

Phytochemical Profiling And Assessment Of The Therapeutic Prospects Of *Saraca Asoca*

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Abstract

The present study investigates the phytochemical composition and potential health benefits of *Saraca asoca*, a medicinal plant widely recognized in traditional Indian medicine. Preliminary phytochemical screening was performed using bark, leaf and flower extracts to identify the major bioactive constituents. The analysis revealed the presence of saponins, tannins, phenolics, alkaloids, flavonoids, terpenoids, carbohydrates and phytosterols. These compounds are known to contribute to multiple therapeutic effects, including regulation of gynaecological health, enhancement of uterine function, and potential anticancer activity through antioxidant and cytotoxic mechanisms. The findings substantiate the traditional medicinal use of *S. asoca* and emphasize its promise as a natural source of plant-derived compounds with significant health-promoting and disease-preventive properties.

Keyword: phytochemical, traditional Indian medicine, *Saraca asoca*

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I. Introduction

For centuries, medicinal plants have been a cornerstone of traditional healthcare systems across the world, long before the emergence of modern pharmaceuticals [1]. Even in the present day, particularly in developing nations, herbal remedies continue to play an important role in meeting primary health needs. Some of the most widely used drugs, including quinine, artemisinin and shikonin, trace their origins to plants, highlighting the therapeutic potential of phytochemicals [2]. These secondary metabolites such as alkaloids, glycosides, tannins, flavonoids and terpenoids exhibit diverse biological activities and are often associated with antimicrobial, antioxidant, anti-inflammatory and anthelmintic properties.

Among such plants, *Saraca asoca*, commonly known as the Ashoka tree, holds both cultural and medicinal significance. Belonging to the family Caesalpiniaceae, this evergreen tree grows throughout India, particularly in the Himalayas, Bengal, Kerala and other regions up to 750 m altitude [3, 4]. It is also commonly known as Kankeli (Sanskrit), Ashoka (Assamese), Ashoka (Bengali), Ashoka (Gujarati), Ashoka (Hindi), Ashokadamara (Kannada), Ashok (Kashmiri), Asokam (Malayalam), Ashok (Marathi), Ashok (Manipuri), Ashoka (Oriya), Ashok (Punjabi), Asogam (Tamil), Ashokapatta (Telugu).

Classification	<i>Saraca asoca</i>
Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Order	Fabales
Family	Caesalpiniaceae
Genus	<i>Saraca</i>
Species	<i>asoca</i>

It is revered in Indian mythology, often associated with Kamadeva, the Hindu god of love, and believed to be the tree under which Gautama Buddha was born, thereby gaining a sacred status in religious rituals [5]. From a medicinal standpoint, *S. asoca* is well documented in Ayurvedic texts, especially for managing gynaecological disorders such as menorrhagia, dysmenorrhea, leucorrhoea and uterine pain. Beyond this, the plant's bark, flowers and leaves are used for treating fever, dyspepsia, ulcers, skin conditions, urinary disorders and even cancers [6]. Modern phytochemical studies confirm the presence of glycosides, flavonoids, tannins, saponins and phenolic acids which contribute to its antimicrobial, antioxidant, anti-implantation and anti-tumor activities [7]. Leaves of *S. asoca* also contain compounds such as gallic acid and ellagic acid, known for anti-inflammatory and gastro protective effects [8]. While the bark of *S. asoca* has been widely investigated due to its frequent inclusion in traditional Ayurvedic formulations, comparatively less emphasis has been placed on its leaves despite reports of their bioactivity. Since phytoconstituents can vary significantly among different plant parts, it is crucial to systematically evaluate to uncover their therapeutic potential.

The present study is therefore undertaken to perform a preliminary phytochemical screening of *Saraca asoca* leaves, with the aim of identifying bioactive components that may contribute to its medicinal properties.

II. Materials And Methods:

Collection of plant materials

The fresh flowers, bark and leaves of *Saraca asoca* were collected from Kerala in August 2025 were used for study.

Preparation of Extract

Fresh samples of *Saraca asoca* (Ashoka) bark, flowers and leaves were collected and thoroughly washed with ethanol to remove dirt and contaminants. The cleaned plant materials were then crushed in a mortar using a four different solvents (Acetone, Ethanol, Methanol, Distilled water). By gradually adding solvents, a smooth slurry was prepared. The slurry was then boiled at 100°C for 15 minutes to extract the active phytochemicals. After boiling, the mixture was filtered through a strainer to separate the solid residues, and the filtrate was collected in a conical flask.

The flask was labelled with the sample information and stored in the refrigerator for 24 hours to maintain the stability of the extract until further use and analysis.

Characterization of extracts by phytochemical analysis

The phytochemical screening of *Saraca asoca* extract was performed using different standard qualitative tests. The presence of phytochemicals was denoted by a (+) sign and the absence by a (–) sign.

III. Result And Discussions

The phytochemical analysis of *Saraca asoca* extracts revealed the presence of various bioactive constituents, which are associated with physiological and therapeutic significance. The bark, leaves and flowers were subjected to preliminary screening using acetone, ethanol, methanol and distilled water. The results demonstrates on the phytochemical composition.

Table 1 Phytochemical analysis of *Saraca asoca* bark sample

Phytochemical	Test	Acetone	Ethanol	Methanol	Distilled water
Saponins	Frothing test	-	+	-	+
Tannin	Braymer's Test	+	+	+	-
	Gelatin test	-	+	+	+
	Lead Acetate Test	+	+	+	+
Phenolic	Lead Acetate Test	+	+	+	+
Alkaloid	Wagner's Test	+	+	-	+
	Mayer's Reagent Test	+	+	-	+
	Dragendorff's Test	+	+	+	+
Flavonoid	NaOH Test	-	-	-	-
	Ammonia Test	-	-	-	-
	Cyanidin Test	-	-	-	-
	H ₂ SO ₄ Test	-	-	-	-
Terpenoid	Salkowski test	+	+	+	+
Carbohydrate	Fehling Test	-	-	-	+
	Benedict Tests	+	+	+	+
Phytosterols	Salkowski	+	+	+	+
	Liebermann Burchad	+	+	+	+
	Keller Kilani Test	+	+	+	+

Table 2 Phytochemical analysis of *Saraca asoca* flower sample

Phytochemical	Test	Acetone	Ethanol	Methanol	Distilled water
Saponins	Frothing test	+	+	+	+
Tannin	Braymer's Test	+	+	+	-
	Gelatin test	+	+	+	-
	Lead Acetate Test	+	+	+	+
Phenolic	Lead Acetate Test	+	+	+	+
Alkaloid	Wagner's Test	-	-	+	-
	Mayer's Reagent Test	+	+	-	-
	Dragendorff's Test	+	+	+	+
Flavonoid	NaOH Test	+	+	-	+
	Ammonia Test	+	-	+	+
	Cyanidin Test	+	+	+	+
	H ₂ SO ₄ Test	-	+	+	-
Terpenoid	Salkowski test	+	+	+	-
Carbohydrate	Fehling Test	-	+	+	-
	Benedict Tests	-	+	+	-
Phytosterols	Salkowski	+	+	+	-
	Liebermann Burchad	-	-	-	+
	Keller Kilani Test	+	-	-	+

Table 3 Phytochemical analysis of *Saraca asoca* leaves sample

Phytochemical	Test	Acetone	Ethanol	Methanol	Distilled water
Saponins	Frothing test	-	+	-	+
Tannin	Braymer's Test	+	-	+	-
	Gelatin test	+	-	-	-
	Lead Acetate Test	+	-	+	+
Phenolic	Lead Acetate Test	+	+	+	-
Alkaloid	Wagner's Test	-	-	+	-
	Mayer's Reagent Test	-	-	+	-
	Dragendorff's Test	-	-	+	-
Flavonoid	NaOH Test	-	-	+	+
	Ammonia Test	-	-	+	+
	Cyanidin Test	+	-	+	+
	H ₂ SO ₄ Test	-	+	-	-
Terpenoid	Salkowski test	-	+	-	-
Carbohydrate	Fehling Test	-	+	-	-
	Benedict's Tests	+	+	-	-
Phytosterols	Salkowski	-	-	+	-
	Liebermann Burchad	+	-	-	+
	Keller Kilani Test	+	-	-	+

IV. Discussion

The phytochemical composition of *Saraca asoca* strongly supports its traditional use in gynaecological health. Tannins and phenolic compounds exert an astringent effect on the uterine lining by precipitating proteins and inducing vasoconstriction, thereby reducing excessive bleeding in conditions such as menorrhagia. Their antioxidant activity further protects endometrial tissues from oxidative stress and free radical damage, ensuring uterine stability. Flavonoids, many of which act as phytoestrogens, bind to estrogen receptors (ER α and ER β) and modulate hormonal signalling, which aids in the regulation of menstrual irregularities and supports reproductive endocrinology. Alkaloids and saponins, also abundant in the bark and flower extracts, contribute to uterotonic effects by enhancing uterine muscle tone and thereby alleviating dysmenorrhea while maintaining normal uterine contractility. In addition, phytosterols act as structural analogues of steroid hormones and influence the hypothalamic-pituitary-gonadal (HPG) axis, which further contributes to reproductive hormonal balance. The gynaecological pathways influenced by these bioactive molecules include estrogen receptor-mediated signalling, modulation of prostaglandin pathways involved in dysmenorrhea, activation of Nrf2 antioxidant defense mechanisms and suppression of pro-inflammatory cytokines such as TNF- α and IL-6.

In addition to gynaecological relevance, the phytochemical constituents of *S. asoca* demonstrate remarkable anticancer potential through multiple mechanisms. Flavonoids such as quercetin and kaempferol inhibit the PI3K/Akt/mTOR pathway, induce apoptosis through caspase-3 activation, and suppress angiogenesis by down regulating VEGF signalling. Tannins and phenolic contribute by promoting cell cycle arrest at the G1/S checkpoint, activating p53-dependent apoptotic mechanisms, and inhibiting NF- κ B-mediated tumor proliferation. Saponins play a significant role in cancer cell death by disrupting cellular membranes, triggering mitochondrial-dependent apoptosis through down regulation of Bcl-2, cytochrome c release, and caspase-9 activation. Phytosterols, particularly β -sitosterol, induce apoptosis via Fas receptor signalling, interfere with MAPK pathways, and limit metastatic potential. Similarly, terpenoids modulate JAK/STAT and Wnt/ β -catenin signalling pathways, thereby inhibiting tumor proliferation and progression. Collectively, these mechanisms target key molecular processes such as caspase-dependent apoptosis, cell cycle regulation at the G1/S checkpoint, suppression of angiogenesis through VEGF inhibition, inhibition of oncogenic transcription factors including NF- κ B and MAPK, and oxidative stress modulation via activation of Nrf2 signalling.

V. Conclusion

The phytochemical analysis of *Saraca asoca* confirms its rich composition of polyphenols, flavonoids, alkaloids, saponins and phytosterols which provide dual therapeutic benefits. In gynaecological health, these compounds regulate menstrual cycles, reduce excessive bleeding, enhance uterine tone, and protect reproductive tissues through antioxidant mechanisms. In cancer biology, they exert potent ant proliferative effects by inducing apoptosis, suppressing angiogenesis, modulating oxidative stress and inhibiting oncogenic signalling pathways. These findings validate the long-standing traditional use of *S. asoca* as a uterine tonic and highlight its promise as a natural source of plant-derived anticancer agents.

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