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Vateria indica L.: A review on enthnobotany and therapeutical properties

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Abstract
The Western Ghats of India constitute one of the world's major biodiversity hotspots and harbor numerous plant species of medicinal relevance. Among these, *Vateria indica* L. (Dipterocarpaceae) is a notable endemic tree species valued for its ecological, Cultural and pharmacological importance (JK *et al*., 2018). The tree is characterized by hermaphrodite flowers and bark produces a resin known as "Sarja", which is traditionally incorporated into Ayurvedic, Siddha and Unani formulations (Kavitha and Geethu., 2017) [8]. According to Pharmacopia, the species is used to manage inflammatory disorders, dermatological conditions, metabolic disturbance and wound healing (John *et al.,*2024) [7]. The plant can be found described in almost all Unani literatures in the treatment of chronic bronchitis, anaemic disorder, ear disorder, skin disorder, gonorrhoea, syphilis, urinary discharges, amenorrhoea, piles, and diabetes mellitus along with this it has various pharmacological activities such as anti- inflammatory, anthelmintic, anti-ulcer, anti-tumor activity and anticancer (Siddiqui *et al*., 2019) [14]

Keywords: *Vateria indica*, Western Ghats, medicinal plants, resin, pharmacological properties

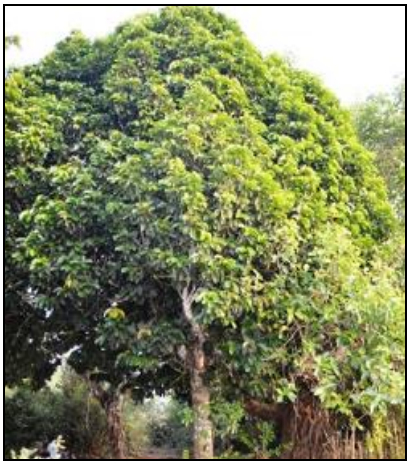
Introduction
Medicinal plants have shaped traditional healing practices across cultures for centuries. The family Dipterocarpaceae comprises numerous resin-producing trees collectively known as dammar-yielding species with various industrial and therapeutic applications (John *et al.,* 2024) [7]. *Vateria indica* L. is one of the most important species of this family which is largely found in western ghats of India and found in the states of Karnataka, Kerala, Tamil Nadu and Maharastra (Dhyani and Barstow., 2020) [3].
V. indica is considered as a sacred plant, which finds a Niche for itself in 'Nakshatra Vana' and accredited as the plant to be worshiped for Moola Nakshatra (Hari and Sushrutha., 2010). Since from the time immemorial people have been exploiting this plant for various purpose, due to this a heavy loss of habitat occurred especially in the 19th century. The extensive use of plant in plywood industries and continuous destruction of plant species as made it a critically endangered species (Hari and Sushrutha., 2010).
Phenolic and other secondary metabolites present in plants of this group contribute to their physiological and therapeutic potential, particularly due to the presence of antioxidant capacities (Gupta *et al.,* 2012) [4]. The resinous substance "Sarja" has been used as a traditional medicine, appearing in the formulations intended for inflammatory, metabolic and dermatological conditions (Kavitha and Geethu., 2017) [8].
The genus *Vateria* consists of three species- *V. indica, V. macrocarpa and V. copallifera.* These are distributed across India and Srilanka (Bugade and Khan., 2022) [2].

Taxonomy
Kingdom: Plantae
Phylum: Tracheophyta
Class: Magnoliopsida
Order: Malvales
Family: Dipterocarpaceae
Regional names of *Vateria indica* L.
English: Indian Copal Tree, White Dammar Tree
Sanskrit: Mandadhupa, Sarja
Kannada: Bileedaamar, Bilagaggala
Telugu: Kahruba Shamai
Tamil: Vellaidaman, Attam
Marathi: Dhoop, Chandrusa
Malayalam: Vellapayin

Origin and distribution
Vateria indica is native to India and thrives in the moist evergreen forest of the Western ghats, particularly in Karnataka, Kerala and Tamil Nadu (JK *et al.,*2018). The species has been recorded from both primary evergreen forests and occasionally from the secondary forest habitats (Ruma *et al.,* 2011) [10]. Due to decreasing population in size, it is classified as vulnerable crop (Dhyani and Barstow., 2020) [3].
The species is steady, with a good subpopulation size in Kerala. The subpopulation reported from Kodagu district of Karnataka has a single large subpopulation with 240 fully-grown individuals, the majority of which were still reproducing. The population is highly split and dominated by coffee and paddy plantation (Ismail *et al*., 2014) [5]. Despite this, good genetic diversity is preserved in the Kodagu district subpopulation (Ismail *et al*., 2014) [5]. Overall population size is considered to be small and decreasing. There is decline in population size due to agricultural clearance of lowland forest habitat leading to a suspected decline of at least 30% over the last three generations.

Botanical Description

V. indica resin



V. indica tree

V. indica fruit

V. indica flower

V. indica is an evergreen tree typically grows upto a height of 40- 60 meters. The bark is smooth and greyish with occasional pale patching (Neginhal *et al.,* 2004) [11]. Young shoots are covered with stellate hairs and exude a resinous substance (Bugade and Khan., 2022) [2]. Leaves are leathery, elliptic- oblong and arranged spirally exhibiting a smooth texture and entire margins (Anjali., 2024) [1]. Flowers in large terminal or lateral corymbose panicles, white, fragrant. Calyx lobes 5, lanceolate, obtuse, canascent on both surfaces. Petals 5, elliptic oblong, obtuse, spreading. Stamens 40-50; anthers nearly sessile, connective muticous. Ovary tomentose.

The tree bears axillary panicles consisting of hermaphrodite flowers containing both functional stamens and carpels (JK *et al.,* 2018). Pollination is predominantly entomophilous (Ruma *et al.,* 2011) [10]. The fruit is a three valved capsule containing a single seed (Bugade and Khan., 2022) [2]. Seeds are recalcitrant in nature, seed viability has been shown high upto 80% for 65 days when stored at 20^0C. (Pinnuri *et al.,* 2024) [9].

Flowering: January–April**.**

Fruiting: May – July.

The propagation of this species is mainly through seeds. So, the availability of quality seeds is required for the propagation. In general, the fruits/ seeds are affected by insect pests, fungi etc. Insects are the one among the major groups of pests causing damage to seeds. The weevil (*Sitophilus vateriae*) causes damage to an extent of about 65-70 per cent in *V. indica* seeds (Nair *et al*., 2007) [16]. *V. indica* similar to many other dipterocarps, shows low seed predation and moderate seedling survival in natural populations. Even though leaf minors induce considerable mortality of seedling it does not significantly affect the seedling recruitment.

The species is used for timber. It is also valued for its resin (or dammar) which is used for tonic, carminative, expectorant properties. The semisolid fat known as "Pinay tallow", 'Malabar tallow', or 'Dhupa fat' obtained from the dried kernels of the seeds is used in the manufacture of candles and soaps. It is used for edible purposes after refining. It is used in confectionary and as an adulterant of ghee. Wood greyish brown, rough, much in demand in plywood and veneer industry; also used for making tea-chests, trunks, ammunition boxes, flooring and other interior fittings. The heartwood can be used for shuttering, centering and scaffolding and for making oars, masts etc. The gum resin known in trade as 'Pinay resin', 'White dammar' or 'Dupa' is used in varnish industry and for making incense. It is also used for setting gold ornaments and for caulking boats. Wood considered to be fairly suitable for paper pulp. The oil-cake left after extraction of oil is used as manure especially in coffee plantations. It is extensively planted as an avenue tree It is used for throat troubles, chronic

bronchitis, piles, diarrhea, rheumatism, tubercular glands, boils etc. (Shiva and Jatan 1998). The species has the potential to be used for restoration in degraded wet and evergreen forest.

Chemical Constituents

Essential oil is rich in β-caryophyllene (36.32%), α-humulene (14.31%), β-humulene (9.73%), caryophyllene oxide (8.28%), allo-aromadendrene (5.63%) and junenol (5.10%). The essential oil has exhibited significant antimicrobial activity against Gram-positive and Gram-negative bacteria (John *et al*., 2024) [7].

Phenolic compounds form a major class of secondary metabolites contributing to antioxidant activity (Gupta *et al.,* 2012). Ethanolic extract of the bark contain notable quantities of total phenols (670 mg/g) and flavonoids (72mg/g), whereas the aqueous extracts contain slightly lower levels (Gupta *et al.,* 2012) [4]. The leaves and roots also exhibit the presence of bergenin and hopeaphenol (Siddiqui., 2019) [14]. Oligostabinoids and monoterpenes are the bioactive compounds present in the bark (Bugade *et al.,* 2022) [2]. Bergenin and hopeaphenol have been reported from the leaves and roots (Siddiqui, 2019) [14]. Oligostilbenoids and monoterpenes make up other significant metabolites in the bark (Bugade and Khan., 2022) [2]. The resin contains triterpenes, hydrocarbons, alcohols, ketones, acids and trace sesquiterpenes (JK *et al.,* 2018). The fatty acid content "Dhupa fat" contains steari (38 – 47%), oleic acid (38- 48%)
and palmitic acids (Sasikumar *et al.,* 2016) [12].

Therapeutic Uses

Due to its high phenolic and flavonoid concentration, extracts of *V. indica* exhibits high antioxidant and antimutagenic properties (Gupta *et al.,* 2012) [4]. The resin "Sarja rasa" traditionally obtained from the trunk is widely used in Ayurveda and siddha for treating inflammatory disorders and aiding tissue repair (Kavitha and Geethu., 2017) [8].

Pharmacological Potential

1. Anti-Inflammatory Activity

Resin extracts of *V. indica* exhibit anti-inflammatory properties, which have been validated through experimental models such as carrageenan- induced paw edema (Kavitha and Geethu., 2017) [8]. The presence of alkaloids, steroids, glycosides and related compounds supports this pharmacological effect (JK *et al.,* 2018).

2. Antioxidant & Antimutagenic Activity

The bark extract is rich in phenolics and flavonoids providing a strong free radicle scavenging potential, which contribute to its antimutagenic effects (Ruma *et al.,* 2011) [10].

3. Anti-ulcer activity

Vateria indica resin extract in the higher dose (500mg/kg) witnessed a significant dose-dependent anti-ulcer activity against ethanolinduced gastric ulcer and indomethacin-induced gastric ulcer models. It also produced a significant (**p≤0.01) reduction in the ulcer index on a higher dose (500mg/kg) as well as standard (ranitidine) treated groups. The study revealed that Vateria indica Linn. resin extract possesses significant anti-ulcer activity (Siddiqui, 2019) [14].

Threats

Major threats to *V. indica* include overharvesting of timber for commercial uses, particularly by the plywood industries and large-scale habitat loss caused by human disturbances in lowland forest regions (Dhyani and Barstow., 2020) [3]. Restricted natural seed dispersal limits regeneration capacity, while growing demand for its nuts and resin poses additional pressure on wild populations (Sinu and Shivanna 2016) [15]. In recent years due to the intensive nut harvest of *Vateria indica* which is market-driven may further affect the structure and quality of the natural populations of *V. indica* (Sinu and Shivanna 2016) [15].

Conclusion

Vateria indica is a medically valuable species with documented antioxidant, anti-inflammatory and antimutagenic activities due to its diverse profile of bioactive metabolites. Despite its therapeutic importance, the species faces significant ecological threats, primarily due to habitat degradation and unsustainable extraction practices. Conservation measures aligned with sustainable harvesting will be essential to ensure its long- term survival.

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