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**Medicinal and ayurvedic relevance of
Gmelina arborea Roxb. ex Sm.**

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ABSTRACT

Gmelina arborea Roxb. ex Sm. is widely recognised in traditional medicine and constitutes an important component of *Brihat Panchamoola* in Ayurveda. Owing to its rich phytochemical composition, the plant has also gained significant attention in modern pharmacological research. It contains a diverse array of bioactive compounds, including lignans, flavonoids, tannins, glycosides, and other secondary metabolites. Phytochemical investigations reveal that the roots are particularly rich in glycosides, especially flavone glycosides such as apigenin-7-rutinoside and luteolin-7-glucuronide, along with compounds like sitosterol, quercetin, and apigenin. Pharmacologically, *G. arborea* exhibits a wide spectrum of biological activities, including anti-inflammatory, antioxidant, hepatoprotective, anticancer, neuroprotective, antitumor, cardioprotective, anticonvulsant, and antihyperlipidemic effects. The present study aims to bridge the gap between traditional knowledge and contemporary scientific research by systematically evaluating the phytochemical constituents and pharmacological potential of this species.

Keywords: Ethnomedicine, medicinal tree, pharmacological activities, therapeutic potential, traditional medicine

INTRODUCTION

Gmelina arborea (commonly known as Gamhar or white teak) is a fast-growing deciduous species belonging to the family Lamiaceae. It is a

moderate- to large-sized tree and is widely valued for its ornamental, medicinal, and economic importance (Singh et al., 2021). The species is native to South and Southeast Asia but has been extensively introduced and cultivated across tropical regions of Africa, Australia, the Americas, the West Indies and several Pacific islands (Banu et al. 2013). In India, it is naturally distributed across diverse ecological zones including the Eastern Sub-Himalayan tract, Aravalli Hills, Indo-Gangetic plains, Central India, Western Peninsula, and parts of the Western Himalaya. It generally occurs at elevations ranging from 50 to 1300 meters (Barua et al. 2018). It is known as Gomari in Assamese, Gamari/ Gambar in Bengali, Shewan/ Sivan in Gujarati, Gambhari in Odia, Gamhar/ Khamara/ Khumbhari/ Sewan in Hindi, Kulimavu/ Kumbuda/ Kumulu in Kannada, Mara/ Shivani in Kashmiri, Kumbil/ Kumbulu/ Kumilu/ Kumiska/ Pokki in Malayalam, Shivan/ Siwan in Marathi (Arora and Tamrakar 2017).

Ecologically, *G. arborea* is a light-demanding and moderately frost-hardy species. It thrives across a wide climatic range, tolerating temperatures from 1°C to 48°C and annual rainfall between 760 and 4500 mm (Singh et al. 2021). The species grows well in soils with pH ranging from 5.0 to 8.0, showing a preference for moist, fertile alluvial soils with sandy loam texture (Arora and Tamrakar 2017). The tree has emerged as an economically significant species worldwide due to its multiple uses. It is extensively utilised for industrial wood, light construction timber, furniture, decorative veneers, and as a raw material for pulp and paper industries (Singh et al. 2021).

Beyond its industrial importance, *G. arborea* holds a prominent place in traditional medicine. Various plant parts contain biologically active compounds such as flavonoids, tannins, lignans, and glycosides, which contribute to their wide therapeutic applications (Attanayake et al. 2015). Due to these properties, it is regarded as a classical medicinal plant in several traditional systems. It is an important component of classical formulations such as Brihat Panchamoola and is recognised for its broad spectrum of therapeutic applications (Kaur and Kaur 2018). Traditionally, *G. arborea* is used to manage disorders related to the digestive, nervous, respiratory, urinary and reproductive systems. The plant is known for its cooling, anti-inflammatory, rejuvenating and tonic effects and plays a significant role in balancing Vata and Kapha doshas in Ayurvedic practice. It has been extensively utilised in the treatment of conditions such as fever, inflammation, anaemia, diabetes, liver disorders and infections, as well as in improving

overall vitality and health (Khajuria et al. 2025). Recent pharmacological studies have provided scientific validation for these traditional claims. Various parts of the plant have demonstrated significant biological activities, including anti-inflammatory, antioxidant, antimicrobial, hepatoprotective, neuroprotective, cardioprotective, and antidiabetic effects (Ijezie et al. 2020). Thus, *Gmelina arborea* represents an important link between traditional knowledge and modern medicine, highlighting its potential as a promising source for the development of novel therapeutic agents.

MORPHOLOGY

G. arborea is a moderate-sized, unarmed, deciduous tree attaining a height of up to 18 m. The bark is grey to yellowish-grey and somewhat corky in texture. Young branchlets and growing parts are covered with fine, white mealy pubescence (Figure 1).

Stem: The stem is hard, woody, and generally smooth, except for occasional branch scars. It is yellowish grey externally and cream-coloured internally. Stem bark is 0.2-0.7 cm thick, sometimes ribbed and quilled. The outer surface is rough and yellowish-brown, showing both longitudinal and horizontal cracks, while the inner surface is comparatively smooth and ranges from reddish-brown to black in colour (Ashalatha and Sankh 2015).

Leaves: Leaves are large, measuring about 10-20 × 7.5-15 cm, broadly ovate with an acuminate apex and entire margins. The upper surface becomes glabrous at maturity, whereas the lower surface is densely covered with stellate, fulvous tomentum. The base is typically cordate, occasionally truncate or shortly cuneate. Petioles are 5-7.5 cm long, cylindrical, slightly puberulous, and glandular at the apex (Kumari et al. 2017).

Flowers: Flowers appear along with or slightly before the emergence of new leaves. They are arranged in small cymes of approximately three flowers, borne on a densely fulvous-hairy panicle up to 30 cm long. Flower buds are clavate and angular, with linear-lanceolate bracts about 8 mm long (Kumar et al. 2022).

Calyx: The calyx is about 5 mm long, broadly campanulate, and densely covered with fulvous hairs, with five small, triangular, acute teeth. The corolla is brownish yellow, about 3.8 cm long, densely hairy externally, and distinctly bilabiate. The upper lip is over 1 cm long and divided into two oblong, obtuse lobes, while the lower lip is about 2.5 cm long, three-lobed, with a prominent,

forward-projecting middle lobe that is ovate, subobtusate, and irregularly crenulated, larger than the rounded lateral lobes.

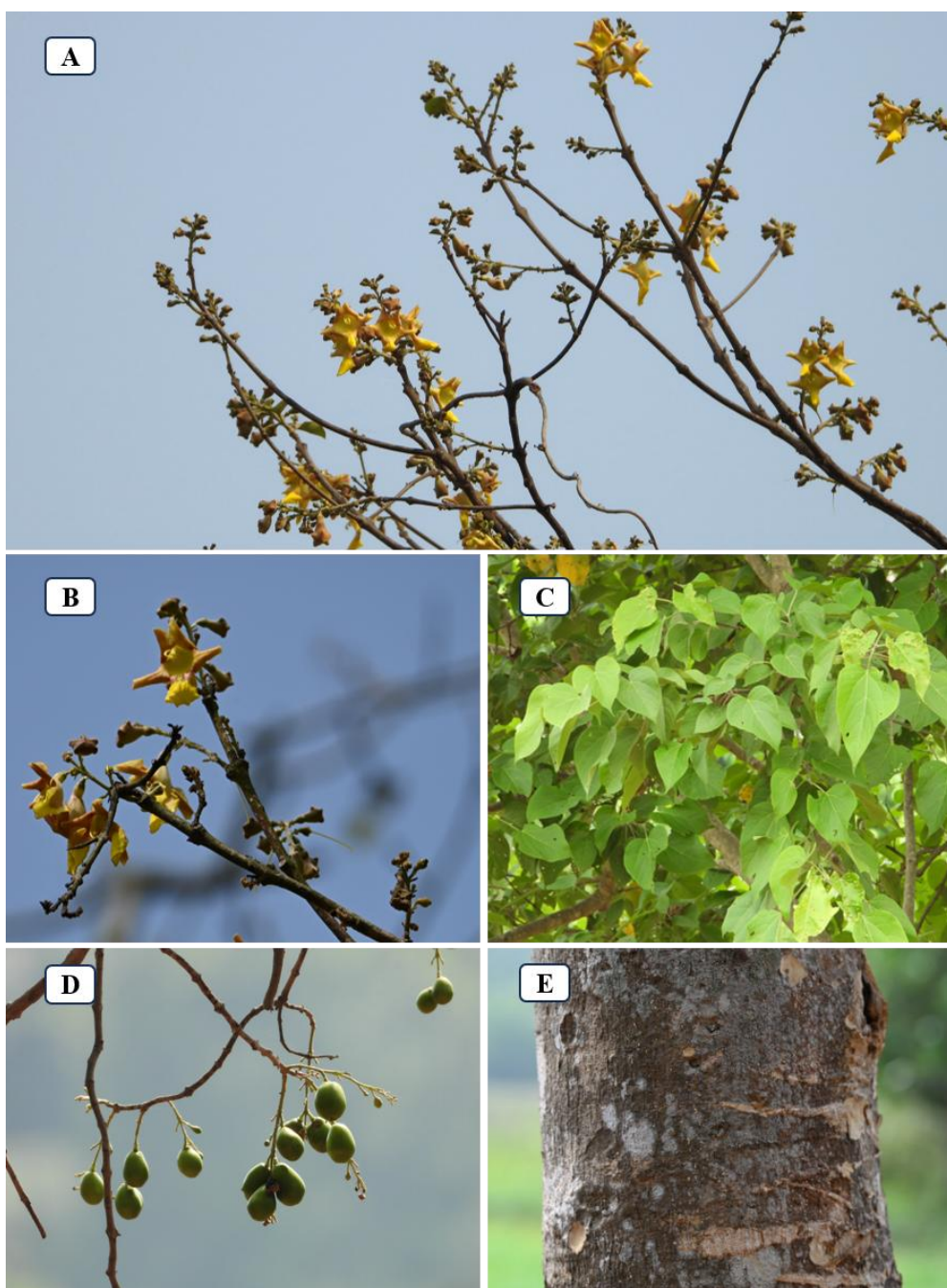


Figure 1: Vegetative parts of *G. arborea*; A) Canopy, B) Flowers, C) Leaves, D) Fruits, E) Bark

Fruit: The fruit is a drupe, measuring 2-2.5 cm in length, ovoid to pyriform in shape, smooth in texture, and turns orange yellow upon ripening (Nayak and Kumar 2023).

Root: The root is cylindrical with an uneven surface and greyish-brown coloration. The fracture is somewhat tough in the bark region but brittle in the woody portion. Fresh root bark is yellowish in colour. When dried, it appears curved or channelled, with thinner pieces forming single quills. The outer surface is rough, marked by vertical cracks, ridges, fissures, and numerous lenticels. The fracture is short and granular (Kumari et al. 2017).

MEDICINAL USES

Each part of *Gmelina arborea* exhibits distinct therapeutic properties, making it a versatile medicinal plant in Ayurveda and folk medicine. Its broad spectrum of applications from digestive and nervous disorders to reproductive and urinary ailments highlights its pharmacological importance and potential for modern drug development.

Leaves

The leaves of *Gmelina arborea* are widely used in traditional medicine for their cooling, anti-inflammatory, and healing properties. Leaf paste is externally applied to relieve headache, especially fever-induced headache, and burning sensations (Kaur and Kaur 2018). The juice of young leaves is used as a remedy for cough and as a wash for ulcers, including intestinal infections and ulcerative conditions (Arora and Tamrakar 2017). Leaves are also tied to affected areas to alleviate pain and inflammation. In traditional preparations, leaf decoction is consumed to balance *tridosha* and improve general health (Khajuria et al. 2025).

Flowers

The flowers possess cooling, bitter, and astringent properties. They are traditionally used in the treatment of leprosy and blood-related disorders. Due to their soothing nature, they help in managing inflammatory conditions and act as a mild tonic (Kumbhar et al. 2018).

Fruits

Fruits of *Gmelina arborea* are considered highly nutritive and medicinal. They act as diuretic, aphrodisiac, and cardiotonic agents. Fruits are used in the treatment of anaemia, leprosy, urinary disorders such as dysuria, gonorrhoea,

and cystitis (Khajuria et al. 2025). They are also beneficial in conditions like semen debility, leucorrhoea, and to prevent miscarriage. Additionally, fruits help relieve excessive thirst, burning sensations, and are useful in tuberculosis and cachexia due to their nutritive properties (Kumbhar et al. 2018).

Bark

The bark exhibits multiple therapeutic properties including stomachic, laxative, hypoglycemic, anthelmintic, and appetizer actions (Lauridsen and Kjaer 2002). It is used in the treatment of abdominal pain, piles, constipation, and blood-related disorders. The bark is also considered a bitter tonic with rejuvenating properties and is used in post-fever debility. Externally and internally, it is applied in cases of scorpion stings and snake bites (Kulkarni et al. 2013).

Root and Root Bark

Roots are one of the most important medicinal parts and are included in classical Ayurvedic formulations such as *Dashamoola*. They possess demulcent, galactagogue, anti-inflammatory, and tonic properties. Root decoction is used for treating abdominal tumors, diarrhoea, colic, fever, gout, rheumatism, and nervous disorders (Sharma et al. 2001). Pulverised root is applied externally in gout. Root bark is used in postpartum disorders, uterine inflammation, and to enhance lactation. It is also beneficial in oedema, epilepsy, convulsions, and urinary disorders (Arora and Tamrakar 2017).

Whole Plant

The entire plant is medicinally significant and is known to enhance digestion, improve memory, and act as a general tonic. It is used in managing fever, heart diseases, nervous disorders, piles, and metabolic imbalances. Traditionally, it is also employed in the treatment of snake bites, scorpion stings, diabetes, and blood disorders (Arora and Tamrakar 2017).

PHARMACOLOGICAL POTENTIAL

Gmelina arborea is an important medicinal tree in traditional systems like Ayurveda and ethnomedicine. Various parts of the plant exhibit a wide range of pharmacological properties due to the presence of bioactive compounds such as flavonoids, lignans, iridoid glycosides, alkaloids, and phenolics.

Anti-inflammatory activity

Extracts of *Gmelina arborea* have demonstrated significant anti-inflammatory effects. The presence of flavonoids and lignans helps inhibit inflammatory mediators, making it useful in treating conditions like arthritis, swelling, and wounds (Nayak et al. 2015a).

Antimicrobial activity

Different solvent extracts (methanol, ethanol, aqueous) from leaves and bark show activity against a range of bacteria and fungi. This supports its traditional use in treating infections, skin diseases, and ulcers (Ijezie et al. 2020).

Antioxidant potential

The plant is rich in phenolic compounds and flavonoids that exhibit strong free radical scavenging activity. This helps in reducing oxidative stress, which is linked to aging, cancer, and chronic diseases (Attanayake et al. 2015).

Hepatoprotective activity

Studies indicate that root and bark extracts protect liver cells against toxin-induced damage. It enhances antioxidant enzyme levels and reduces lipid peroxidation, making it beneficial in liver disorders (Kannan et al. 2012).

Neuroprotective and CNS activity

Gmelina arborea has shown potential in improving memory and reducing anxiety. It may act as a mild CNS depressant and is traditionally used in managing neurological disorders (Bhattacharyya et al. 2024).

Antidiabetic activity

The plant exhibits hypoglycemic effects by reducing blood glucose levels. It may enhance insulin secretion or improve glucose utilization, supporting its use in diabetes management (Nayak et al. 2012).

Anticancer activity

Preliminary studies suggest cytotoxic effects against certain cancer cell lines, attributed to bioactive constituents like lignans and flavonoids (Shoeb et al. 2014).

Cardioprotective activity

Its antioxidant and anti-inflammatory properties contribute to heart health by reducing oxidative stress and improving lipid profiles (Vijay et al. 2011).

Analgesic and antipyretic effects

Extracts of the plant have been shown to reduce pain and fever, supporting its traditional use in treating body aches and febrile conditions (Nayak et al. 2015b).

Wound healing activity

Topical application promotes faster wound contraction and tissue regeneration due to antimicrobial and anti-inflammatory properties (Prakashbabu et al. 2017).

CONCLUSION

G. arborea holds a prominent position in Ayurveda and traditional Indian medicine due to its wide-ranging therapeutic properties and inclusion in important classical formulations such as *Brihat Panchamoola*. Every part of the plant contributes to its medicinal value, reflecting its holistic significance in indigenous healthcare systems. In Ayurvedic practice, Gambhari is valued for its ability to balance *Vata* and *Kapha doshas*, and is extensively used as a rejuvenative, tonic, and restorative drug. It plays a crucial role in managing disorders related to the digestive, nervous, respiratory, urinary and reproductive systems. Modern pharmacological studies further validate these traditional claims by demonstrating a wide spectrum of biological activities, including anti-inflammatory, antioxidant, hepatoprotective, neuroprotective, cardioprotective and antidiabetic effects. The presence of diverse bioactive compounds such as flavonoids, lignans, iridoid glycosides, and sterols underpins these medicinal properties. Gambhari represents a significant bridge between traditional knowledge and contemporary medicine. Its extensive ethnomedicinal use, coupled with emerging scientific evidence, highlights its potential as a valuable source for the development of novel therapeutic agents. Further clinical investigations and standardization studies are essential to fully establish its efficacy, safety and application in modern healthcare systems.

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