingredient, and humectant (in skin conditioners), also a biological additive in shampoos; face.

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body, and hand creams and lotions; bath products, hair conditioners; cleansing products; moisturizing creams and lotions; and paste masks (mud packs) (NIKITAKIS).

Food. Raw honey or honey in honeycomb sections (in beeswax) used as a sweetener.

Health Food/Herb Teas. A Vermont physician, D. C. Jarvis, catapulted honey into the health food realm by claiming that it improved digestion; facilitated wound healing; and had sedative, antiarthritic, and antibacterial effects (TYLER 1). The primary use, however, is as a sweetener for herb teas.

Traditional Medicine. In Indian folk medicine honey is considered demulcent; used for the treatment of eye ailments; sore throat, coughs, colds and constipation.

Heated or mixed with hot liquids it is used in conjunction with emetic and enema formulations.

In Chinese medicine used as a nutritive, demulcent, emollient laxative, in cough due to lung dryness, constipation, stomachache, sinusitis, oral ulcerations, scalds, and as a detoxicant for aconitine (HSU).

Traditionally considered useful topically for indolent skin ulcers where antibiotics fail to achieve results. Has also been used to soothe dermal lesions and necrotic malignant breast ulcers.

COMMERCIAL PREPARATIONS

Raw honey, honey in beeswax comb.

Regulatory Status. A common food; GRAS.

REFERENCES

See the General References for CSIR I: HSU; MARTINDALE; NIKITAKIS; TYLER 1.

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HOPS

Source: *Humulus lupulus* L. (Family Moraceae or Cannabaceae).

Synonyms. European hops and common hops.

GENERAL DESCRIPTION

A twinning perennial herb with male and female flowers on separate plants (dioecious); up to about 8 m high; native to Eurasia and North America; extensively cultivated worldwide (e.g., United States, Germany, and the Czech Republic). Part used is the female membranous conelike

inflorescence (strobile) with its glandular hairs, collected in the fall and carefully dried, often bleached with sulfur dioxide from burning sulfur; an essential oil is obtained by steam distillation of the freshly dried cones. The glandular hairs, separated from the strobiles, compose lupulin, which contains more resins and volatile oil than hops and is also used like hops.

Major producers of hops include the United States, Germany, and the Czech Republic.

CHEMICAL COMPOSITION

Contains 0.3–1% volatile oil; 3–12% resinous bitter principles composed of α -bitter acids (humulone, cohumulone, adhumul-

one. prehumulone, posthumulone, etc., with first three in predominance) and β -bitter acids (lupulone, colupulone, adlupulone, etc., in decreasing concentration); other resins, some of which are oxidation products of the α - and β -acids; xanthohumol (a chalcone); flavonoid glycosides (astragalin, quercitrin, isoquercitrin, rutin, kaempferol-3-rutinoside, etc.); phenolic acids; tannins; lipids; amino acids; estrogenic substances; and many other compounds (KARRER, JIANGSU, LIST AND HÖRHAMMER). 1-3

The volatile oil is made up mostly of humulene (α -carvophyllene), myrcene, β carvophyllene, and farnesene, which together may account for more than 90% of the oil. Other compounds present number more than 100, including germacratriene, α - and β -selinenes, selina-3,7(11)-diene, selina-4(14),7(11)-diene, α -copaene, α - β -pinenes, limonene, p-cymene, linalool, nerol, geraniol, nerolidol, citral, methylnonyl ketone, other oxygenated compounds, 2,3,4-trithiapentane (present only in oil of unsulfured hops in ca. 0.01%), S-methylthio-2-methylbutanoate, S-methylthio-4-methylpentanoate, and 4,5epithiocaryophyllene.1,4-9

PHARMACOLOGY OR BIOLOGICAL ACTIVITIES

Hops extracts have been reported to have various biological activities, including antimicrobial activities, which are due to the bitter acids (especially lupulone and humulone), the more hydrophobic ones being the more active; 10-13 strong spasmolytic effects on isolated smooth muscle preparations; 14 hypnotic and sedative effects, which were disputed by one report; 15 estrogenic properties, which were not observed in a later study; 16 and allergenic activity on humans, causing contact dermatitis due to the pollen (JIANGSU, LIST AND HÖRHAMMER, MERCK).

Alcoholic extracts of hops in various

dosage forms have been used clinically in treating numerous forms of leprosy, pulmonary tuberculosis, and acute bacterial dysentery, with varying degrees of success (JIANGSU).

2-methyl-3-butene-2-ol (present in hops up to 0.15%) has sedative effects in rats. $^{17.18}$

A stimulant effect on gastric secretion has been demonstrated for hops in laboratory animals.¹⁹

USES

Medicinal, Pharmaceutical, and Cosmetic. Extracts are used in certain skin creams and lotions, especially in Europe, for their alleged skin-softening properties.

Food. Major use is in beer, with the bitter taste derived primarily from oxidation products of humulone. Extracts and oil are also used as flavor components in nonalcoholic beverages, frozen dairy desserts, candy, baked goods, and gelatins and puddings, with the highest average maximum use level of 0.072% reported for an extract (type not indicated) in baked goods.

Health Food/Herb Teas. Used in sleeping preparations. Cut strobiles, powdered, or dried extract powder for tea, tincture, capsules, tablets, etc. Also used in "dream pillows," to promote sleep; and bath preparations (FOSTER). Use in medicinal bath preparations in Germany has been disallowed.²⁰

Traditional Medicine. Used as a diuretic and anodyne and in treating nervous diarrhea, insomnia, restlessness, and other nervous conditions as well as intestinal cramps and lack of appetite, among others, usually in the form of a tea; also used in Chinese medicine for pulmonary tuberculosis and cystitis (JIANGSU).

It has reportedly been used in cancers.21

COMMERCIAL PREPARATIONS

Crude, extracts, and oil; crude was formerly official in N.F., and oil is official in F.C.C. Strengths (see *glossary*) are either expressed in flavor intensities or in weight-to-weight ratios.

Regulatory Status. GRAS with both hops

and lupulin listed (\$182.20). The strobiles are the subject of a German therapeutic monograph, with use approved for mood disturbance (unrest, anxiety) and sleep disturbances. The proposed ESCOP monograph indicated usage for nervous tension, excitability, restlessness, sleep disturbances, and lack of appetite (ESCOP 2).

REFERENCES

See the General References for arctander; bailey 2; bianchini and corbetta; blumenthal; escop 2; fema; foster; foster and duke; guenther; jiangsu; lewis and elvinlewis; list and hörhammer; lust; terrell; uphof; wren; youngken.

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Horehound 303

HOREHOUND

Source: *Marrubium vulgare* L. (Family Labiatae or Lamiaceae)

Synonyms. Marrubium, hoarhound, common hoarhound, and white horehound.

GENERAL DESCRIPTION

A perennial aromatic herb with hairy stems and leaves; up to about 1 m high; native to Europe and Asia; naturalized in North America. Parts used are the dried leaves and flowering tops.

Ballota nigra L and its six subspecies, traded (primarily in Europe) as black horehound, has similar indications to horehound, though use is limited because of extreme bitter taste (WREN).

CHEMICAL COMPOSITION

Contains 0.3-1% of a bitter principle called marrubiin (a diterpene lactone); 1.2 several diterpene alcohols (e.g., marrubiol, marrubenol, peregrinol, and vulgarol); 1.3.4 small amounts of alkaloids (ca. 0.3% betonicine, its stereoisomer turicine, and ca. 0.2% choline); trace of a volatile oil containing monoterpenes (α -pinene, camphene, limonene, sabinene, p-cymene, etc.) and a sesquiterpene; C_{27} to C_{34} alkanes (normal and branched); free phytol; and tannin, pectic substances, saponin, resin, β -sitosterol, and others (LIST AND HÖRHAMMER).

PHARMACOLOGY OR BIOLOGICAL ACTIVITIES

Marrubiin is reported to have expectorant properties, and when its lactone ring is opened, the resulting acid (marrubic acid) has strong choleretic activity (TYLER 1). It also has a normalizing effect on extrasystolic arrythmias but in large doses disturbs the heart rhythm, which can be

counteracted by atropine (LIST AND HÖRHAMMER).

The volatile oil of horehound has also been reported to have vasodilative and expectorant properties.⁶

An aqueous extract of horehound has been reported to be antagonistic toward serotonin *in vitro*, and is antiinflammatory in the rat paw edema test (WREN).

Weak antioxidant activity is linked to total hydroxycinnamic derivatives $(0.6\%)^{10}$.

USES

Medicinal, Pharmaceutical, and Cosmetic. Extracts used as an expectorant in cold and cough medicines, especially in Europe.

Food. Extracts are used in flavoring numerous food products, especially candy and alcoholic beverages (e.g., bitters and liqueurs). Other foods in which horehound extracts are used include nonalcoholic beverages, frozen dairy desserts, baked goods, and gelatins and puddings. Highest average maximum use level is 0.073% reported in candy.

Health Food/Herb Teas. Herb used as a minor (bitter) flavoring component in some tea formulations; also in confectionaries intended to have a soothing effect on coughs and colds (FOSTER).

Traditional Medicine. It is used in treating sore throat, colds, coughs, and other respiratory ailments; also used as a diuretic, bitter tonic, and diaphoretic as well as in treating cancers.¹¹

COMMERCIAL PREPARATIONS

Crude and extracts; crude was formerly official in U.S.P. Strengths (see *glossary*) of extracts are expressed in flavor intensities or weight-to-weight ratios.

Regulatory Status. GRAS (\$182.10 and \$182.20). The leaves are the subject of a

German therapeutic monograph, with approval of use of herb and extracts for coughs, colds, and as digestive aid and

appetite stimulant.¹² Declared ineffective as an OTC cough suppressant and expectorant by the FDA (TYLER 1).

REFERENCES

See the General References for Bailey 1; BIANCHINI AND CORBETTA; BLUMENTHAL; FEMA; FOSTER; GOSSELIN; KROCHMAL AND KROCHMAL; LEWIS AND ELVIN-LEWIS; LUST; TERRELL; TYLER 1: UPHOF; WREN; YOUNGKEN.

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HORSECHESTNUT

Source: *Aesculus hippocastanum* L. (Family Hippocastanaceae).

GENERAL DESCRIPTION

Deciduous tree to 25 m; leaves opposite, digitate with five to seven obovate, irregularly crenate-serrate leaflets; glabrous above, tomentose beneath. Flowers white, with yellow to pink spot at base, in large cylindrical paniele. Spiny globose fruits 2 to 6 cm in diameter with large brown smooth seed. 2–4 cm in diameter; found in mountain woods, indigenous to central Balkan peninsula, widely planted and established throughout the northern hemisphere as a shade and ornamental tree (TUTIN 2). The

parts used are the seed, branch bark, and leaves.

CHEMICAL COMPOSITION

The seeds and bark contain a mixture of triterpene saponins known as aescin (escin), composed of acylated glycosides of protoeasigenin and barringtogenol-C, hippoaesculin and others; quinones, including plastoquinone 8; flavones, including 3,5-dihydroxy-3',4',7-trimethoxyflavone, myricetin 3',4',7-trimethyl ether; sterols, including stigmasterol, α -spinasterol, and β -sitosterol; linolenic, palmitic, and stearic acids; and others. The glycoside aesculin (esculin) (7-hydroxycoumarin 6- β -glucoside) is considered the most toxic component of the seed (GLASBY 2; WREN).

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PHARMACOLOGY OR BIOLOGICAL ACTIVITIES

Horsechestnut extracts, notably aescin, has antiinflammatory, antiedema, antiexudative, and venotonic activity.

Aescin was found to be responsible for antiexudative and edema-protective activity. Aescin acts on the capillary membrane. normalizing vascular permeability, enhancing capillary resistance, and reducing the outflow of fluid into the extracapillary space. Aescin has a "sealing" effect on the capillaries and reduces the number and diameter of the small pores of the capillary wall by which exchange of water occurs. Antiinflammatory activity at the initial exudation phase of inflammation has been confirmed in various *in vitro* and *in vivo* models. 5.6

In vitro aescin has been found to stimulate an increase in venous tone, with a decrease in the volume of venous district of the saphenous vein and its collaterals, facilitating return blood flow to the heart.^{2,7}

Efficacy of a 2%-aescin-containing gel in reducing tenderness of experimentally induced hematoma has recently been confirmed.⁸

In vitro antitumor activity has been observed from hippoaesculin and barringtogenol-C-21-angelate.^{2,9}

Horsechestnut seeds are considered inedible and poisonous. The bitter flavor prevents consumption of large amounts. The leaves, flowers, young sprouts and seeds are toxic. Symptoms of poisoning include nervous muscle twitching, weakness, dilated pupils, vomiting, diarrhea, depression, paralysis and stupor (HARDIN AND ARENA). Incidents of anaphylactic shock after i.v. injections of horsechestnut have been reported, along with renal toxicity or failure (FROHNE AND PFÄNDER).²

USES

Medicinal, Pharmaceutical, and Cosmetic. Horsechestnut extract or aescin (0.250.5%) has reportedly been used in shampoos, shower foams, foam baths, skin care products, body and hand creams, lotions, and toothpastes. Cosmetic use in Europe has been based on its clearing and redness-reducing properties, and its effectiveness in preventing cellulitis.¹⁰

Numerous clinical studies and published case reports confirm the efficacy of aescincontaining topical products, especially in the treatment of sports injuries, including blunt trauma of the lower limbs, ¹¹ joint sprains, tendonitis, hematomas, muscle strain, traumatic edema, ¹² Achilles' tendonitis; surgical outpatient trauma, including fractures, sprains, crush injuries, and contusion; ¹³ postoperative or postpartum edema in gynecology and obstetrics; ⁴ and others.

Intravenous (never extravenous) administration of aescin in ampoules is used clinically by physicians in Germany and other European countries for treatment of posttraumatic, intraoperative or postoperative conditions of cerebral edema, and other surgical specialties.¹⁴

Traditional Medicine. Fruits, bark, or seed has reportedly been used externally for ulcers; a folk cancer remedy. Seeds used for gastritis, enteritis, and hemorrhoids (DUKE 2). Bark tea astringent, used in malaria, dysentery; externally for lupus and skin ulcers (FOSTER AND DUKE).

Leaf preparations used in European traditions for eczema, varicose veins, supportive treatment of varicose ulcers, phlebitis, thrombophlebitis, hemorrhoids, menstrual spastic pain, soft tissue swelling from bone fracture and sprains, and other uses. Effectiveness of leaf preparation claims is unsubstantiated.¹⁵

COMMERCIAL PREPARATIONS

In Germany and other countries topical gels contain 1% aescin; ampoules containing 5.1 mg sodium aescinate (equivalent to 5 mg aescin); sugar-coated tablets; and

liquid oral preparations are available. Topical products are available in Canada. No horsechestnut or aescin-containing drug formulations are available in the United States, though aescin is available in bulk.

Regulatory Status. Undetermined in the United States. In Germany, horsechestnut seeds are the subject of a positive therapeutic monograph, indicated for chronic venous insufficiency, including edema, cramps

in the calves, itching, pain and sensations of heaviness in the legs, varicose veins, postthrombotic syndrome, plus post-traumatic and postoperative swelling of soft tissue, in average daily doses equivalent to 30–150 mg of aescin in liquid or solid preparations for oral administration. Horsechestnut leaf preparations claims are not substantiated, therefore, therapeutic use is not recommended. 15

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HORSETAIL

Source: Equisetum arvense L.; E. hymale L. (Family Equisetaceae).

Synonyms. Common horsetail, field horsetail, running clubmoss, and shenjincao (E. arvense); rough horsetail, common scouring rush, and muzei (E. hymale).

GENERAL DESCRIPTION

E. arvense stems are branched, jointed, with 6–16 grooves and ridges; leaves minute, in whorls united into a sheath at the base. Spore-bearing cones on separate stalks; E. hymale stems are unbranched, with 10–30 grooves, 30–100 cm high; both species occur in moist soils; common in much of temperate Northern Hemisphere

(Asia, Europe, North America). The part used is the dried stems.

CHEMICAL COMPOSITION

E. arvense contains 0.3-1% flavonoids, including quercetin-3-glucoside, luteolin-5glucoside, protogenkwanin-4"-O-glucoside, kaempferol, apigenin, isoquercitrin, and others (depending on chemotype).²⁻⁴ Two distinct chemotypes are recognized, one from Europe, characterized by guercetin-3-O-sophoroside, protogenkwanin-4'-O-β-Dglucopyranoside, and genkwanin-4'-O-B-Dglucopyranoside. North American and Asian materials are characterized by the presence of flavone-5-glucosides and their 6"-malonyl esters, especially luteolin. Both chemotypes contain quercetin-3-O-B-Dglucopyranoside and its malonyl ester as the major flavonoids.^{2,3} Equisetum hybrids are extremely variable in morphological features. It has been suggested that hybrid parent species can be verified with analysis of flavonoid patterns.5

Phenolic acids of *E. arvense* include di-*E*-caffeoyl-*meso*-tartaric acid, and methyl esters of protocatechuic and caffeic acids; aconitic, oxalic, malic, tannic, arabinoic, and threonic acids;^{6.7} minerals, including silicic acid and silicates (5–8%) water soluble up to 80%,⁸ potassium, aluminum, and manganese; sterols, including campesterol, isocuosterol, and brassinosteroids;⁷ and others. Trace amounts of nicotine have been found in *E. arvense*.⁹

PHARMACOLOGY OR BIOLOGICAL ACTIVITIES

Horsetail is considered mildly diuretic, hemostyptic, and vulnerary.

A study of four Mexican Equisetum species revealed that chloroform extracts of E. hymale var. affine had the greatest diuretic activity, more effective than spironolactone, furosemide, and hydrochlorothiazide. An increase in excretion of

sodium, chloride, and potassium, with a rise in urine pH was also observed. 7.10

Other activities include a hemostyptic effect observed in animals, and a strengthening and regenerating effect on connective tissue (BRADLY, WEISS).

Silica, necessary for the formation of articular cartilage and connective tissue, is taken up by the plant in the form of a bioavailable monosilicic acid, perhaps accounting for traditional uses of the plant.

E. arvense and other species are known to cause toxicity in livestock, including horses, sheep, and rarely cattle. Toxicity, similar to nicotine poisoning has been reported in children who have chewed the stems. Horsetail may also caused seborrheic dermatitis. An antithiamine action has been recognized in Equisetum ingestion in horses, destroying thiamine (vitamin B₁) in the stomach of monogastric animals, including humans.

E. palustre L., which contains the alkaloid palustrine, is toxic to livestock. The German Pharmacopoeia requires examination of E. arvense for adulteration with other Equisetum species, especially E. palustre (FROHNE AND PFÄNDER). A critical review of the German Pharmacopeial methods, along with new analytical procedures, investigations, and improvements, have recently been proposed.¹²

USES

Medicinal, Pharmaceutical, and Cosmetic. Horsetail extract is used as a biological additive in shampoos, skin care products, etc.

Preparations of the herb are used in German phytotherapy for posttraumatic and static edema and in irrigation therapy for bacterial and inflammatory conditions of the lower urinary and renal tract (contraindicated in cases of impaired heart or kidney function). Externally, compresses or poultices are used for the supportive treatment of poorly healing wounds.¹³

Health Food/Herb Teas. Horsetail is primarily used as a dietary supplement for mineral content, also in diuretic formulations, including teas, tinctures, capsules, tablets, etc. (FOSTER AND DUKE).

Traditional Medicine. In Europe, the herb has reportedly been used to promote renal function; digestive elimination; an adjuvant in weight loss products (BRADLEY). American Indian groups used plant tea for kidney and bladder ailments and constipation. In India, horsetail is used as a diuretic, hemostatic; root as an analgesic for teething babies. A folk remedy for bloody urine, gout, gonorrhea, stomach disorders; poulticed for wounds (FOSTER AND DUKE).

A French patent exists for the use of isolated silica compounds from *E. arvense* for the treatment of bone fractures, osteoporosis, connective tissue, and tooth and nail injuries.⁷

In traditional Chinese medicine, E. hymale, and E. debile Roxb. (substitute in

Yunnan) have been used to treat bloody stools, dysentery with blood, anal prolapse, malaria, sore throat; externally poulticed for sores; an injectable drug has been used in China to treat neurodermatitis (JIANGSU).

COMMERCIAL PREPARATIONS

Crude dried herb, fresh stems and extracts.

Regulatory Status. Undetermined in the United States. E. arvense is the subject of a positive German monograph, as a mild diuretic; externally for supportive treatment of poorly healing wounds.¹³ Health and Welfare Canada requires manufacturers to prove E. arvense products are free of thiaminase-like activity (though the compound responsible for antithiamine action has not been identified). The action is based on the concern that irreversible brain damage may occur in thiamine-deficient individuals.⁷

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