Willow

Species (Family)

Salix species including *Salix alba* L., *Salix fragilis* L., *Salix pentandra* L., *Salix purpurea* L. (Salicaceae)

Synonym(s)

Salix

Part(s) Used

Bark

Pharmacopoeial and Other Monographs

American Herbal Pharmacopoeia[G1]
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[G1,G2,G6,G49,G52,G62,G64]

Glycosides (phenolic) Various phenolic glycosides including salicin, salicortin, tremulacin, salireposide, picein and triandrin.[1] Acetylated salicin, salicortin, salireposide, and esters of salicylic acid and salicyl alcohol may also occur.

Salicylates (calculated as salicin) Vary between species, e.g. 0.5% in *S. alba*, 1–10% in *S. fragilis*, 3–9% in *S. purpurea*.[2]

Flavonoids Flavanones, eriodictoyl-7-glucoside; naringenin-5-glucoside; chalcone; isosalipurposide; catechin.[2,G52]

Tannins Condensed.

Other constituents Catechins.

There is reported to be no difference between the phenolic glycoside pattern of the bark and leaf. The latter is also reported to contain flavonoids, catechins and condensed tannins.[2,3]

Food Use

Willow is not used in foods.

Herbal Use[G1,G2,G4,G6,G7,G8,G32,G52,G56,G64]

Willow is stated to possess anti-inflammatory, anti-rheumatic, antipyretic, antihidrotic, analgesic, antiseptic and astringent properties. Traditionally it has been used for muscular and arthrodial rheumatism with inflammation and pain, influenza, respiratory catarrh, gouty arthritis, ankylosing spondylitis, and specifically for rheumatoid arthritis and other systemic connective tissue disorders characterised by inflammatory changes. The German Commission E approved internal use for diseases accompanied by fever, rheumatic ailments and headaches.[G3]

Dosage

Dry bark 1–3 g or by decoction three times daily[G6,G7] corresponding to 60–120 mg total salicin daily.[G3]

Liquid extract 1–3 mL (1:1 in 25% alcohol) three times daily.[G6,G7]

Pharmacological Actions

In vitro and animal studies

Pharmacological actions documented for salicylates include anti-inflammatory, antipyretic, hyperglycaemic/hypoglycaemic and uricosuric/antiuricosuric activities, and increased blood-clotting time and plasma albumin binding.[G46] Anti-inflammatory activity for salicin and tremulacin (isolated from *Populus* spp.) has been assessed in the hen's egg choriollantoic test.[4,G52] The results indicate that the activity may be due to the metabolites of these compounds.[4] Salicin is probably the most active anti-inflammatory compound in willow; it is metabolised

to salicylic acid.[5] The enzymatic degradation of salicin, salicortin and tremulacin by β-glucosidase and by esterase has been investigated.[6]

Tannins are known to have astringent properties.

Clinical studies

Willow bark extract (equivalent to 240 mg salicin/day) was compared with placebo in a two-week, randomised, double-blind, controlled trial involving 78 patients with osteoarthritis.[7] A difference in pain dimension in the treated group, compared with placebo, just reached statistical significance ($p = 0.047$). It was concluded that willow bark extract had a moderate analgesic effect in osteoarthritis, and that it was well tolerated.

The pharmacological actions of salicylates in humans are well documented, and are applicable to willow. Salicin is a prodrug which is metabolised to saligenin in the gastrointestinal tract and to salicylic acid after absorption.[2]

Side-effects, Toxicity

Side-effects and signs of toxicity normally associated with salicylates, such as gastric and renal irritation, hypersensitivity, blood in the stools, tinnitus, nausea and vomiting, may occur. Salicin is documented to cause skin rashes.[G44]

Contra-indications, Warnings

Minor adverse effects including stomach ache, nausea, dizziness, sweating and rash have been reported in a small percentage of individuals.[G52] Precautions associated with salicylate therapy are also applicable to willow. Therefore individuals with known hypersensitivity to aspirin, asthma, active peptic ulceration, diabetes, gout, haemophilia, hypoprothrombinaemia, kidney or liver disease should be aware of the possible risks associated with the ingestion of willow.[8,G46] Irritant effects of salicylates on the gastrointestinal tract may be enhanced by alcohol, and barbiturates and oral sedatives have been documented to enhance salicylate toxicity as well as masking the symptoms of overdosage.[G46] Concurrent administration of willow with other salicylate-containing products, such as aspirin, should be avoided. Drug interactions listed for salicylates are also applicable to willow and include oral anticoagulants, methotrexate, metoclopramide, phenytoin, probenecid, spironolactone and valproate.

Pregnancy and lactation The safety of willow has not been established. Conflicting reports have been documented concerning the safety of aspirin taken during pregnancy. In view of this, the use of willow during pregnancy should be avoided. Salicylates excreted in breast milk have been reported to cause macular rashes in breastfed babies.[G46]

Pharmaceutical Comment

Willow is rich in phenolic constituents, such as flavonoids, tannins and salicylates. Pharmacological actions normally associated with salicylates are also applicable to willow which support most of the herbal uses, although no studies were located specifically for willow. In view of the lack of toxicity data on willow, the usual precautions taken with other salicylate-containing drugs are applicable. Products containing willow should preferably be standardised on their salicin content, in view of the considerable variation in salicylate concentrations between different *Salix* species.

References

See also General References G1, G2, G3, G5, G6, G9, G10, G31, G36, G37, G43, G49, G52, G54, G56, G62 and G64.

1 Meier B *et al.* Identifikation und Bestimmung von je acht Phenolglykosiden in *Salix purpurea* und *Salix daphnoides* mit moderner HPLC. *Pharm Acta Helv* 1985; 60: 269–274.

2 Meier B *et al.* Pharmaceutical aspects of the use of willows in herbal remedies. *Planta Med* 1988: 54: 559–560.

3 Karl C *et al.* Flavonoide aus *Salix alba*, die Struktur des terniflorins und eines Weiteren Acylflavonoides. *Phytochemistry* 1976; 15: 1084–1085.

4 Albrecht M *et al.* Anti-inflammatory activity of flavonol glycosides and salicin derivatives from the leaves of *Populus tremuloides*. *Planta Med* 1990; 56: 660.

5 Meier B, Liebi M. Salicinhaltige pflanzliche Arzneimittel-Überlegungen zu wirksamkeit und unbedenklichkeit. *Z Phytother* 1990; 11: 50–58.

6 Julkunen-Tiitto R, Meier B. The enzymatic decomposition of salicin and its derivatives obtained from salicaceae species. *J Nat Prod* 1992; 55: 1204–1212.

7 Schmid B *et al.* Efficacy and tolerability of a standardized willow bark extract in patients with osteoarthritis: randomized placebo-controlled, double blind clinical trial. *Phytother Res* 2001; 15: 344–350.

8 Baker S, Thomas PS. Herbal medicine precipitating massive haemolysis. *Lancet* 1987; i: 1039–1040.