



REVIEW ON TRADITIONALLY MEDICINAL IMPORTANCE, MORPHOLOGY, PHYTOCHEMISTRY AND PHARMACOLOGICAL ACTIVITIES OF *DALBERGIA SISSOO*

Ratna D. Nikum*, Dr. J.Y. Nehete.

M. Pharmacy (Pharmacognosy)*, M. Pharmacy (HOD of Pharmacognosy) Ph. D.

Department of Pharmacognosy, MGV's Pharmacy College Panchavati, Nashik, Maharashtra, India.

Abstract:

Natural plant products have been used throughout human history for many purposes. *Dalbergia Sissoo* is also an herbal medicinal plant which belongs to family Fabaceae (Leguminosae). The aim of present review is, therefore, an effort to give a detailed survey of the literature on its traditionally medicinal use, morphology, phytochemistry and pharmacological activities of the plant *Dalbergia sissoo*. *Dalbergia Sissoo* is traditionally used in the treatment of various systemic disease and disorders such as cardiac diseases, gastrointestinal related disorders and diseases, sexual diseases and skin diseases. It contains many active constituents i.e. flavonoids, alkaloids, glycosides, carbohydrates, tannins proteins, fatty acids and amino acids, those are useful in the treatment of various type of diseases. Plant part extracts from *Dalbergia Sissoo* are reported on anti-inflammatory, anti-termite, anti-diabetic, analgesic and antipyretic, anti-helminthic, antioxidant, antimicrobial, antinociceptive, osteogenic, anti-spermatogenic, gastro protective, neuroprotective, anti-molluscicidal, anti-larvicidal, antiulcer, immunomodulatory, antibacterial activity are revealed in this review article.

Keywords: *Dalbergia sissoo*, Traditional importance, Phytochemistry and Pharmacology.

INTRODUCTION

Herbs are plants which having healing properties and can treat a number of health related problems.^[1] Herbal medicine (Herbalism) is the study of pharmacognosy and the use of medicinal plants, which are a basis of traditional medicine.^[2] The World Health Organization (WHO) estimates that 80 % of the population of some Asian and African countries now a days use herbal medicine for some aspect of primary health care.^[3] Some prescription drugs have a basis as herbal remedies, including artemisinin, aspirin, digitalis, and quinine.^[4] The use of herbal remedies is most popular in people having chronic diseases, such as cancer, diabetes, asthma and end-stage kidney disease.^{[5][6][7]} Multiple factors such as age, ethnicity, gender, education and social class are also shown to have association with prevalence of herbal remedies use.^[8]

Dalbergia sissoo is an important medicinal plant which is belongs to legume family (Fabaceae)^[9]. *Dalbergia sissoo*, commonly known as Indian Rosewood and also known as sisu, Sheesham, tahlil and Tali. It is native to Himalayan foothills in Northern India and is distributed in many countries such as India, Pakistan, Burma, Sri Lanka and Mauritius. It is introduced in many other countries of tropics and subtropics and now naturalize in Africa and America.^[10] It is occurring at river banks below up to 900 meters (3,000 ft) elevation but can range naturally up to 1,300 m (4,300 ft). It can withstand in average rainfall up to 2,000 millimeters and it can grow in droughts of 3-4 months. It prefers soils from pure sand and gravel to rich alluvium of river banks and it grow in slightly saline soils.^[11] .Sissoo is an important timber tree of India. It has nut-brown heartwood

which is very hard, heavy, strong and elastic. The wood is used to making doors, window frames, flooring, furniture, boats, cabinets, etc. The pulp of wood is also used in paper making. It enriches soil due to the presence of nitrogen fixing bacteria in roots. The leaves falling from the tree are help to improves soil quality.^[10]

Dalbergia Sissoo is also an herbal medicinal tree. In Ayurveda, it is used for the treatment of various diseases. The wood and bark of *D. Sissoo* used abortifacient, anthelmintic, antipyretic, aphrodisiac, expectorant and refrigerant treatment. In Africa, this tree is used to treat wounds and gonorrhoea^[11].

The genus consists of 300 species among which 25 species occur in India. Many species of *Dalbergia* are important timber trees, valued for their decorative and often fragrant wood, rich in aromatic oils^[12] The most famous of these are the rosewoods, so-named because of the smell, but several other valuable woods are yielded by the genus^[13].

The isolation of several compounds of confirmed biological activity such as flavones, isoflavones, quinines and coumarins from *Dalbergia sissoo*. It also contains tectoridin, caviunin-7-O- glucoside, iso-caviunin, tectorigenin, dalbergin, bio-ghanin A, and 7-hydroxy -4-methylcoumarin. The heartwood gave 3,5-dihydroxy-trans-stibene, biochanin A, dalbergichromene, dalbergenone and iso-dalbergin^[14-17].

Dalbergia sissoo is also effective against blood diseases, syphilis, stomach problems, dysentery, nausea, eye and nose disorders, ulcers, skin diseases; has been used as an aphrodisiac and expectorant; also for its nitric oxide production inhibition activity, anti-inflammatory, analgesic, antipyretic, larvicidal activities.^[18-23]

2 SYNONYMS: ^[24] *Amermnon Sissoo* (Roxb.) Kuntze, *Amerimnon P. Browne*, *Ecastaphyllum P. Browne*, *Coroyo Pierre*, *Triptolemea Mart.*

3 VERNACULAR NAMES: ^[25]

Sanskrit - Shinshapa, Aguru

English - Indian Rosewood Bombay Blackwood

Hindi - Shisham, sissu, sissai, sisam

Tamil - Sisso, gette

Kannada - Betti, shista baage agaru, bindi

Bengali - Shishu, Sissoo

French - Ebenier Juane

Arabic - Arabic

Indonesia - du Khaek Pradu Khack

Javanese - Sonowaseso

Spanish - Sisu

Thai - du-Khaek Pradu Khaek

Persian - Jag

Trade Name – *Sissoo*

4 SCIENTIFIC CLASSIFICATION:^[26]

Kingdom – Plantae

Unranked - Angiosperma

Unranked - Ecidicots

Unranked - Rosids

Order - Fabales

Family – Fabaceae (Leguminosae)

Sub Family – Faboideae

Tribe – *Dalbergia*

Genus - *Dalbergia*

Species – *Sissoo*

5 TAXONOMICAL CLASSIFICATION : ^[27-29]

Domain: Eukaryota

Kingdom: Plantae

Division: Magnoliophyta

Phylum: Tracheophyta

Class: Magnoliopsida

Order: Fabales

Family: Fabaceae

Tribe: Dalbergieae

Genus: *Dalbergia*

Species: *D. sissoo*

Binomial name: *Dalbergia sissoo*

6 BOTANICAL DISCRIPTION:

Dalbergia sissoo is a medium to large tree of about 25 meters height with grey yellow trunk, 2 to 3 meters in diameter.^[30]



Fig. 1: Whole plant of *Dalbergia sissoo*

6.1 Leaves are leathery, pinnately compound, alternate leaflets, petiolated leaf stalk, measures about 15 cm long, each leaflet widest at the base, 4 to 6cm long with a fine pointed tip.^[30]



Fig. 2: Leaves of *Dalbergia sissoo*



Fig. 3: Flowers of *Dalbergia sissoo*

6.2 Flowers are whitish to pink, fragrant, nearly sessile, and in dense clusters.^[30]

6.3 Pods are oblong, flat, thin, strap-like 4 to 8cm long, 1 cm wide and light brown. They contain 1 to 5 flat bean-shaped seeds up to 8 to 10mm long. It has a long taproot and numerous surface roots which produce suckers. Young shoots are downy and drooping, stems have light brown to dark grey bark up to 2.5 cm (0.98 in) thick, shed in narrow strips.^[31]

6.4 Seeds are about 6 to 8×4 to 5 mm, kidney shaped, thin and flat, light brown. The seed is dry and hard. The sapwood is white to pale brown in colour and the heartwood is golden to dark brown in colour.^[32-33]



Fig 5: Pods of *Dalbergia sissoo*



Fig 4: Seeds of *Dalbergia sissoo*

7 GEOGRAPHICAL DISTRIBUTION :

- **Exotic range:** Afghanistan, Bangladesh, Bhutan, India, Malaysia, Pakistan.
- **Native Range:** Cameroon, Cyprus, Ethiopia, Indonesia, Iraq, Israel, Kenya, Mauritius, Nigeria, Sudan, Tanzania, Thailand, Togo, US, Zimbabwe ^[34].

8 TRADITIONAL USE OF VARIOUS PARTS OF DALBERGIA SISSOO:

Dalbergia sissoo is a medicinal plant which has different biological activities. It is used in conditions such as emesis, ulcers, leukoderma, dysentery, stomach troubles and skin diseases^[35-37]. Plant parts of *Dalbergia sissoo* are traditionally used in treating many diseases and are mentioned below:

8.1 Bark:

Active extracts of bark possess carbohydrates, phenolic compounds, flavonoids and tannins. In the Ayurvedic medicinal system, bark of *Dalbergia Sissoo* is used for the treatment of abortifacient, anthelmintic, antipyretic, aperitif, aphrodisiac, expectorant, and refrigerant and also used for controlling anal disorders, dysentery, dyspepsia, leukoderma, and skin ailments. Bark is used to treat Vata related disorders such as sciatica, hemiplegia.^[38]

8.2 Seed:

Seed oil *Dalbergia sissoo* is used in treatment of blue itching, burning on the skin and scabies.^[39]

8.3 Leaves :

Rural people in India and Nepal use *Dalbergia sissoo* leaves in treatment of animals suffering from non-specific diarrhoea. Leaf extract has been used to treat sore throats, heart problems, dysentery, syphilis, and gonorrhoea ^[40]. The juice of the leaves is used for anthelmintic, good for diseases of the eye and the nose. It is used to treat scabies, burning sensation of the body, scalding urine, syphilis, and digestive disorders^[41]. Decoction of leaves is used for the treatment of gonorrhoea. Ayurvedics has also prescribed the leaf juice for eye ailments.

8.4 Wood :

The wood was used for anthelmintic, antileprotic and cooling. Aerial parts were used for spasmolytic, aphrodisiac and expectorant. Wood is used in the treatment of leprosy, boils, vomiting. Yunana use the wood of *D. Sissoo* for blood disorders, burning sensations, eye and nose disorders, scabies, scalding urine, stomach problems, and syphilis.^[42]

8.5 Heart wood :

The heart wood is used to treat herpes, vitiligo, and fever. Shimshapa Sara ksheerapaka is indicated in treating fever (Sushruta).

8.6 Root :

Roots is used in the treatment of diarrhoea and dysentery.

9 PHYTOCHEMICAL CONSTITUENTS OF DELBERGIA SISSOO:

9.1 Stem bark : Dalbergione, dalbergin, methyl dalbergin, 4- phenylchromene, dalbergichromene and isotectorigenin ^[43].

9.2 Leaves and trunk : Dalbergenone, Dalbergin and methyl dalbergin, 4-phenylchromene, dalbergichromene^[44-45].

9.3 Heart wood : Dalbergiphenol, Dalbergenone, Dalbergin, Methyl dalbergin.

9.4 Flowers : Biochanin A, tectorigenin, 7,4 dimethyl tectorigenin and 7-Omethyl tectorigenin. Heart wood also contains fixed oil, containing myristic, palmitic, stearic, arachidic, linoleic, oleic acid, and essential oil, containing two sesquiterpene derivatives bisabolene and nerolidol.^[46]

9.5 Green Pods: Mesoinisitol, 7-O- methyl tectorigenin and 4'- rhamnoglucoside.

9.6 Mature Pods: Isocaviumin, tectorigenin, dalbergin, caviunin and tannins

Table 1: Ethnomedical information of *Dalbergia sissoo* Linn.^[47-52]

Form used	Pharmacological activity
Extract of aerial part	Used for bronchodilator, antipyretic, analgesic and it has estrogen like activities
Dried leaves	Antibacterial, antiprotozoal and anti-inflammatory activity
Leaf Juice	Used in gonorrhoea
Wood paste	Used to treat wound, itching, abscess and vomiting
Oil	Shows repellent activity against <i>Anopheles stephensi</i> , <i>Aedes aegypti</i> , <i>Culex quinquefasciatus</i> and is also resistant to some wood boring insects
Wood and active extract of bark	Ayurvedics: abortifacient, anthelmintic, antipyretic, aperitif, aphrodisiac, expectorant, refrigerant, anal disorders, dysentery, dyspepsia, leukoderma and skin ailments. Yunani: wood is useful in blood disorders, scabies, eye and nose disorders, burning sensations, scalding urine, stomach problems, syphilis boils, eruptions, leprosy and nausea.

10. REPORTED PHARMACOLOGICAL ACTIVITIES:

10.1 Anti-Inflammatory Activity: Anti-inflammatory activity of ethanolic extract of *Dalbergia sissoo* bark was evaluated. It can be concluded that the ethanolic extract at 1000 mg/kg showed the most potent anti-inflammatory activity compared to the other groups (300 and 500 mg/kg) throughout the observation period^[53]

10.2 Anti-Termite Activity: The anti-termite activity of heartwood of *Dalbergia sissoo* was evaluated. It was concluded that the plant extracts could be used as an alternative for synthetic pesticides for the control of termite in buildings^[54]

10.3 Anti-Diabetic Potential: Pankaj Singh Niranjana et al., conducted a study in 2010 to evaluate the antidiabetic activity of ethanolic extract of *Dalbergia sissoo* leaves in alloxan-induced diabetic rats. They concluded that the ethanolic extract of the leaves is 12% more effective in reducing the blood glucose level compared to standard Glibenclamide^[55].

10.4 Analgesic and Antipyretic Effects: Phytochemical, analgesic and antipyretic activities of ethanol extract of *Dalbergia sissoo* seeds were evaluated. It was concluded that *Dalbergia sissoo* seeds extract has moderate analgesic and remarkable antipyretic activities^[56].

10.5 Anti-Helminthic Potential: The anti-helminthic activity of *Dalbergia sissoo* was determined. The study showed the potential usefulness of *Dalbergia sissoo* against helminthic infections^[57]

10.6 Antioxidant Potential: The stem bark of *Dalbergia sissoo* was evaluated for its antioxidant potential. Finally results shown, among the different extracts of stem bark of the plant, chloroform extract exhibited marked antioxidant activity, whereas methanolic extract showed moderate activity in different in-vitro antioxidant assays^[58].

10.7 Antimicrobial Property: In this study, an herbal preparation of *Dalbergia sissoo* and *Datura stramonium* was evaluated for its antibacterial efficacy against gram-positive (*Staphylococcus aureus* and *Streptococcus pneumoniae*) and gram-negative (*Escherichia coli*, *Pseudomonas aeruginosa*, and *Klebsiella pneumoniae*) bacteria. The results of the study show that the extract of *Dalbergia sissoo* and *Datura stramonium* may be used as a potent antiseptic preparation for the prevention and treatment of chronic bacterial infections^[59]

10.8 Antinociceptive Activity: The antinociceptive activity of ethanolic extract of the plant bark of *Dalbergia sissoo* was evaluated using tail flick method on Wistar rats. Three different doses (300, 500, and 1000 mg/kg) in 0.5% carboxymethyl cellulose were administered. Phytochemical investigation of the ethanolic extract showed the presence of carbohydrates, proteins, amino acids, phenolic compounds, and flavonoids. The antinociceptive activity of the bark extract may be due to the presence of phytochemical constituents such as flavonoids^[60].

10.9 Osteogenic Activity: One new isoflavone glucoside, caviunin 7-O-[β -D-apiofuranosyl-(1 \rightarrow 6)- β -D-glucopyranoside] and a new itaconic derivative, (E)- 4-methoxy- 2- (3,4-dihydroxy benzylidene)-4-oxobutanoic acid along with series of isoflavones and flavonols with their glucosides, and a lignan glucoside was isolated from the ethanolic extract of *Dalbergia sissoo* leaves and were assessed for osteogenic activity in primary calvarial osteoblast cultures. The result showed that compounds exhibited significant osteogenic activity^[61]

10.10 Anti-spermatogenic activity: A study was undertaken to evaluate the anti-spermatogenic efficacy of ethanol extract of stem bark of *Dalbergia sissoo* Roxb. For the in vitro study, semen samples were obtained from 15 healthy fertile men aged 25–35 years. Sperm motility was examined by the Sander-Cramer method. Ethanol extract at a concentration of 20 mg/mL caused complete immobilization within 3 minutes. The in vivo studies ethanol extract at a dose of 200 mg/kg body weight resulted in a significant decrease ($p < 0.01$) in weight of the testis and epididymis. A significant decrease ($p < 0.01$) in sperm motility and sperm count in the epididymis were observed. Histological changes in the epididymis and testis were also investigated.^[62]

10.11 Gastro protective action: This study was conducted to evaluate the antiulcer effects of *D. sissoo* stem bark methanol extract (DSME) against the diclofenac sodium-induced ulceration in rats. The results of this study showed that DSME exhibits a potential gastro protective activity probably due to its antioxidant and cytoprotection ability^[63]

10.12 Neuroprotective action: This research was performed in 3- Nitro propionic acid induced neurotoxic rats to characterize the neuroprotective effect of ethanolic extract of *Dalbergia sissoo* leaves. The ethanolic extract of *Dalbergia sissoo* leaves was administered 300 and 600mg/kg orally to neurotoxic rats. These results suggest that ethanolic extract of *Dalbergia sissoo* leaves may have potential therapeutic value in various neurological disorders, probably by its antioxidant, anti-inflammatory and estrogenic properties^[64]

10.13 Anti-molluscicidal activity: The crude aqueous and ethanolic extracts from different parts of *Dalbergia sissoo* were evaluated against egg masses and adults of *Biomphalaria pfeifferi* the snail intermediate host of *Schistosoma mansoni* in Nigeria. Only the ethanolic extracts of the fruits and roots showed significant activities against the adult snails and their egg masses while all other extracts demonstrated weak molluscicidal and ovicidal activities.^[65]

10.14 Anti-larvicidal activity: Studies were carried out to evaluate the growth inhibitor, repellent action & anti larvicidal action of *D. sissoo* oil against *Aedes aegypti*, *Anopheles stephensi* and *Culex quinquefasciatus* under laboratory conditions. The oil also showed strong repellent action when oil was applied on exposed parts of human volunteers. They were protected from mosquito bites for 8 ± 11 h. The protection obtained with *sissoo* oil was comparable to that with commercial Mylol oil consisting of di-butyl and dimethyl phthalates^[66]

10.15 Antiulcer activity : This study evaluate the Antiulcer activity of crude ethanolic bark extract of *Dalbergia sissoo* using pylorus ligation and Indomethacin induced ulcer model in Wistar albino rats. The antiulcer effect of EBED may be due to any of the probable mechanisms viz. reduction in gastric acid secretion, antioxidant action, mucoprotection or gastric cytoprotection attributed by the presence of various secondary metabolites.^[67]

10.16 Immunomodulatory activity : The Immunomodulatory effect of *Dalbergia sissoo* bark by using four methods named as Humoral immune response, WBC count, cellular immune response, and Carbon clearance test. Administration of *Dalbergia sissoo* produced a significant stimulation of immune system. The Metabolic extract of *Dalbergia sissoo* bark dose of 250 and 500 mg/kg body weight was used. Control saline (0.9% w/v NaCl) was used as a general vehicle. Administration of *Dalbergia sissoo* produced a significant stimulation of immune system and also it can be concluded that the immunostimulatory property of extract was dose dependent^[68].

10.17 Antibacterial Activity : Antibacterial activity of ethanolic, distilled water and methanol extract of the leaves of *Dalbergia Sissoo* Roxb. was studied against *Escherichia coli* and *Bacillus licheniformis* by agar well diffusion method. The growth of both *E.coli* and *B.licheniformis* was inhibited by all the three extracts of dried Leaf Extracts of *Dalbergia Sissoo* Roxb. The root extracts of *Dalbergia Sissoo* Roxb. have potent antibacterial activity when compared with conventionally used drugs and is almost equipotent to the standard (gentamycin) antibacterial drug^[69].

Table 2: List Of Different Species Of Dalbergia Genus^[70-71]

Sr. No.	Species	Sr. No.	Species
1	(Rosewood) <i>D. abrahamii</i>	26	(Bombay Blackwood) <i>D. latifolia</i>
2	(Burmese Rosewood) <i>D. bariensis</i>	27	(Bois de Rose) <i>D. maritima</i>
3	(Palisander) <i>D. baronii</i>	28	(African Blackwood) <i>D. melanoxylon</i>
4	(Caroba-Brava) <i>D. brasiliensis</i>	29	(Canela-De-Buro) <i>D. miscolobium</i>
5	(Brown's Indian Rosewood) <i>D. brawenei</i>	30	(Rosewood) <i>D. mollis</i>
6	(Granadillo) <i>D. calacina</i>	31	(Bejuco De Peseta) <i>D. monetaria</i>
7	(Dalbergia) <i>D. candenatensis</i>	32	(Bahia Rosewood) <i>D. nigra</i>
8	(Jacarand) <i>D. catingicola</i>	33	(Fragrant Rosewood) <i>D. odorifera</i>
9	(Brazilian Kingwood) <i>D. cearensis</i>	34	(Bruma Rosewood) <i>D. oliveri</i>
10	(Rose Wood) <i>D. cochinchinensis</i>	35	(Dalbergia) <i>D. palauensis</i>
11	(Granadilo) <i>D. cubilquitzensis</i>	36	(Dalbergia) <i>D. palauensis</i>
12	(Bruma Blackwood) <i>D. cultrata</i>	37	(Akar laka) <i>D. parviflora</i>
13	(Bruma Blackwood) <i>D. cultrate var cultrata</i>	38	(Nambar) <i>D. retusa var retusa</i>
14	(Bastiao-De-Arruda) <i>D. decipularis</i>	39	(Rabo-De-Guariba) <i>D. riparia</i>
15	(Bejuco De Peseta) <i>D. ecastaphyllum</i>	40	(Malabar Blackwood) <i>D. sissooides</i>
16	(Mussuta) <i>D. elegans</i>	41	(Indian Rosewood) <i>D. sissoo</i>
17	(Jacarand-Rosa) <i>D. foliolosa</i>	42	(Sabuarana) <i>D. spruceana</i>
18	(Jacaranda-Rosa) <i>D. frutescens</i>	43	(Rosewood) <i>D. stevensonii</i>
19	(Pau-De-Estribio) <i>D. frutescens var frutescens</i>	44	(Vernica) <i>D. subsymosa</i>
20	(Jacarand-Rosa) <i>D. frutescens var tomentosa</i>	45	(Rosewood) <i>D. trichocarpe</i>
21	(Ebano) <i>D. funera</i>	46	(Dalbergia) <i>D. tucurensis</i>
22	Tripa-De-Galinha) <i>D. gracilis</i>	47	Heliotropio) <i>D. villosa</i>
23	(Sebastiao-De-Arruda) <i>D. hortensis</i>	48	(Heliotropio) <i>D. villosa var barretoana</i>
24	(jacaranda) <i>D. inundata</i>	49	(Rosewood) <i>D. xerophila</i>
25	(Shisham) <i>D. lanceolaria</i>	50	(Yucatan Rosewood) <i>D. yucatenis</i>

11. Conclusion

Dalbergia sissoo has many types of pharmacological effect due to its active phytoconstituents. *Dalbergia sissoo* is used traditionally in the treatment of various systemic complications, therefore it required furthermore phytochemical and pharmacological research on plant parts of *Dalbergia sissoo*. This review will help to researchers to make advancement in traditional use of different plant part of *Dalbergia sissoo*. This review will help to do research work on the different species of Dalbergia genus.

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