Pokeroot

Species (Family)

Phytolacca americana L. (Phytolaccaceae)

Synonym(s)

Phytolacca decandra L., Pocan, Pokeweed, Red Plant

Part(s) Used

Root

Pharmacopoeial and Other Monographs

BHP 1996[G9]
Mills and Bone[G50]
PDR for Herbal Medicines 2nd edition[G36]

Legal Category (Licensed Products)

GSL [G37]

Constituents[G22,G48,G64]

Alkaloids Betalain-type. Betanidine, betanine, isobetanine, isobetanidine, isoprebetanine, phytolaccine and prebetanine.

Lectins Pokeweed mitogen (PWM) consisting of five glycoproteins Pa^{-1} to Pa^{-5}.

Saponins Triterpenes – phytolaccosides A-1, D_2, and O,[1–3] aglycones include phytolaccagenin, jaligonic acid, phytolaccagenic acid, aesculentic acid,[2,4–6] acinosolic acid methyl ester;[5] monodesmosidic and bidesmosidic compounds with oleanolic acid and phytolaccagenic acids as aglycone in *P. dodecandra*.[7]

Other constituents Isoamericanin A (neo-lignan),[8] PAP, pokeweed antiviral protein)[9], α-spinasterol,[5], histamine and gamma aminobutyric acid (GABA).[10]

Food Use

Pokeroot is not commonly used in foods. In the USA, the Herb Trade Association has recommended that pokeroot should not be sold as a herbal beverage or food.[11]

Herbal Use

Pokeroot is stated to possess antirheumatic, anticatarrhal, mild anodyne, emetic, purgative, parasiticidal and fungicidal properties. Traditionally, it has been used for rheumatism, respiratory catarrh, tonsillitis, laryngitis, adenitis, mumps, skin infections (e.g. scabies, tinea, sycosis, acne), mammary abscesses and mastitis.[G7,G64]

Dosage

Dried root 0.06–0.3 g or by decoction three times daily.[G7]

Liquid extract 0.1–0.5 mL (1:1 in 45% alcohol) three times daily.[G7]

Tincture (BPC 1923) 0.2–0.6 mL.

Pharmacological Actions

In vitro and animal studies

Anti-inflammatory activity has been documented for saponin fractions isolated from *P. americana*.[2,12] Activity comparable or greater than that of cortisone acetate was observed in the carageenan rat paw oedema test when the extract was administered by intraperitoneal injection. The major aglycone, phytolaccagenin, was reported to exhibit greater activity than glycyrrhetic acid and oleanolic acid, which are both known to be effective in acute inflammation. Oral administration required a six-fold increase in dose for comparable activity.[12] Potency of the saponin extract was reduced to one-eighth of that of cortisone when tested against chronic inflammation (granuloma pouch method).[12] The ED_{50} for saponin and phytolaccagenin fractions against carrageenan-induced oedema in the rat (intraperitoneal injection) has been determined as 15.1 and 26 mg/kg respectively.[12]

Isoamericanin A (a neo-lignan) isolated from the seeds of *P. americana* has been reported to increase prostaglandin I_2 (PGI_2) production from the rat aorta by up to about 150% at a concentration of 10^{-5} and to elicit a moderate inductive effect on the *in vivo* release of PGI_2.[8]

Hypotensive properties have been described for a pokeroot extract with the activity attributed to histamine and GABA.[10]

A diuretic effect has been described in rats administered pokeroot extract orally at a dose of 500 mg/kg.[13] The effect was reported to be significantly greater than that observed in the saline-treated group of rats, but less than in the frusemide-treated (150 mg/kg) group.

In vitro contraction of the guinea-pig ileum has been described for pokeroot extracts.[14] Activity was attributed to a single active constituent that proved to be heat resistant.

The properties of pokeweed antiviral protein have been reviewed.[15]

Molluscicidal activity against schistosomiasis-transmitting snails and spermicidal activity have been documented for saponin components obtained from the fruits of the related species, *P. dodecandra*.[7,16,17] An enzyme located in the seeds has been found to be necessary for molluscicidal activity of *P. dodecandra*.[18] Crushing the seeds to release the enzyme is critical for activity. The enzyme is inactivated by heat or alcohol and a cold water extraction of the finely ground fruits was found to provide the greatest molluscicidal activity. The saponin-containing extract of *P. dodecandra* is commonly referred to as 'Endod'.[19] Fruits of *P. americana* also possess molluscicidal properties.[G44]

Abortifacient activity in mice has been exhibited by a related species *P. acinosa* Roxb. with activity strongest in the seed and weakest in the leaf. Activity in the various extracts was destroyed by heat and pepsin suggesting a protein to be the active principle.[20]

Side-effects, Toxicity

Haematological aberrations have been observed in human peripheral blood following oral ingestion of the berries or exposure of broken skin/conjunctival membrane to the berry juice.[21–23] Analysis of peripheral blood revealed plasmacytoid cells, dividing cells and mature plasmacytes. Eosinophilia was also noted. The mitogenic principles in pokeroot, lectins, are reported to be a mixture of agglutinating and non-agglutinating glycoproteins affecting both T cell and B cell lymphocytes.[24]

Pokeroot leaf extracts have been reported to be agglutinating, but lacking in mitogenic activity.[25]

A 43-year-old woman suffered the following symptoms 30 minutes after drinking a cup of herbal tea prepared from half a teaspoon of powdered pokeroot: nausea, vomiting, cramping, generalised abdominal pain followed by profound watery diarrhoea, weakness, haematemesis and bloody diarrhoea, hypotension and tachycardia.[26] Chewing the root for the relief of a sore throat and cough has resulted in severe abdominal cramps, protracted vomiting and profuse watery diarrhoea.[27] Additional symptoms of poisoning that have been documented for pokeroot include difficulty with breathing, spasms, severe convulsions and death.[28]

The clinical symptoms of pokeroot poisoning have been reviewed.[27]

All parts of the pokeroot plant are considered as potentially toxic, with the root generally recognised as the most toxic part.[27] Toxicity is reported to increase with plant maturity although the young green berries are more toxic compared to the more mature red fruits.[27]

High doses of saponin extracts have produced thymolytic effects in rats.[12]

LD_{50} values for the saponin fraction (intraperitoneal injection) have been determined as 181 mg/kg in mice and 208 mg/kg in rats.[12] In contrast, no deaths were observed in rats administered phytolaccagenin intraperitoneal injection up to a dose of 2 g/kg.[12] Oral doses of saponin up to 1.5 g/kg did not produce any mortalities in treated rats.[12]

The mutagenic potential of *P. americana* and *P. dodecandra* fruit extracts has been tested using *Salmonella typhimurium* strain TM677.[19] No activity was found for any of the extracts tested.

Contra-indications, Warnings

Fresh pokeroot is poisonous and the dried root emetic and cathartic.[G42] The toxic effects documented following the ingestion of pokeroot make it unsuitable for internal ingestion. In addition, external contact with the berry juice should be avoided: systemic symptoms of toxicity have occurred following exposure of broken skin and conjunctival membranes to the juice.

In 1979, the American Herb Trade Association declared that pokeroot should no longer be sold as a herbal beverage or food.[11] It further recommended that all packages containing pokeroot carry an appropriate warning regarding the potential toxicity of pokeroot when taken internally. In the UK, manufacturers of licensed medicinal products are permitted to include pokeroot provided that the dose is restricted and that suitable evidence is given to demonstrate the absence of the toxic protein constituents.

Pregnancy and lactation Pokeroot is reputed to affect the menstrual cycle and is documented to exhibit uterine stimulant activity in animals.[G30]

Pharmaceutical Comment

Apart from its traditional use as a herbal remedy, pokeroot is also known to possess molluscicidal properties. Anti-inflammatory activity documented in animal studies support the traditional use of pokeroot in rheumatism. However, pokeroot is also recognised as a toxic plant. The effects of pokeroot intoxication arise from the ingestion of any or all plant parts, liquid preparations of plant extracts such as herbal teas, or through skin contact with the plant.[27] The main toxic agents are the pokeweed mitogen (lectins) and the glycoside saponins. The toxic properties of these two classes of compounds, mitogenic and irritant respectively, are well recognised. Excessive use of pokeroot cannot be supported in the light of these known toxicities.

References

See also General References G9, G10, G18, G20, G22, G30, G32, G36, G37, G42, G43, G48, G50 and G64.

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