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Full Length Research Paper

Phytopharmacological aspects of *Salacia chinensis*

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Salacia chinensis **Linn. (Family Celastraceae) commonly known as Saptrangi and commonly used herb in Ayurvedic medicine. The present work is an attempt to compile information on pharmacological and phytochemical aspects of *S. chinensis* Linn. Its roots have biologically active compounds, such as triterpenes, phenolic compounds, glycosides and coloring agents which show various medicinal properties. The root extract shows various activities like, antioxidant, anticaries, antiulcer, antidiabetic, hypoglycemic, antiobesity and skin lightening agent. This work will help reader with detail understanding of Salacia root's properties.**

Key words: *Salacia chinensis,* Saptrangi, root, phytochemistry, pharmacology.

INTRODUCTION

Salacia chinensis Linn. (Synonyms: *Salacia prinoides*) Family: Celastraceae (Spike-thorn family) commonly called as Saptrangi, Dimal, Modhupal, Ingli, Cherukuranti, Nisul-bondi. This is a small erect or straggling tree or large, woody, climbing shrub found almost throughout India including Andaman and Nicobar Islands (Mehra and Handa, 1969).

MATERIALS AND METHODS

Three species of *Salacia* that is, *S. chinensis, Salacia reticulate, Salacia oblonga* are used traditionally in Ayurveda, Unani systems as antidiabetic agent. Preclinical research and isolated clinical trials studying these effects have been promising. Fruits and Roots are the useful parts. Ripe fruits are eaten. Roots have been used as an antidiabetic drug. *S. chinensis* have been used in India and in other countries as a tonic, blood purifier and to treat amenorrhea and dysmenorrhea. Its root bark was used in gonorrhoea, rheumatism and skin diseases. Its aqueous extract showed significant hypoglycemic activity. Root bark boiled in oil or as decoction or as powder is used for the treatment of rheumatism, gonorrhoea, itches, and asthma, thirst and ear diseases (Encyclopedia of World Medicinal Plants. Vol.1. 1713: 2418; Almeida and Almeida, 1994; Singh and Duggal, 2010; Mehra and Handa, 1967). The root is dark yellow externally and light yellow internally. It has characteristic odor and bitter in taste. The TS of root (Figure 1) shows wavy cork, cortex consisting of brown matter, uniserriate and few biserriate medullary rays and vascular bundle consists mainly of secondary xylem and phloem. Pith, Pericycle and endodermis is absent. Starch is present in the cortex region. The standardization parameters like ash value and extractive value have been also studied. The ash value results for this plant are Total ash 4.825%w/w; Water-soluble ash 2.75%w/w, Acid-insoluble ash 3.5%w/w. The extractive value results are found to be 3.275%w/w in Water-s oluble extractive value and 1.8%w/w in Alcohol-soluble extractive value (Dholwani et al., 2009). Table 1 is showing Fluorescence analysis of root powder.

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RESULTS

The roots contains the phytoconstituents like alkaloides, glycosides, polyphenols, flavanoides, coumarins, proteins, carbohydrates, gums and mucilage, fixed oil and volatile oil. Triterpenoids like lupanes, hopanes, friedelanes are abundant in root and stem of plant. Salacinol from the stems of *S. chinensis* was found to alpha- glucosidase inhibitor. Mangiferin showed inhibitory effect on rat lense aldose reductase. Figure 2 and Table 2 has given idea about chemical composition of salacia roots.

Recent studies have demonstrated that *Salacia* roots are very useful in type 2 diabetes and obesity-associated hyperglycemia, dyslipidemia and related cardiovascular complications and it may be due to the fact that it modulate multiple targets (Yuhao et al., 2008) like peroxisome proliferator-activated receptor-alpha-mediated lipogenic gene transcription, angiotensin II/angiotensin II type 1 receptor, alpha-glucosidase, aldose reductase and pancreatic lipase. These activities are due to the constituentslike mangiferin, salacinol, kotalanol and kotalagenin 16-acetate (Yoshikawa et al.,

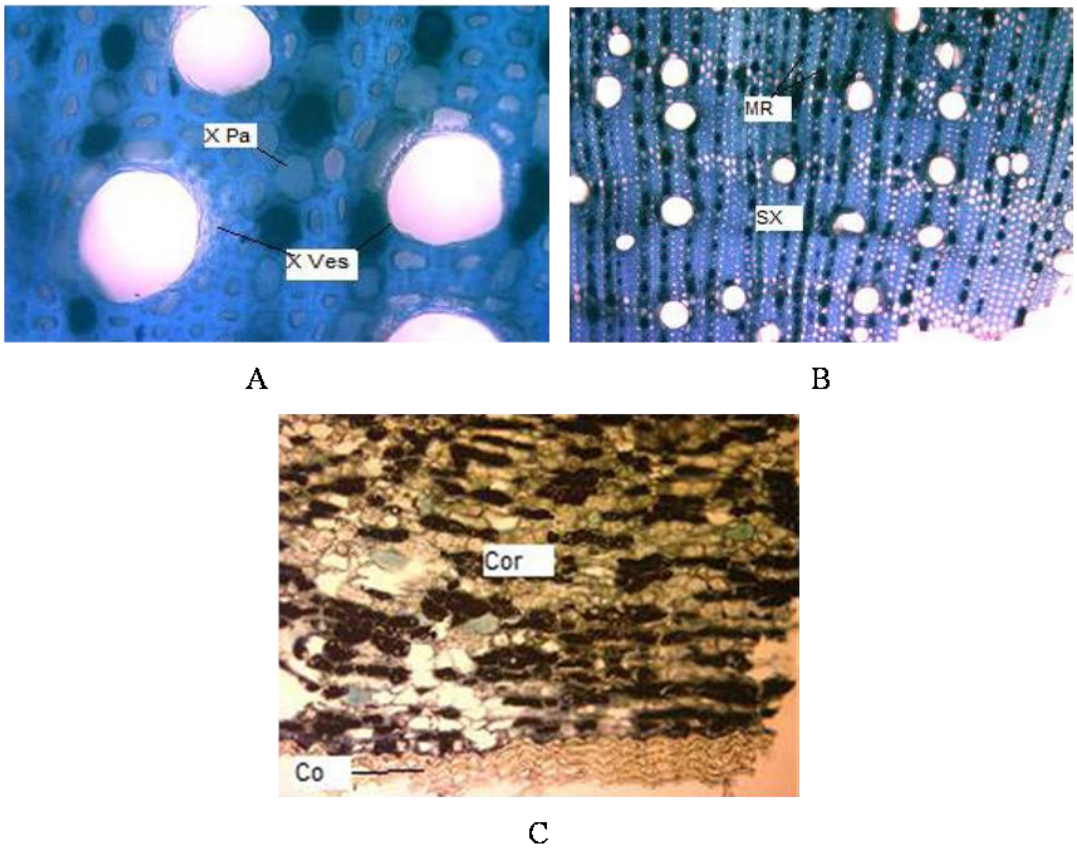


Figure 1. A, B and C: *Salacia* roots microscopy showing vascular bundles, medullary rays, and annular rings.

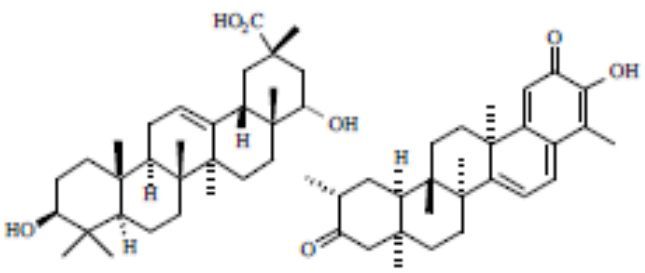
Table 1. Fluorescence analysis of root powder.

Treatment	Day light	UV light (254 nm)
Powder as such	Yellow color	Light green
Powder + 1N NaOH(Aq.)	Brown	Dark brown
Powder + 1N NaOH(Alc.)	Yellowish brown	Light yellow
Powder + 1N HCL	Green	Light green
Powder + Iodine	Dark brown	Brown
Powder + Ammonia	Yellow	Greenish yellow
Powder + 5% $FeCl_3$	Dark yellow	Dark brown
Powder + 1N H_2SO_4	Black	No color

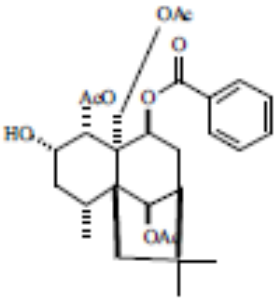
2001; Matsuda et al., 2002; Nadagouda et al., 2010). Clinical trial studies have also been carried out to confirm the effects. Table 3 is explaining the all activities of salacia roots.

Conclusion

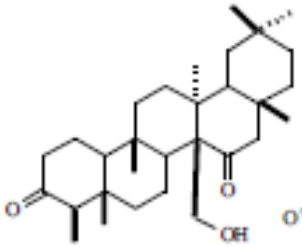
S. chinensis is a traditional South and Southeast Asian herb medicine and has been reported to have an antidiabetic function through α-glucosidases inhibitory activity. The various active constituents have been found to affect multiple targets in diabetes, obesity and associated cardiovascular diseases through modulating PPAR-α-mediated lipogenic gene transcription and angiotensin II/angiotensin II type 1 receptor, inhibiting α-glucosidase, aldose reductase and pancreatic lipase. Although toxicological studies have suggested minimal adverse effects of this plant in rodents, a clinical trial is crucial to further confirm the safety of *Salacia* roots. In addition, mechanistic studies are necessary in order to know drug interaction of *Salacia* root with other



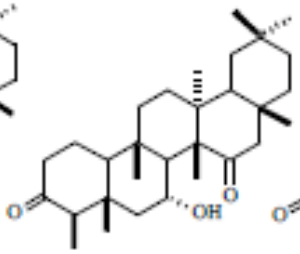
tingenone tingenine B



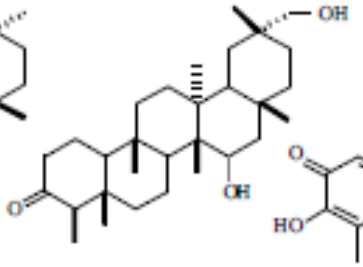
salasol A



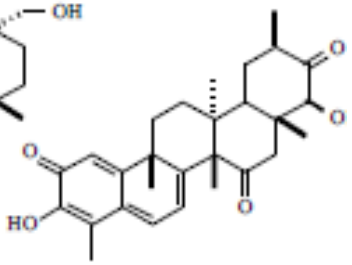
salasones A



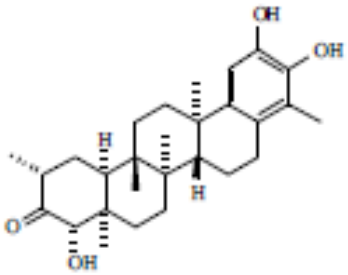
salasones B



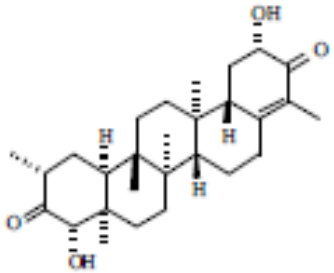
salasones C



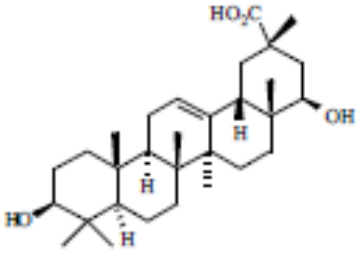
salaquinone A



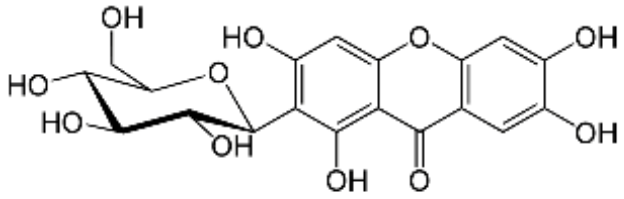
regeol A



triptocalline A



3 ,22 -dihydroxyolean-12-en-29-oic acid



Mangiferin

Figure 2. Chemical constituents of *S. chinensis.*

Table 2. Phytochemistry of roots of *S. chinensis* Linn.

Constituents	Plant part
Triterpenes foliasalacins D1 (I), D2 (II), and D (III), Phenolic glycosides named foliachinenosides A1 (1), A2 (2), A3 (3), B1 (4), B2 (5), C (6), and D (7); Foliasalaciosides A1,A2, B1, B2,C and D; megastigmane glycosides named foliasalaciosides E1 (I)-I (1-7)	Leaves (Yoshikawa et al., 2008).
Megastigmane glycosides foliasalaciosides A1 (1) (I), A2 (2), B1 (3), B2 (4), C (5), and D (6)	Leaves (Pongpiriyadacha et al., 2003). (Methanolic extract)
Triterpenes like 28- hydroxy –3- oxo- 30- lupanoic acid, 29- nor-21α- H- hopane- 3,22- dione, 21α- H- hop- 22(29)- ene- 3β, 30- diol, and betulin, 3 – oxo- lupane- 30 – al; Betuline, 29- nor- 21- αH- hopane- 3, 22- dione and 21- αH- hop- 22 (29)- ene- 3β,30- diol	Stems (n-hexane extract) (Krishnan and Rangaswami, 1967a,b).
α-glucosidase inhibitor salacinol, Dimer(II), octaacetate, hexamethyl ether, Friedelane-type triterpenes, salasones D and E, norfriedelane-type triterpene, salaquinone B, polyacylated eudesmane-type sesquiterpine, salasol B; Two new friedelane-type triterpenes, salasones D and E, a new norfriedelane-type triterpene, salaquinone B, and a new polyacylated eudesmane-type sesquiterpene, salasol B,	Stems (Joshi et al., 1973).
Two new triterpenoids, named 7α,21α-dihydroxyfriedelane-3-one (1) and 7α,29-dihydroxyfriedelane-3-one (2) and 21α,30-dihydroxyfriedelane-3-one	Stems (Rogers et al., 1974). (ethyl acetate extract)
Friedelane-type triterpenes, salasones A, B, and C, norfriedelane-type triterpene, salaquinone A, acylated eudesmane-type sesquiterpine, salasol A	Stems (80% of methanolic extract) (Tran et al., 2008).
3β,22β-dihydroxyolean- 12- en- 29- oic acid, tingenone, tingenine B, regeol A, triptocalline A, and mangiferin	Stems (80% of methanolic extract) (Kishi et al., 2003).
1,3-diketofriedelane derivatives : six closely related triterpenes, P, Q, R, S, T and V	Root bark (Yoshikawa and Morikawa, 2003; Masayuki et al., 2008).

Table 3. Pharmacology of roots of *S. chinensis* Linn.

S/no.	Activity	Model	Plant part	Conclusion
1	Antidiabetic activity (Yoshikawa et al., 2003).	Maltose or sucrose loaded rats	Methanolic extract of stems	Inhibitory effects on intestinal alpha-glucosidase, rat lens aldose reductase, formation of Amadori compounds and advanced glycation end-products, nitric oxide production from lipopolysaccharide-activated mouse peritoneal macrophage, and radical scavenging activities.
2	Antidiabetic activity (Govind et al., 2010)	Streptozotocin (STZ) - induced diabetic rats.	*Salacia chinensis* and *Coccinia indica* and *Hipophae rhamnoides*	Found to be effective
3	Antihyperglycemic activity (Sellamuthu et al., 2009).	Streptozotocin (STZ) - induced diabetic rats.	Mangiferin purified from methanolic root ext. of *S. chinensis* mangiferin possess antidiabetic activity against STZ-induced diabetic rats.	Mangiferin is found responsible for antidiabetic activity.
4	Hypotensive activity (Jansakul et al., 2005).	Hypotensive activity in anesthetized female rats in estrus, and for vasodilator activities on isolated thoracic aortic rings *in vitro*.	Stem ethanolic extract	n-butanol extract from stems of Salacia chinensis possesses a hypotensive effect. The mechanism involved may be an indirect effect by stimulated release of nitric oxide from vascular endothelial cells and causes vasodilatation.

Table 3. Contd.

5	Hepatoprotective activity (Asuti, 2010).	Wistar strain of albino rats of either sex against CCl_4 induced	Root extract	Found to be effective
6	Anticaries activity (Vuong and Hoover, 2010)	Prevents glucan adhesion on tooth plane and inhibits glucosyltransferase activity, and can be used for preventing caries.	*Salacia extract*	*Salacia* extract inhibit sucrose-dependent biofilm formation by MS, similar to acarbose, and have potential as anti-plaque anti-caries agents
7	Reproductive function activity (Yang et al., 2011)	Sprague–Dawley male and female rats	S. chinensis extract	No effects on the reproductive outcome such as estrous cycle of F0 females or any parameters for reproductive function or survival, growth, sensory reflex or function development of F1 pups even at a remarkably high dosage level, 2000 mg/kg/day,
8.	Anticancer activity (Tran et al., 2010)	Against the four cancer cell lines Hep-G2, LU, KB, and MCF-7.	Eight triterpenoids from this plant	The new compound showed good activity against all four tested cell lines.

therapeutic interventions.

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