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A Review on *Shinshapa (Dalbergia Sissoo* Roxb.): Ayurvedic Perspective, Phytochemistry, and Therapeutic Applications

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ABSTRACT

Dalbergia sissoo Roxb. (*Shinshapa*), commonly referred to as Indian Rosewood, is a fast-growing deciduous tree of the Fabaceae family, long esteemed in Ayurvedic medicine. Traditionally, it has been employed in the management of skin disorders, inflammation, fever, ulcers, and hepatic dysfunctions, with classical texts attributing to it *tridoṣa-shmaka* (balancing all three doshas. Contemporary phytochemical analyses have identified a broad spectrum of bioactive constituents, including flavonoids, neoflavonoids, triterpenoids, and phenolics, which underpin its reported antioxidant, anti-inflammatory, hepatoprotective, and antimicrobial effects. Pharmacological investigations further substantiate its antinociceptive, anti-osteoporotic, neuroprotective, anticancer, and antimicrobial activities, while toxicological evaluations indicate a favorable safety profile at therapeutic doses. Notably, emerging studies highlight its role in nanomedicine, particularly through the green synthesis of copper oxide nanoparticles exhibiting potent activity against multidrug-resistant pathogens. By integrating Ayurvedic insights with modern scientific validation, *D. sissoo* demonstrates considerable potential as a multipurpose medicinal plant with both therapeutic and industrial applications. This review synthesizes classical references, phytochemical profiles, pharmacological findings, and toxicological data, thereby underscoring its value in advancing sustainable, plant-based therapeutic strategies.

Keywords: *Ayurveda*, *Dalbergia sissoo* Roxb., *Shinshapa*, pharmacological activities, neuroprotection, Antimicrobial.

Introduction

Shinshapa (*Dalbergia sissoo* Roxb.), commonly known as Indian Rosewood, is a fast-growing deciduous tree indigenous to the Indian subcontinent and a valued species within the Fabaceae family. [i] It has long been cultivated for both economic and medicinal purposes. In traditional medicine, particularly Ayurveda, it is recognized for its therapeutic applications in the treatment of skin disorders, inflammation, wounds, fevers, and liver dysfunctions (Nadkarni, 1976). [ii] It is one of the few medicinal plants that bridge the classical Ayurvedic approach and contemporary scientific validation. Ayurvedic texts such as the *Bhavaprakasha Nighantu* and the *Charaka Samhita* detail the use of Shinshapa as a pitta-kapha balancing herb, recommended for use in conditions such as kustha (skin diseases), vrana (ulcers), and jwara (fever). It is described as having tikta (bitter), kashaya (astringent) rasa, sheeta virya (cool potency), and katu vipaka (pungent post-digestive effect), which align with its application in inflammation and detoxification therapies (API, Vol. VI).[iii] Recent studies have shown that various extracts of *Dalbergia sissoo* contain significant levels of bioactive compounds like flavonoids, triterpenoids, and phenolics, which correlate with its anti-inflammatory, hepatoprotective, and antioxidant activities (Gupta et al., 2006; Kaur et al., 2020).[iv],[v]Its relevance has extended into other traditional systems such as Unani and Siddha medicine as well. This integrative value makes *Shinshapa* a significant candidate for further investigation and potential inclusion in global therapeutic protocols aimed at sustainable and natural treatments. With growing concerns around antibiotic resistance and chronic inflammatory diseases, there is a renewed interest in revisiting traditional medicinal plants. This review consolidates Ayurvedic principles, botanical information, phytochemistry, and modern pharmacological insights to present a comprehensive perspective on the therapeutic potential of *Dalbergia sissoo* Roxb.

Materials and Methods

This review employed a narrative approach. Ayurvedic classical texts, including *Charaka Samhita*, *Sushruta Samhita*, *Bhavaprakasha Nighantu*, and the Ayurvedic Pharmacopoeia of India, were examined for traditional references to *Shinshapa*. Scientific data were collected from electronic databases such as PubMed, ScienceDirect, Scopus, and Google Scholar using keywords including "*Dalbergia sissoo*," "*Shinshapa*," and "therapeutic effects."Inclusion criteria comprised peer-reviewed articles published in English related to the botanical description, phytochemical content, and pharmacological activities of *Dalbergia sissoo*. Many articles were reviewed, including both in vitro and in vivo studies, ethnobotanical surveys, and reviews.

Botanical description

Dalbergia sissoo Roxb. (*Shisham*), commonly known as Indian Rosewood, belongs to the family Fabaceae. It is widely cultivated in the plains of India and naturally distributed in the western Himalayas up to an altitude of about 1300 meters, as well as in the Terai regions of Nepal, Sikkim, and the forests of upper Assam. The tree generally attains a height of 10–15 meters, sometimes reaching up to 25 meters, with a trunk diameter of 2–3 meters, and spreads into a broad crown. It produces strong and durable timber that is highly valued for its strength, smooth texture, and dark brown hue, making it suitable for the preparation of various articles and furniture. The leaves are round, pointed, and resemble those of Ziziphus species, though comparatively larger, thicker, and glossier on the upper surface, occurring in small clusters. The flowers are small and borne in bunches, while the fruits are long, thin, and flat pods containing small, compressed seeds. Owing to these characteristics, *Dalbergia sissoo* is recognized as an important timber-yielding species with both economic and ecological significance. [vi] (see fig.1)

Kingdom- Plantae

Order- Fabales

Family- Fabaceae

Sub Family- Faboideae

Tribe - Dalbergia

Genus- Dalbergia

Species- Sissoo

Fig .1 SHINSHPA

Vernacular names [vii]

Sanskrit- Shinshapa, Aguru

English -Indian Rosewood,

Hindi -Shisham, sissu, sissai, sisam

Tamil -Sisso, gette

Kannada- Betti, shista baage agaru, bindi

Bengali - Shishu, Sissoo

Classical Categorization

- Bhavaprakasha Nighantu – Vataadi varga [viii]
- Dhanvantari Nighantu – Aamaradi varga
- Raja Nighantu – Prabhadradi varga
- Kaiyadeva Nighantu – Aushadi varga
- Sodal Nighantu – Aamaradi varga
- Charak Samhita – Kashayaskanda
- Sushruth Samhita- Shalsaradi, muskadi gana.

Table 1. Ayurvedic Pharmacodynamics [ix]

Dravya	***Shinshapa***
Rasa	*Kashaya, Katu, Tikta*
Guna	*Laghu, Ruksha*
Virya	*Ushna*
Vipaka	*Katu*
Dosha Karma	*Tridhosha shamak*

Observation and Results

Phytochemical Constituents

Various classes of bioactive compounds have been isolated from different parts of D. sissoo: isoflavones (e.g., sissotrin, biochanin A, tectorigenin), neoflavonoids (dalbergichromene), chalcones, glycosides (caviunin glucosides), sterols, tannins, saponins, terpenoids, and fatty acids. (Table 2)

Table 2. Major phytochemicals isolated from *Dalbergia sissoo*

Plant Part	**Phytochemicals Reported**	**Reference**
Bark	Isoflavones (sissotrin, biochanin A), tannins, triterpenoids	Gupta et al., 2006[x]
Leaves	Neoflavonoids (dalbergichromene), chalcones, flavonoids, phenolic acids	Kaur et al.,2020[xi]
Seeds	Fatty acids, glycosides, sterols	Khan et al., 2013[xii]
Heartwood	Terpenoids, lignans, saponins	Nadkarni, 1976[xiii]

Pharmacological Activities

Antinociceptive (Analgesic) Action

The antinociceptive activity of the methanol extract of *Dalbergia sissoo* leaves (MEDS) was evaluated using both chemical and heat-induced pain models in mice, including the hot plate, tail immersion, acetic acid-induced writhing, formalin, glutamate, and cinnamaldehyde tests, at oral doses of 100, 200, and 400 mg/kg. Morphine sulphate (5 mg/kg, i.p.) and diclofenac sodium (10 mg/kg, i.p.) served as standard reference drugs. To investigate the potential involvement of opioid receptors in the central antinociceptive action of MEDS, naloxone was administered as an antagonist. The results demonstrated that MEDS produced significant, dose-dependent antinociceptive effects in all the experimental models ($p < 0.001$). These findings suggest the participation of both central and peripheral mechanisms in its activity, with naloxone confirming the role of opioid receptors in the central pathway. In

conclusion, the study provides evidence that the leaves of *D. sissoo* possess central and peripheral antinociceptive properties, thereby supporting their traditional application in the management of various painful conditions. [xiv]

Anti-Osteoporotic

SEL-Ds exhibited anti-osteoporotic activity, as evidenced by the reduction in serum TNF-α levels accompanied by a simultaneous decrease in ALP. The maintenance of bone mineral density (BMD) in most women further supports its anti-osteoporotic potential. Its anti-inflammatory effect was reflected by the decline in hs-CRP levels and the improvement observed in cluster analysis of musculoskeletal symptom profiles. Moreover, the safety of *D. sissoo* at the administered dose (300 mg twice daily for one year) was confirmed by the absence of adverse events and the stability of organ function test results. [xv]

Anti-Inflammatory Effects

The anti-inflammatory potential of the 90% ethanolic extract of *Dalbergia sissoo* leaves (DSELE) was evaluated in various experimental models of inflammation in rats following oral administration at doses of 100, 300, and 1000 mg/kg. DSELE produced significant inhibition of carrageenan-, kaolin-, and nystatin-induced paw oedema, as well as a marked reduction in granuloma weight in the cotton pellet-induced chronic inflammation model. In mice, it also suppressed dye leakage in the acetic acid-induced vascular permeability assay. Importantly, the extract did not exhibit any ulcerogenic effects on the gastric mucosa in either acute or chronic studies. Acute toxicity testing further indicated that DSELE was safe up to a dose of 10.125 g/kg (p.o.) in rats. Overall, the findings demonstrate that DSELE possesses significant anti-inflammatory properties across acute, sub-acute, and chronic models of inflammation, without adverse effects on gastric mucosa. At all tested doses, the extract effectively reduced paw oedema and granuloma formation, with its activity in chronic inflammation being comparable to that of phenylbutazone. [xvi]

Antimicrobial Activity

Antimicrobial screening revealed that the ethanolic extract of *Dalbergia sissoo* exhibited the largest zones of inhibition, particularly against *Klebsiella aerogenes* (16.26 mm) and *Micrococcus luteus* (18.8 mm) at a concentration of 60 mg/mL. Additionally, the extract demonstrated notable corrosion inhibitory activity, achieving 81.76% inhibition against a 1 M HCl solution, indicating its potential for industrial applications. These results suggest that the ethanolic extract of *D. sissoo* is a cost-effective source of bioactive compounds with promising applications in both pharmaceutical and industrial sectors. [xvii]

Antioxidant activity

The in vitro antioxidant activity methanolic and ethanolic leaf extract of Dalbergia sissoo was evaluated by the DPPH method using ascorbic acid as a standard. All the leaf extracts of *D. sissoo* exhibited a significant dose-dependent inhibition of DPPH activity. However, the activity shown by the ethanolic extracts was more than ethanolic extracts. The EC_{50} for the Ethanolic extract was 106.32 micrograms per ml, and for the methanolic extract was 815.53 micrograms per ml. The antioxidant activity of the leaf extract was shown in the following order: ascorbic acid> ethanolic extract> ethanolic extracts. [xviii]

Toxicological Studies

Various review articles on the Toxicological studies on *D. sissoo* have confirmed its safety profile across different plant parts. Acute toxicity experiments with ethanol and alcoholic bark extracts showed that Swiss albino mice and rats tolerated doses up to 3000 mg/kg body weight without mortality or toxic symptoms. Even at high doses between 50 and 3000 mg/kg, no abnormal behavior, weight changes, or clinical signs of toxicity were observed during seven days. Similarly, methanolic leaf extract demonstrated very low toxic potential, with an LD50 greater than 3000 mg/kg. Only minor histological alterations were noted in the kidney and liver, while long-term administration of the extracts produced no cumulative toxic effects. These results suggest that both bark and leaf extracts of *D. sissoo* are safe and further support its use as an herbal remedy for various health disorders. [xix]

Discussion

Natural and traditional medicines derived from plants and herbs are considered among the safest and most effective sources of therapeutics. In Western India, various parts of *Dalbergia sissoo* (Fabaceae) have traditionally been employed by local tribes for the treatment of different cancers, although these claims have not been scientifically validated. Therefore, this study aimed to evaluate the antioxidant and anticancer potential of extracts from the bark, root, and branches of *D. sissoo*. Antioxidant activity was assessed using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assay, while anticancer effects were evaluated in vitro against six cancer cell lines (K562, PC3, A431, A549, NCIH 460, and HEK 293 T) through cell viability and cytotoxicity assays. Additionally, in silico molecular docking, molecular dynamics (MD) simulations, and ADME analyses were performed on previously reported bioactive compounds from these plant parts to validate their potential bioactivity. The DPPH assay demonstrated that the methanol:water bark extract exhibited the highest antioxidant activity, with an IC50 of 45.63 ± 1.24 mg/mL. Moreover, this extract effectively inhibited the proliferation of A431, A549, and NCIH 460 cell lines, yielding IC50 values of 15.37, 29.09, and 17.02 µg/mL, respectively, indicating substantial anticancer potential. Molecular docking and dynamic simulation studies further revealed that Prunetin, Tectorigenin, and Prunetin 4'-O-Galactoside exhibited strong binding affinity to the EGFR binding domain. Overall, the findings suggest that these compounds may serve as promising antioxidant and anticancer agents, with potential applications in the pharmaceutical sector. [xx]

Ayurvedic literature suggests that *Dalbergia sissoo*, traditionally used for gastric and skin ailments, possesses brain-revitalizing properties; however, its neuroprotective effects in an amyloid-β (Aβ) 1-42 model of Alzheimer's disease (AD) have not been established. In this study, ethanolic extracts of *D. sissoo* leaves (EEDS) were administered orally to rats at doses of 300 and 500 mg/kg for two weeks prior to intracerebroventricular injection of Aβ (1-42), and their effects on cognitive function, oxidative stress, and neuroinflammation were evaluated. Memory performance assessed using the Morris water maze task demonstrated significant improvement in Aβ-treated rats, while biochemical analyses revealed a reduction in oxidative stress through decreased nitrite and malondialdehyde levels and increased catalase activity and glutathione content in the hippocampus. Additionally, EEDS attenuated neuroinflammation in a dose-dependent manner by lowering key neuroinflammatory markers. These findings indicate that *D. sissoo* leaf extract can alleviate Aβ-induced cognitive deficits by modulating cholinergic function, oxidative stress, and neuroinflammatory pathways, highlighting its potential in neuroprotection. [xxi]

The rise of antibiotic-resistant bacteria due to excessive and improper antibiotic use has prompted the search for alternative treatments against multidrug-resistant (MDR) pathogens. In this study, copper oxide nanoparticles (CuO NPs) were green-synthesized using *Dalbergia sissoo* leaf extract and characterized by UV-visible spectroscopy, SEM, FTIR, and XRD, confirming an absorption peak at 290 nm, crystalline structure, and functional groups acting as reducing and capping agents. SEM showed few spherical nanoparticles (<100 nm) with most forming agglomerated clusters. The CuO NPs demonstrated strong antimicrobial activity against MDR bacteria (*Acinetobacter baumannii, Staphylococcus aureus, Escherichia coli,* and *Klebsiella pneumoniae*) with inhibition zones up to 24 mm and MICs of 62.5–125 µg/mL, induced significant membrane disruption ($p < 0.05$), and inhibited biofilm formation by 68.4–75.8% at higher concentrations. Synergistic effects with antibiotics were observed, and in vitro antioxidant assays showed dose-dependent free radical scavenging activity against DPPH (73.6%), ABTS (68%), and H_2O_2 (63%), indicating the nanoparticles' multifunctional therapeutic potential. [xxii]

The classical Ayurvedic lexicons describe *Shinshapa* (*Dalbergia sissoo* Roxb.) with multiple synonyms such as *Mahshyama, Kṛṣṇasara, Kapila, Kushimsapa, and Bhasmagarbha*, highlighting its diverse morphological varieties and therapeutic potentials. It is characterized as *kaṭu* (pungent), *tikta* (bitter), and *kaṣhya* (astringent) in taste, with *uṣṇa virya* (heating potency). Pharmacologically, the plant is attributed with actions such as *medohara* (reducing adiposity), *kuṣṭhaghna* (alleviating skin disorders, including leprosy and vitiligo), *krimighna* (anthelmintic), and *garbhapatini* (abortifacient). Further, it is described to alleviate *basti-roga* (urinary disorders), *sotha* (inflammation, edema), *atisara* (diarrhea), *jvara* (fevers of vāta–pitta origin), *vaman* (emesis), *svasa* (respiratory afflictions), and *hikka* (hiccup). Its formulations are indicated for promoting digestion (*dipaniya*), pacifying *pitta-doṣa*–related burning sensations, and improving overall strength (*balya*) and taste perception (*rucikara*). Distinct varieties such as *Sweta-Shinshapa* (white variety) are described as *shita virya* (cooling in potency), effective in pacifying *pitta* and mitigating burning sensations, whereas *Kapilā-śiṁśapā* (yellowish variety) is credited with relieving fatigue, vomiting, and hiccups. Collectively, references across *Bhavaprakasha Nighaṇṭu, Dhanvantari Nighaṇṭu, Kaiyadeva Nighaṇṭu,* and *Raja Nighaṇṭu* establish *Shinshapa* as a medicinal plant of high therapeutic significance, employed in conditions ranging from metabolic disorders to systemic inflammatory and infectious diseases. [xxiii]

Conclusion

Dalbergia sissoo (*Shinshapa*) is a medicinally important plant that reflects the close connection between Ayurvedic wisdom and modern scientific findings. Classical texts highlight its use in skin diseases, fever, ulcers, liver disorders, and inflammatory conditions, while recent studies confirm its antioxidant, anti-inflammatory, antimicrobial, neuroprotective, and anticancer activities. Toxicological studies support its safety, and new approaches such as nanoparticle synthesis have expanded its relevance to modern healthcare and industry. Although its potential is evident, further clinical trials and standardization are required to ensure its wider acceptance. Overall, *Shinshapa* stands out as a valuable plant that can contribute to sustainable and integrative healthcare in the present times.

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