

A Review: Phytoconstituents, Activities, Chemical and Pharmacological Aspects of *Saraca Asoca* Plant

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Abstract

The oldest tree in India is the Ashoka, often referred to as a "ashok briksh" and identified by botanists as either *Saraca asoca* (Roxb.), *De.wilde*, or *Saraca indica*, all of which are members of the Caesalpinaceae family. As more individuals look for treatments and health strategies free from the negative effects of artificial chemicals, medicinal plants are becoming more widely employed. In addition to a variety of pharmacological properties like spasmogenic, oxytocic, uterotonic, anti-bacterial, anti-menorrhagic, anti-cancer, anti-estrogenic, anti-progestational, dermatoprotective, anti-mutagenic, and genoprotective properties, *asoca sativa* is said to contain glycoside, flavanoids, tannins, and saponins. This article provides information on the pharmacognocical properties of Ashoka herb as well as its socio-ethnobotanical usage, phytoconstituents, and several documented pharmacological activities. It is envisaged that this evaluation would bring together relevant, ideal, and distinct information under one roof and offer fresh guidance to researchers and the pharmaceutical sector, hence increasing the natural product's pharma value. This review includes a phytochemical constituent list, pharmacological activity reports, and a pharmacognomic assessment of the leaves and bark of distinct plant sections. Therefore, the purpose of this review is to conduct a comparative analysis of the morphology, microscopy, phytochemical, and pharmacological properties of the bark and leaves of the Ashoka (*Saraca Asoca*) herb.

Keywords- Anti-estrogenic, Genoprotective activities, Pharmacological, *Saraca Asoca*, Socio-ethnobotanical.

1. Introduction

Due to the exceptional power of herbal therapy, several alternative medicine therapies, like Unani and Ayurveda, use herbal remedies to treat their patients. Roughly 25% of prescription medications come from plants that are trees, shrubs, or herbs¹. Because of the vast abundance of medicinal plants that nature has given our nation, India is frequently referred to as the "Medical Garden of the World." Thus, *Saraca asoca* stands as one of the most important plants used from ancient times to the present. The Sanskrit term asoka, sometimes known as ashoka, meaning "without sorrow" or "that gives no grief." One of India's most revered and mythical trees is the Ashoka. The common name for the assoka tree is *Saraca asoca* (Roxb.), De.wild, or *Saraca indica*².

Ashoka leaves are traditionally used in India to alleviate women's depression, dysmenorrhea, and excessive uterine bleeding. Additionally, it is used to treat dyspepsia, irritation, and irregular vaginal discharge. Its antibacterial, anticancer, antihemorrhagic, and anti-oxytocic properties have been discovered³. The dried bark of the *Saraca asoka* tree has organic calcium compounds such as catechol, sterol, and tannins. Aluminum, strontium, calcium, iron, magnesium, phosphate, potassium, sodium, and silica are also present in the tree's powdered bark. Menstrual diseases characterized by heavy bleeding, discomfort, dysmenorrhea, abdominal pain, and uterine spasms can be treated with the *Saraca asoca* plant. The asoca plant is useful as a uterine tonic for irregular menstrual cycles and miscarriages because it strengthens the uterine muscles and endometrium. The aim of the present study is to provide complete information about the medicinal & pharmacological importance of the *Saraca asoca*⁴.



Figure 1. Leaves & Bark of Ashoka Plant

2. Description

2.1 Parts used: Bark, leaves, Flower.

2.2 Externally: The medication is applied locally to treat a variety of poisonings and pain.

2.3 Internally : It is recommended for uncomfortable visceral conditions.

2.4 Systematic :

- a) Digestive system: in cases of dysentery, diarrhea, worm infestation, and thirst.
- b) Heart and circulatory system: Edema and hemorrhages are suggested by the flower.
- c) Menorrhagia, dysmenorrhoea, leucorrhoea, and other uterine illnesses are cases of the reproductive system.
- d) Urinary system: Powdered leaves are used to treat urinary tract stones and dysuria⁴.

2.5 Action of Drug :

Bark has uterine sedative and strong astringent properties. It directly affects the uterine muscle fibers. It stimulates the ovarian tissue as well as the endometrium. It appears that the ketosterol found in Ashoka bark has androgenic properties. The steroidal component and the calcium salt seem to be responsible for the drug's action. Two active components are said to be present in the aqueous bark extract: one stimulates and the other relaxes the guinea pig's ilium's plain muscle. According to reports, the pharmacological component in leaves stimulates the uterus, increasing the frequency and duration of contractions without causing tonic contractions, as is the case with ergot or pituitary stimulation. There are additional reports of a crystalline glycosidal material in leaves to induce contractions of the uterus. It is proposed that the medication might be helpful in any situation where uterine hemorrhage occurs and ergot is recommended⁴.

2.6 Synonyms :

Ashok, Shoknashan, Smaradhivas, Kankeli, Vanjuldrum, Raktapallava, Hempushpa, Nata, Pindapushpa, Gandhapushpa, Madhupushpa⁵.

2.7 Vernacular Names :

In Indian literature, this tree is known by several different names. The Ashoka tree goes by a few names.

Latin name : *Saraca indica* Common name: Asoka, Hempushpa

English name : Asoka⁵

Habitat

It can be found throughout the Indian subcontinent. The Western Ghats and Deccan plateau are thought to be the tree's original habitat. The eastern and central Himalayas are also home to it. It can grow up to 750 meters above sea level, according to reports. The plant can reach up to nine meters in height and length. Across India, the plant is typically found in fertile and semi-fertile regions. The tree is a member of the family Caesalpinaceae.⁶ The color of this perennial plant can vary from a deep green to a grayish green. The lenticels have opposing ridges and a round shape. Usually, the seeds have fibers and are reddish brown in color^{6,7}.

2.8 Cultivation

- 1. Soil and climate:** Medium to deep, well-drained, fertile soils that are slightly acidic to neutral are necessary for the plant's healthy growth. Under irrigation, it thrives in tropical to subtropical environments.
- 2. Nursery Growing and Planting:** The crop can be propagated by seeds and stem grafting. During the rainy season, the seedlings are sown in the well-manured field. Crops are typically rainfed, however irrigation can be applied as needed (weekly or fortnightly) to improve production⁷.
- 3. Irrigation:** Although crops are often produced under rain, irrigation can be used as needed (weekly or fortnightly) to improve production.
- 4. Harvesting and Post-harvest Procedures:** Trees that are 10 years old or older must have their bark peeled and sun dried.⁸

3. Taxonomic Classification

Kingdom : Plantae

Divison : Magnoliophyta

Class : Mgnoliopsida

Order : Fabales
Family : Caesalpinaceae
Genus : Saraca
Species : *Asoca*^{8,9}

4. Adulterants

Because of its inherently sluggish growth rate, the damaging extraction of crude medicines, and the lack of a well-coordinated cultivation and collecting program, *S. asoca* is becoming increasingly scarce. Each of these elements has played a part in creating the current situation. On the other hand, it is often contaminated with *Polyalthia longifolia* bark in order to meet the population's growing needs and maximize the possible profits⁹. This tree has bark characteristics that are similar to those of *S. asoca*. There are also cases where the bark of *S. asoca* is mixed with the bark of the peacock flower (*Caesalpinia pulcherrima*) and the Rohitaka (*Aphanamixis polystachya*). The therapeutic efficacy of the drugs made from these adulterants is compromised when they are used since their efficacy is significantly reduced at that point¹⁰.

5. Traditional uses

S. asoca bark is a possibly medicinal material used to cure ulcers, biliousness, piles, dyspepsia, and dysentery. There have been reports of blood-purifying qualities in the plant's leaves. To relieve stomach discomfort, juice made from *S. asoca* leaf extracts is sometimes combined with cumin seeds.¹⁰ Moreover, the herb has favorable effects on the uterine muscles and endometrium, and it may be a powerful uterine tonic for irregular menstrual periods. The plant bioactive has been researched to support the circulatory system and has shown a strong therapeutic effect against cardiac conditions and arrhythmias. Additionally, *S. asoca* has been linked to better urine flow and the reduction of uncomfortable urination¹⁰.

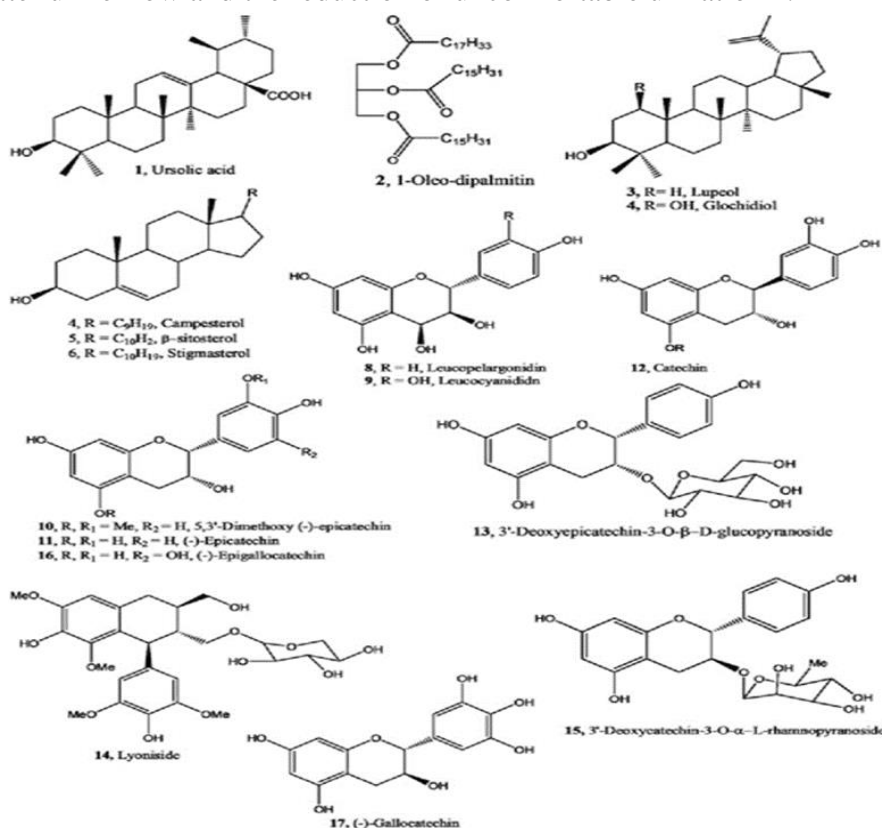


Figure 2. Chemical Constituents Present in Leaf & Bark of *Saraca Asoca* Herb

6. Phytochemical Study

Saraca asoca is reported to contain glycoside, flavonoids, tannins, steroids and saponins.

Table 1. Active Principle in Bark and Leaves of *Saraca asoca*

Plant Parts	Phytoconstituents	References
Bark	Procyanidin, epicatechin, sterol, quercetin, 11-deoxyprocyanidin B, Catechin, epigallocatechin, kaempferol, leucopelargonidin, leucocyanandin	10,11
Leaves	Lyoniside, nudiposode, catechol, glycosides, 9 B- xylopyranosyl, schizandriside, flavonoids - epicatechin, procyanidin B2 and B-Sitosterol glucoside	10,11

7. Microscopical Features

7.1 Leaves

The leaf's transverse section clarifies that it is a dicotyledon. The epidermis has only one layer. Furthermore, a stratified spongy tissue with gaps and a single-layered palisade makes up the mesophyll. The vascular bundle in the midrib is surrounded by a sclerenchymatous ring. Under a microscope, the xylem, phloem, and bundle sheath are distinct and noticeable. The walls of the upper and lower epidermal cells are slightly wavy and have a polygonal form¹².

7.2 Bark

A periderm consisting of a broad cork layer, a narrow cambium that is flattened radially, and a wide secondary cortex with one or two continuous layers of stone cells may be seen in the transverse slice of the stem bark. In addition, prismatic crystals and yellow masses comprise parenchymatous tissue. The components of the secondary phloem are group-organized phloem fibers, sieve tubes containing partner cells, and phloem parenchyma¹².

8. Pharmacological activity of leaves and bark of *Saraca Asoca*

Numerous pharmacological properties are present in *Saraca asoca*, including antimicrobial, anticancer, antimenorrhagic, antioxytocic, antihelminthic, antitumor, antioxidant, anti-inflammatory, antihyperglycemic, central nervous system depressant, analgesic, anti-inflammatory, antiarthritic, and cardioprotective properties. The following properties: antifungal, antiulcer, larvicidal, uterine tonic, and antidiabetic. A few of them are talked about here¹².

8.1 Anti-menorrhagic Activity

Saraca asoca is regarded as a woman's buddy due to its ability to heal a variety of gynecological conditions. In India, dried bark has been used to treat menorrhagia. In cases of uterine problems, females are administered dried bark and flower as a tonic. All disorders related to the menstrual period are also treated with the stem bark of *Saraca asoca*. Research on this leaf action is still possible¹².

8.2 Antimicrobial Activity

By using the micro broth dilution experiment, different components of *S. asoca* were investigated for their antimicrobial activity against six different bacteria (*P. aeruginosa*, *K. pneumoniae*, *S. aureus*, *E. coli*, *A. fumigatus*, and *A. flavus*). By measuring the minimum inhibitory concentration and determining that plant internal tissue exposed to an external environment increased the synthesis of anti-infective molecules, it was determined that LHWE (leaves hot water extract) and RBHWE (renewed bark hot water extract) exhibited superior anti-microbial activity. The antimicrobial activity of *S. asoca* was attributed to the presence of catechin^{12,13}.

8.3 Uterine Tonic

Because of its stimulating effects on the endometrium and ovarian tissue, *Saraca asoca* is used as a plant as a uterine tonic. An herbal remedy called U-3107 was created using two distinct plant extracts, bark and leaf, which are beneficial for treating a range of menstrual diseases, including premenstrual syndrome, menorrhagia, dysmenorrhea, puberty, abnormal bleeding, and impending abortion^{12,13}.

8.4 Anti-helmintic Activity

In Leaves: The human body becomes malnourished, feeble, and vulnerable to bacterial and viral illnesses when parasitic worms are present. It has been claimed that mature Indian earthworms can be killed or paralyzed by methanolic preparations of *S. asoca* leaves^{12,13}.

The stem bark of the *Saraca indica* plant exhibits strong anthelmintic properties because it contains flavonoids, terpenoids, alkaloids, glycosides, saponins, and tannin^{12,13}.

8.5 Anti-inflammatory & Anti-arthritis effect

It has been demonstrated that the ethanolic and methanolic extracts of *S. asoca*'s leaf and bark have anti-inflammatory potential by strongly preventing the binding of different transcription factors to their target DNA sequences, such as NF- κ B, AP-1, GATA-1, etc., and so reducing the levels of proinflammatory cytokines. It has also been demonstrated that *S. asoca* extract lowers levels of TNF- α and IL-1, two pro-inflammatory cytokines¹³.

Several studies use the model system of Carageenan-induced paw oedema and brine shrimp assay to describe the antiarthritic potential of *S. asoca* leaves and bark¹³.

8.6 Antidiabetic Property

In leaves: Studies have demonstrated that the flavonoid fraction of *S. asoca* flowers and leaves inhibits the type-2 diabetes-related enzymes alpha-glucosidase and alpha-amylase as well as prevents the oxidation of low-density lipoprotein (LDL)^{13,14}.

In bark: Ashoka bark decoction is used to treat diabetes by taking two doses each day. When consumed with milk, dried powdered *Saraca asoca* herb has anti-diabetic properties^{13,14}.

8.7 Antioxidant Activity

In Leaf, Jayita Saha and colleagues investigated the antioxidants found in several *Saraca asoca* sections. In an *in-vitro* model for DPPH radical scavenging, the antioxidant activity of methanol extracts was evaluated at various doses. By comparing the IC₅₀ values of the various plant sections of *S. asoca*, antioxidant activity was demonstrated. The *asoca* plant's methanol extract of the leaves had an IC₅₀ value of 28.6 \pm 0.62 mg/ml, which was slightly higher than the IC₅₀ values of the plant's flower and bark, which were 6.83 \pm 0.07 mg/ml and 6.6 \pm 0.10 mg/ml, respectively¹⁴.

Navneet Kumar et al. investigated the *in-vitro* antioxidant activity of a bark extract from *Saraca indica* in stem bark. It was discovered that plant phenolic compounds exhibit potent free radical scavenger action by preventing lipid peroxidation through the neutralization of peroxy radicals produced during lipid oxidation^{15,16}.

8.8 Anticancer effects

The cytotoxic activities of various extracts of *Saraca indica* L. leaves were screened, and the results showed that the total ethanolic extract was active against MCF-7, HEPG-2, and HCT-116 ($IC_{50} \leq 30 \mu\text{g/mL}$ [20]) and inactive against the HeLa cell line; on the other hand, the EtOAc extract demonstrated potent cytotoxic activity against HCT-116, as well as active against MCF-7, HEPG-2, and HEPG-2, with IC_{50} values of 0.038, 3.29, 10.14, and 19.21 $\mu\text{g/mL}$, respectively, in comparison to standard doxorubicin, which was found to be 0.175, 0.155, 0.9, and 0.69 $\mu\text{g/mL}$ ¹⁵⁻¹⁷.

The antiproliferative effect of SIE was assessed in two different types of breast cancer cells (MCA-MB-231 and MCF-7) in a study by Navneet Kumar et al. on stem bark. SIE suppressed the growth of MDA-MB-231 (ER negative) and MCF-7 (ER positive) cells, but its effects were more pronounced in MCF-7 cells, where its IC_{50} values were $73.6 \pm 0.625 \mu\text{g/mL}$ and $128 \pm 0.914 \mu\text{g/mL}$, in MCF-7 and MDA-MB-231 respectively¹⁸⁻²⁰.

8.9 Larvicidal Activity

Fighting the threat posed by insects like mosquitoes is crucial in the fight against infectious diseases including dengue, filariasis, malaria, and others. It has been demonstrated that the bark, leaves, and flowers of *S. indica*, when extracted using petroleum ether and chloroform, dramatically reduced the population of the mosquito *Culex quinquefasciatus*, so preventing the reproduction of insect vectors^{21,22}.

9. Toxicology

When taken orally, ashoka extract is a therapeutically useful organo-chemical substance derived from plants that has few to no harmful effects. The effects of Ashoka administration on blood were investigated in an experimental setting by Teli et al. It was discovered that when Ashoka was taken regularly, it had no harmful effects. Additionally, a second study on animals looked at the toxicity of Ashoka extract at a dosage of 1000 mg/kg. There were no negative toxic consequences noted, such as diarrhea, irritability, or convulsions. Animals also did not show any noticeable behavioral changes²³⁻²⁵.

10. Future Perspectives

S. asoca is considered to be a universal cure in ancient Indian scriptures. The preferred medication for feminine issues is Ashoka. Ashoka has been used for ages to cure bleeding disorders, hemorrhoids, leucorrhoea, menorrhagia, and other feminine issues. The bark and leaves of this plant exhibit a range of pharmacological effects, including as anti-microbial, anti-tumor, anti-cancer, anti-menorrhagic, antioxidant, larvicidal, CNS depressive, anti-mutagenic, and genoprotective qualities. The traditional uses and ethnopharmacological properties of *S. asoca* are widely recognized. Developing multi-active natural medicines for cancer chemoprevention would likely involve extensive study into identifying effective bioactive principles and synergistic interactions of phytochemicals, both of which are expected to produce a lot of knowledge²⁶⁻²⁸.

11. Conclusion

The review above concludes that there are numerous therapeutic benefits associated with *Saraca asoca*. Analgesic, anti-inflammatory, anti-ulcer, anti-cancer, larvicidal, anti-oxytocin, antibacterial, anti-diabetic, anthelmintic, CNS depressive, antimenorrhagic, uterine tonic, and many more pharmacological properties are shown in the bark and leaves portion of it. The plant is regarded as a friend to women because it helps with a number of gynecological conditions. Future investigations on the bark and leaves of *Saraca asoca*, as well as studies on standardization and stability, can be conducted to prevent adulteration and demonstrate the plant's potential as a pharmaceutical industry source.

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