**Journal for Research in Applied Sciences and Biotechnology**

www.jrasb.com

**ISSN: 2583-4053**

Volume-4 Issue-2 || April 2025 || PP. 27-32

https://doi.org/10.55544/jrasb.4.2.4

# A Review on Biological Potential of Gmelina in Traditional Therapeutic Aspects

**Dr. Atul Khajuria[1], Dr. Rahul Kumar Sharma[2] and Ms. Ravinder Kaur[3,4]**

[1]Director, Allied Health Science, Desh Bhagat University, Mandi Gobindgarh, Punjab-147301, INDIA

[2]Assistant Professor, Pharmacology, Amar Shaheed Baba Ajit Singh Jujhar Singh Memorial College of Pharmacy (An Autonomous College) BELA (Ropar) Punjab-140111, INDIA

[3]Research Student, Microbiology, Desh Bhagat University, Mandi Gobindgarh, Punjab-147301, INDIA

[4]Assistant Professor, Paramedical Sciences, Amar Shaheed Baba Ajit Singh Jujhar Singh Memorial College of Pharmacy (An Autonomous College) BELA (Ropar) Punjab-140111, INDIA

[3,4]Corresponding Author: 8011rj@gmail.com

ORCiD

**https://orcid.org/0009-0002-8407-1510**

**www.jrasb.com || Vol. 4 No. 2 (2025): April Issue**

| **Received:** 21-03-2024 | **Revised:** 27-03-2024 | **Accepted:** 02-04-2024 |
|---|---|---|

**ABSTRACT**

***Gmelina arborea* Roxb (Family: Verbenaceae) is a beautiful fast growing tree distributed chiefly in South-East Asia and tropical Africa. As medicine it has been used in Ayurveda since ancient times in ulcer, diarrhoea, thirst, anaemia, leprosy, vaginal discharges, piles, fever and varieties of ailments. Till now a large number of phytoconstituents have been isolated from *Gmelina arborea* (Gambhari), which include lignans, flavanoids, coumarins, steroids, terpenes, fatty acids and iridoid glycosides. Various in vitro and in vivo experimental studies indicated that it possesses anti-oxidant, anti- microbial, diuretic, cardio-protective, anthelmintic, anti-ulcer, anti-diabetic, immunomodulatory, anti-pyretic and analgesic activities. Hence it appears to be a promising herbal candidate to undergo further exploration. In the present review an attempt had been made to explore the different aspects of Gambhari.**

***Keywords-*** *Gmelina arborea*, macroscopy, microscopy, pharmacological activity, traditional uses**.**

## I. INTRODUCTION

India has a unique position in the world, where a number of recognized indigenous systems of medicine viz. Ayurveda, Siddha, Unani, Homeopathy, Yoga and Naturopathy are being utilized for the health care of people. The demand for plant-based medicines, heath products, pharmaceuticals, food supplement, cosmetics etc. are increasing in both developing and developed countries, due to the growing recognition that the natural products are nontoxic, have less side effects and easily available at affordable prices.[1,2] Chemicals derived from plants represent a plethora of drugs used today and constitute a potential for developing some novel semi-synthetic therapeutic agents. One such a very valuable medicinal plant is *Gmelina arborea* Roxb. (Family: Verbenaceae) is locally known as 'Gambhari'. In English it is known as 'Candahar tree' or 'White teak'. The roots, fruits and the leaves of Gambhari have great medicinal value. Almost all parts of this tree are used in folk medicine for treating various stomach disorders, fever and skin problems.[3,4] It is mainly used in the treatment of diarrhoea, inflammation, sexual debility in male, leprosy, ulcer, dysurea, anaemia, vaginal discharges, burning sensation and headache. Thus Gambhari have the potential for the development of modern medicine for the

**Journal for Research in Applied Sciences and Biotechnology**

www.jrasb.com

**ISSN: 2583-4053**

Volume-4 Issue-2 || April 2025 || PP. 27-32

https://doi.org/10.55544/jrasb.4.2.4

treatment of various diseases. The attempt is made to present an overview of pharmacognostic characters, phytochemical and pharmacological activities of the *Gmelina arborea* Roxb.[5,6]

## II. ORIGIN AND GEOGRAPHICAL DISTRIBUTION

It is found in moist deciduous forests of southern and south-eastern Asia. In India, Gambhari found distributed in deciduous forests throughout greater part of up to an altitude 1500 meters. This species which is native to Asia; has been introduced as a plantation tree in several countries, particularly in West Africa, South America and in Cote d'lvoire and Nigeria primarily for its timber yielding quality. extends from the lower Himalayan course of the River Chenab (West Pakistan), India, Nepal, Sikkim, Assam, Ceylon throughout Burma to Thailand, Laos, Cambodia, Vietnam and the southern provinces of China.[7,8]

### *1.1 Propogation and Cultivation*

Gambhari can be propagated by seeds, cuttings and stumps. The best method of propagation is by seeds. In these mature fruits are soaked in water for a week and macerated to separate the seed from fleshy pulp. Then seeds are air for 5-7 days. They can be stored at room temperature where they remain viable for about 2-3 months wh about 3 years. Before sowing, seeds are soaked in tap water for 24 hours. Then seeds are sown in nursery bed which is made by a mixture of sand and loamy soil. Seeds germinate within 2-3 weeks and are ready for transplanting to polybags of size 10 × 15 cm, when the first pair of leaves appears. After about 6 months when seedlings reach up to a height of30-45 cm, they are ready for planting in the field, in dug holes. The usual spacing in the field ranges from 2.5 m × 2.5 to 3.5 × 3.5 m. Because *G. arborea* intolerant and sensitive to competition, 3 required during the first 2 years of growth.

To improve growth and survival; fertilizers are applied at the rate of 100 kg/hectare once at about 30 days after out planting and second time after 90 days. Flowering take places during February to April when the tree is more or less leafless and fruiting starts from May to June. Mature fruits are collected after they have fallen to the ground or by shaking the branches. The tree grows fast; 1-2 m per year commonly on deep alluvial river soils and at altitude of about 450 1000 m. It may be ready for harvesting after 4 or 5 years. It is a short-lived tree but with good soil condition, proper care and maintenance; it is capable of survey 40 years.[9,10,11]

### *1.2 Macroscopic Characters*

*Gmelina arborea* is beautiful fast growing, moderate to large unarmed, deciduous tree up to 30 m tall with girth of 1.2 to 4.5 m and a clear bole of 9-15 m. Gamhar tree standing straight having branches on top and thick foliage forming a conical crown on the top of the tall stem. Branchlets and young parts are clothed with fine white pubescent.[12]

#### 1.2.1 Leaves:

Leaves are petiolate, the petioles 5-15 cm long, leaf blades broadly ovate, 10-25 × 7.5-18 cm. opposite, cordate, glandular, glabrous above and fulvous tomentose beneath.

**Figure 1. Leaf of *Gmelina arborea***

#### 1.2.2 Flowers:

Flowers abundant, short stalked, hairy, trumpet shaped and 4-5 cm long brownish yellow in terminal panicle. Inflorescences fulvous-tomentose throughout, the bracts linear to linear-lanceolate; calyx broadly campanulate, 5 toothed; corolla showy, having 4 stamens, exserted. Flowers of Gambhari are funnel shaped, tubular below. The upper lip often orange-pink, deeply divided into 2 oblong, backwardly curled lobules and the lower lip often lemon yellow, up to twice as long as the upper and 3-lobed.[13]

**Figure 2.** flower of *Gmelina arborea*

**Journal for Research in Applied Sciences and Biotechnology**

www.jrasb.com

**ISSN: 2583-4053**

Volume-4 Issue-2 || April 2025 || PP. 27-32

https://doi.org/10.55544/jrasb.4.2.4

**1.2.3 Fruits:**

Fruits are fleshy ovoid drupes, 2-2.5 cm long, aromatic, orange yellow when ripe; 1-2 seeded.

**1.2.4 Barks**:

The mature rootbark yellowish in colour when fresh. Dried pieces are curved and channeled. External surface is rugged due to presence of vertical cracks, ridges, fissures and lenticles. Mature stem bark occurs as flat and slightly curved pieces. The external surface is slightly rough due to the presence of a few cracks, ridges, etc. Fracture is short and granular.[14,15]

***1.3 Traditional Therapeutic Uses***

Gambhari is one of the herb mentioned in all ancient scriptures of Ayurveda, having unlimited medicinal value. It is traditionally used externally as well number of ailments related to central nervous, gastro intestinal, circulatory, respiratory, urinary and reproductive systems.

Leaf paste is applied to relieve headache and juice as wash for foul gastric ulcers. Leaves are demulcent; used to remove worms. The leaves are also used in dyspepsia, cough and wound treatment. Because of cooling and soothing actions, fresh juice of leaves is massaged to mitigate the burning sensation of the body. Leaves are used as diuretic and with milk and sugar recommended in inflammatory condition of gonorrhoea and catarrh of urinary bladder.[16,17] Charaka prescribed a paste of leaves as ingredient of a medicated clarified butter for stiffness of back and facial paralysis. Flowers are acrid, refrigerant, sweet, bitter, astringent and useful in leprosy and blood diseases. The cold infusion of fruits is extremely beneficial in fever of pitta origin and bilious affections.[18,19] Soup of fruit is given in diarrhoea. Chakraduta gave ripe fruits with honey for checking haemorrhages. Ripe fruits are dried and cooked with cow's milk for urticaria. Ripe fruit is cardiotonic hence useful in cardiac disorders and is a nutritive tonic, so it is beneficial as anabolic in tuberculosis to hasten the healing of cavitations in the lungs and cachexia. Fruits are diuretic hence its juice is given in dysuria, gonorrhoea and cystitis to relieve pain and swelling. Besides being a galactogogue, the fruit is aphrodisiac; also used in semen debility and to prevent miscarriage. Fruit has potential as brain and hair tonic.[20,21] The roots are acrid, bitter tonic, demulcent, stomachic, laxative, anasarca and anti-bilious. Pulverised root is applied for gout. In the form of infusion or decoction it is used in fever and indigestion. With liquorice, sugar and honey it is given as galactogogue in cases of scanty secrection of milk in women.[22,23] The root of *G. arborea* is one of the ingredients of "*dashmuladikwath"* and "*bhrihatpanchamool*" of ayurveda, which constitutes a number of ayurvedic preparations used as tonics. Root as aperients improves appetite, used in constipation. It is also helpful in diarrhoea and haemorrhoids. Roots alleviate vata and kapha, have hot potency and heavy attribute. It is used against anthrax, bites, cholera, colic, convulsions, dropsy, epilepsy, headache, intoxication, rheumatism, sore throat, burning sensations and snakebite. The roots are also useful in hallucination, piles and urinary discharge.[24,25] The bark is a bitter tonic, stomachic and useful in fever and indigestion. The powder of bark along with gingelly seeds, manjista and shatavari is given in milk, to prevent abortions in the early stages of pregnancy.[26] The root bark is used internally in oedema due to any cause; its decotion is given in postpartum disorders. It has nutritive and rejuvenating properties. The bark has been known to be used externally and internally for snake-bites and scorpion-stings. The decoction of root bark is used for washing and healing of septic wounds.[27,28]

***1.4 Pharmacological and Biological Studies***

**1.4.1 Antioxidant Activity:** Aqueous extracts of bark and fruit at 1, 5 and 10 % concentrations inhibited the $H_2O_2$ and paraquatinduced oxidative stress in mice liver slices *in vitro* in a concentration-dependent manner. The presence of extracts in the incubation medium significantly reduced the $H_2O_2$ and paraquatinduced rise in liver cells' LDH, SOD, CAT and GR activities.[29]

**1.4.2 Anabolic Effects**: The fruits administration at 0.5 g/animal/d p.o. dose to normal rabbits, increased the levels of α2 and γ – globulin in serum, gain in body weight and alertness in physical behaviour compared to control groups. These observations indicated the anabolic (Rasayana) activity of the fruit powder.[30]

**1.4.3 Hemagglutination Activity**: The saline extract of the seeds showed hemagglutination activity against the erythrocytes of monkeys.[31]

**1.4.4 Antibacterial Activity**: *In vitro* antibacterial activity was determined against gram-positive and gram-negative bacteria. Coarse powder of dried fruit of *Gmelina arborea* was made and extracted by Soxhlation method using ethanol, ethyl acetate, n butanol and petroleum ether as solvent. The minimum inhibitory concentration for each extract was also determined using the disk diffusion technique. Only ethanol extract showed

**ISSN: 2583-4053**

Volume-4 Issue-2 || April 2025 || PP. 27-32

https://doi.org/10.55544/jrasb.4.2.4

significant antibacterial activity against grampositive and gram-negative bacteria, and the activities shown by ethanol extract were comparable with the standard drug streptomycin. The n-butanol extract showed no activity against test organisms, whereas ethyl acetate and petroleum ether extracts showed inhibitory action against *P. aeruginosa*. Among different organisms, *S. aureus* is more sensitive to ethanolic extract, while *P. aeruginosa* is sensitive to ethyl acetate and petroleum ether extracts.[32,33]

**1.4.5 Acute and Subacute Toxicity Study**: With doses of 300 mg, 500 mg, and 1 g/kg, acute and subacute toxicity of fruits powder of *Gmelina arborea* Roxb. was determined in 28 days. No behavioural and mortality changes are noticed in different test doses. Hence, the test drug at a dose of 2 g/kg was nontoxic for the human body because there were no variations in the biochemistry, haematology, behaviour and histology of vital organs.[34]

**1.4.6 Antidiabetic Activity:** In this study, ethanol, ethyl acetate, n butanol and petroleum ether were tested in single doses in each group of experimental animals (300 mg /kg bw) *in vivo* study of antidiabetic activities of fruits extracts of *Gmelina arborea* by alloxan induced diabetic model conducted on healthy Wistar rats of either sex. Coarse powder of dried fruit of *Gmelina arborea* was made and extracted by Soxhlation method using ethanol, ethyl acetate, n butanol and petroleum ether as solvent. The extracts of *Gmelina arborea* were tested in single doses in each group of experimental animals (300 mg/Kg b.w). Glibenclamide was used as the standard drug in the alloxan-induced diabetic model at a dose of 5 mg/Kg of the body weight of the rat. The extracts produced a significant antidiabetic effect and are comparable with the standard drug (Glibenclamide). All the extracts were able to reduce sugar levels in the blood. The antidiabetic activity of the extracts are in the order of ethanol> n-butanol> petroleum ether> ethyl acetate. The ethanol extract was found to have good antidiabetic activity in comparison to other extracts.[35,36]

**1.4.7 Diuretic Activity**: The diuretic activity of different fruit extracts of the plant *Gmelina arborea* using ethanol, ethyl acetate, nbutanol and petroleum ether as solvents. Urea (1 g/kg) was used as the standard drug, and saline water was 0.9 % w/v used as the standard control. All the extracts (highest in n- butanol extract) significantly increased urine volume compared to standard control groups.[37]

**1.4.8 Hepatoprotective and Antioxidant Activity:** The effect of *Gmelina arborea* fruit aqueous extracts on paraquat and hydrogen peroxide–induced oxidative stress was investigated using liver slice culture. Adding fruit extracts and these cytotoxic agents led to a decrease in lactate dehydrogenase release. The addition of the fruit extracts, along with the pro-oxidants, suppressed the enzyme activities. The extract also displayed antioxidant activity *in vitro* radical scavenging assays (DPPH, FRAP, ABTS).[38]

**1.4.9 Biochemical Evaluation:** An experiment was conducted to evaluate the influence of *Gmelina arborea* fruits meal on haematology and certain biochemical parameters, including blood enzyme profile and urine analysis of wean pigs. A significant difference was recorded in the percent of lymphocytes and neutrophils of the leucocytes and uric acid production in urine analysis.[39,40]

**1.4.10 Cardioprotective activity:** Effect of ethanolic extract of leaves of *G. arborea* showed potential protective effect against doxorubicin 20mg/kg body weight induced cardiac toxicity in rats. It was found that ethanolic extract increases activities of cardiac markers such as serum glutamic oxaloacetic transaminase (SGOT), serum glutamic pyruvic transaminase (SGPT) and alkaline phosphate (ALP) in plasma and significantly inhibits doxorubicin-provoked glutathione depletion in cardiac tissues. The reductions of cardiac activities of catalase, superoxide dismutase, glutathione peroxidase and glutathione reductase were significantly mitigated. Results have shown that pre-treatment with ethanolic extract of leaves of *G. arborea* guarded against doxorubicin-induced rise of serum lactate dehydrogenase and alleviated histopathological changes in rat's hearts treated with doxorubicin. Hence this shows that Gambhari protects against doxorubicin-induced cardiotoxicity in rats.[41,42]

## III. CONCLUSION

In the present review we have made an attempt to compile the botanical, ethno-pharmacological, pharmacological information on *Gmelina arborea*, a medicinal herb used in the Indian system of medicine. In order to scientifically validate its traditional therapeutic claim and even postulate the possible mechanisms involved in its actions number of research on this herb had done and still going on. Further study needed to investigate bioactive molecules responsible for such health beneficial action of *Gmelina arborea*. This review will definitely help for the researchers as well as practitioners, dealing with this plant.

## REFERENCES

[1] Sharma A et al. Herbal medicine for market potential in India: an overview. Academic Journal of Plant Science. 1(2); 2008: 26-36.

[2] Sini KR, Sinha BN andAiyolu RK. Pharmacognostic evaluation on the leaves of *Cappariszeylanica.* Linn. Journal of Pharmacy Research.4(5); 2011: 1372-1373.

[3] Sharma PC, Yelne MB and Dennis TJ. Database on Medicinal Plants used in Ayurveda, vol. 3, Central Council for Research in Ayurveda and Siddha, Department of ISM and H Ministry of health and Family Welfare Government of India, 2001; pp. 217–228.

**ISSN: 2583-4053**

Volume-4 Issue-2 || April 2025 || PP. 27-32

https://doi.org/10.55544/jrasb.4.2.4

[4] Agharkar SP. Medicinal plants of Bombay presidency. Scientific Publishers, Jodhpur (India). 1991:pp. 230.

[5] Controller of Publication, The Ayurvedic Pharmacopoeia of India, Govt. of India, Ministry ofHealth & Family welfare, Dept.of ISM & H., Delhi. 2003:pp. 53-54.

[6] Sharma BP and Balakrishnav NP. Flora of India: Botanical Survey of Calcutta. 1993: 402-413.

[7] Dvorak WS. World view of *Gmelina arborea*-Opportunities and challenges. New Forests. 28; 2004: 111–126

[8] Lamb AFA. Fast growing timber trees of the lowland tropics – No. 1. *Gmelina arborea*. Commonwealth Forestry Institute, University of Oxford; 1968 January.

[9] Jensen M. Trees commonly cultivated in SouthEast Asia: An illustrated field guide. Bangkok, Thailand: RAP publication;1999 Feb; 2nd ed: pp. 132.

[10] Forestry/ Fuelwood Research and development Project. Growing multipurpose trees on small farms. Bangkok, Thailand: Winrock international. 1994; 2nd ed: pp. 321.

[11] Mohmmed KH. *Gmelina arborea*: A popular plantation species in the tropics. FACT Sheet 99-05. Forest, farm and community tree network publication. USA; Sep 1999.

[12] Florido LV and Cornejo AT. Research information series on ecosystems. Vol.14, No.3; 2002:pp. 3-6.

[13] Tiwari VJ.Ethnobotanical survey of Halbi tribe of Chandrapur and Gadchiroli districts of Maharashtra state, India. Fitoterapia. 66; 1995: 346–350.

[14] Joy PP, Thomas J, Mathew S et al.Medicinal plants. Kerala Agricultural University. NayaProkash, Calcutta. 1998:pp. 72.

[15] Smith AC. Flora Vitiensis nova: a new flora of Fiji. National Tropical Botanical Garden, Vol 5.Lawai Kauai, Hawaii. 1991: pp. 203.

[16] Kapoor LD. Handbook of Ayurvedic medicinal plants: Herbal reference library. Boca Raton, CRC press Inc; New York, London. 2005; 1st ed:pp. 197.

[17] Chotani DL, Patel NM. Preliminary phytochemical screening, pharmacognostic and phytochemical evaluation of leaf of *Gmelina arborea*. Hemchandracharya North Gujarat University, Patan( N.G.) India. 2012.

[18] Junjarwad AV et al. Pharmacognostical, physicochemical and histochemical evaluation of Brihatpanchmoolachurna. International Journal of Research in Ayurveda and Pharmacy.2(5); 2011: 1423-1426.

[19] The Wealth of India, Raw Materials. Publication and Information Directorate. New Delhi: CSSIR; 1956: pp. 154-155.

[20] Tyagi DK. Pharma forestry: field guide to medicinal plants. New Delhi: Atlantic Publishers. 2005:pp. 157.

[21] Nadkarni KM. Indian material medica-with Ayurvedic, UnaniTibbi, Siddha, Allopathic, Homopathic, Naturopathic and Home remedies, Vol.1. India, Popular prakashan private Ltd. 1908;1st ed: pp. 585.

[22] Khare CP. Encyclopedia of Indian medicinal plants. SpingerVerlag Berlin-Heidelberg, Germany. 2004; pp. 236-237.

[23] Duke JA. Handbook of Medicinal Herbs. Boca Raton: CRC Press; 1985; pp. 120-121.

[24] Gogte VM. Ayurvedic pharmacology & therapeutic uses of medicinal plants (Dravyagunavignyan). Mumbai,ChaukhambaSanskrit Pratishthan publisher; 2002; 1st ed:pp. 364-366.

[25] Lele RD. Ayurveda (Ancient Indian System of Medicine) and modern molecular medicine. Journal of the Association of Physicians of India. 47; 1999: 625-628.

[26] Lauridsen EB and Kjaer ED. Provenance research in *Gmelina arborea*Roxb.- A summary of results from three decades of research and a discussion of how to use them. International Forestry Review. 4(1); 2002: 234-239.

[27] Panda SKet al. Phytotherapy and traditional knowledge of tribal communities of Mayurbhanj district, Orissa, India. Pharmacognosy and Phytotherapy.3(7);2011; 101-113.

[28] Hosny M and Rosaazza JP. Gmelinosides A-L: Twelve acylatediridoid glycosides from *Gmelina arborea*. Journal of Natural Products. 61; 1998: 734-742.

[29] Rao DV, Rao EV and Viswanathan N. Occurrence of luteolin in the leaves of *Gmelina arborea* Linn. Current Science. 36; 1967: 71-72.

*[30]* Nair AGR and Subramanian SS. Quercetagetin and other flavones form *Gmelina arborea* and *G. asiatica*. Phytochemistry. 61; 1975: 734-742.

[31] Tiwari N et al. Iridoid glycosides from *Gmelina arborea*.Phytochemistry. 69; 2008: 2387-2390.

[32] Joshi SG. Medicinal plants. New Delhi, Oxford & IBH publications. 2004; 1st ed:pp. 396.

[33] Moronkola DO et al. Essential oil composition of *Gmelina arborea*Roxb.,Verbenaceae, from Nigeria. Journal of Essential Oil Research. 21(3); 2009: 264-266.

[34] Akinjagunla YS et al. Chemical composition and phytate content of *Gmelina arborea*seeds. Continental Journal of Agricultural Science. 1; 2007: 8-13.

[35] Daniel M. Medicinal plants-chemistry and properties. Science publishers. USA, 2008. pp. 152.

[36] Adhyapak S et al. High Performance Liquid Chromatographic method for quantization of

**ISSN: 2583-4053**

Volume-4 Issue-2 || April 2025 || PP. 27-32

https://doi.org/10.55544/jrasb.4.2.4

apigenin from dried root powder of *Gmelina arborea* Linn. International Journal of Pharma and Bio Sciences. 2(1); 2011: 742-749.

[37] Satyanarayana P et al. An apiose-containing coumarin glycoside from *Gmelina arborea*root. Phytochemistry. 24, (8); 1985: 1862-1863.

[38] Anjaneyulu ASR et al. The structure of gummadiol-a lignan hemi-acetal. Tetrahedron Letter. 16 (22); 1975: 1803-1806.

[39] Row LR et al. Structure of gmelanone-a novel lignan with the 3, 6-dioxabicyclo [3, 2, 1] octane skeleton. Journal of the Chemical Society, Chemical Communications. 12; 1974: 476-477.

[40] Anjaneyulu ASR et al. Novel hydroxyl lignans from the heartwood of *Gmelina arborea*. Tetrahedron. 33(1); 1977: 133-143.

[41] Satyanarayana P et al. Arborone and 7-oxo-dihydrogmelinol: two new keto-lignans from *Gmelina arborea*. Journal of Natural Products. 49 (6); 1986: 1061-1064.

[42] Falah S, Katayana T and Suzuki T. Chemical constituents from *Gmelina arborea* bark and their antioxidant activity. Journal of Wood Science. 54; 2008: 483-489.