

A REVIEW ON PHARMACOLOGICAL ACTIVITIES OF *VATERIA INDICA* LINN.

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ABSTRACT

Vateria indica Linn is a large evergreen tree that belongs to Dipterocarpaceae family. The tree grows mostly in moist evergreen forests but frequently extends into deciduous forests adjoining rivers; usually found in the state of Karnataka, Kerala and Tamil Nadu. It is a multipurpose tree which has economic and medicinal significance. It is used in the treatment of chronic bronchitis, ringworm, scrofula, wounds, boils, rheumatism, urinary discharges, amenorrhoea, piles, gonorrhoea and syphilis. The plant can be found described in almost all Ayurvedic literatures in the treatment of anaemic disorder, ear disorder, skin disorder and diabetes mellitus. The paper reports on its pharmacological activities such as anti-inflammatory, anthelmintic, anti-ulcer, anti-tumour activity and anticancer potential.

Keywords: *Vateria indica*, Anti-inflammatory, Anthelmintic, Anti-ulcer, Anti-tumour.

INTRODUCTION

From the very beginning of human existence, man has familiarized himself with plants and used them in a variety of ways throughout the ages. Primitive man in search of food and to cope successfully with human sufferings began to distinguish those plants suitable for medicinal purpose from others with definitive pharmacological action. This relationship between plants and man has grown and many plants came to be used as medicines. The growth of knowledge to cure diseases continued at an accelerating pace and a number of new plant derived drugs increased likewise. India is known as the "Emporium of Medicinal plants" due to availability of several thousands of medicinal plants in the different bioclimatic zones.¹ The writings indicate that therapeutic use of plants is as old as 4000 - 5000 B.C. and Chinese used first the natural herbal preparations as medicines. In India, however, earliest references of use of plants as medicine appear in Rig-Veda, which is said to be written between 1600 - 3500 B.C. Later the properties and therapeutic uses of medicinal plants were studied in detail and recorded empirically by the ancient physicians (an indigenous system of medicine) which are a basic foundation of ancient medical science in India.²

As defined by WHO, health is a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity. Medicinal plants can make an important contribution to the WHO goal to ensure, that all people, worldwide, will lead a sustainable socioeconomic productive life. The

use of traditional medicine and medicinal plants in most developing countries, as a basis for the maintenance of good health, has been widely observed by UNESCO, 1996.³

Herbal medicine or phytomedicine is the use of plants for medicinal and therapeutic purpose for curing of diseases and improve human health. Plants have secondary metabolites called phytochemicals ('Phyto' from Greek - meaning 'plant'). These are active ingredients which possess therapeutic properties that are considered as a medicine or drug. Plants used as food and in traditional medicine are more likely to yield pharmacologically active compounds. It has been observed that numerous plants have pharmacological effects due to the presence of metabolites. Plant metabolites are organic compounds which can be classified into primary metabolites and secondary metabolites. Primary metabolites are organic compounds includes glucose, starch, polysaccharide, protein, lipids and nucleic acid which are beneficial for growth and development of the human body. Secondary metabolites which include alkaloids, flavonoids, saponins, terpenoids, steroids, glycosides, tannins, volatile oils etc., are used for curing many diseases. Alkaloids have antispasmodic, antimalarial, analgesic, diuretic activities; Terpenoids are known for their antiviral, anthelmintic, antibacterial, anticancer, antimalarial, anti-inflammatory properties; Glycosides are reported for antifungal and antibacterial properties; Phenols and flavonoids have an antioxidant, antiallergic, antibacterial properties etc. and Saponins are

reported to have anti-inflammatory, antiviral, plant defence activities.⁴

However, the potential use of higher plants as a source of new drugs is still poorly explored. The present review article gives an account on different screening models used in various pharmacological activities of the plant *Vateria indica* Linn.

Vateria indica Linn, the white dammar, is a species of plant in the Dipterocarpaceae family. It is a slow-growing species, endemic and found primarily in the south west coast evergreen forests, upto an altitude of 750 m, and also occasionally in secondary evergreen dipterocarp forest in the state of Karnataka, Kerala and Tamil Nadu.⁵ It is also occasionally found in deciduous forests, adjoining rivers in the aforementioned areas. Apart from the Ghats, these trees are also found on the Deccan Plateau and along the Arabian sea-coast, the altitudinal range being from 60 to 1220 meters. They generally grow upto 40 meters tall, but with some specimens reaching 60 meters. The tree grows mostly in moist evergreen forests but frequently extends into deciduous forests adjoining rivers. It is commonly called as White Dammar, Indian Copal, Malabar tallow, Piney varnish, Sarja (Sanskrit), Safed dammar (Hindi), Dhoopada mara (Kannada), Vella Kundurukkum (Malayalam), Tella Damaramu (Tamil), Raal (Marathi), Shakgachha (Bengali).

Vateria indica Linn is a large magnificent evergreen tree. Trunk is about 3 m in girth. The bark appears rough, whitish to grey, peeling off in thick round flakes. Leaves are simple, alternate, spiral, stipules caduceous, petiole 2-3.5 cm, swollen at apex, apex abruptly acuminate or obtuse, base rounded, margin entire, midrib flat above and curved near margin, closely obliquely per current.⁵ Leaves falls in March, new foliage appears in April-May, the second flush of foliage starts after rains, in October-December. Flowers are white, fragrant, arranged in panicles. The

flowering time is from January to March and fruits ripen from May to July. The fruits are fleshy, wingless, about 50 to 60 mm long and contain one large seed which is filled with fat.⁶ Oil is obtained from the seeds.

CHEMICAL CONSTITUENTS

The Phytochemical analysis of *Vateria indica* stem bark suggests the presence of carbohydrate, tannin, phenols and flavonoid in aqueous and ethanolic extract. Petroleum ether extract of stem bark showed the presence of phytosterols.⁵ The bark also contains polyphenols – dl – epi-catechin, laevorotatory isomers of fisetinidol, fzelechin and bergenin. The leaves and roots contain bergenin and hopeaphenol. The stem is known to produce biological active compounds such as oligostilbenoids and monoterpenes. Resin is a complex mixture of several triterpene hydrocarbons, ketones, alcohols and acids, along with small amounts of sesquiterpenes. The fruit shell contains 25% tannins.⁷ *Vateria indica* oil is known as piney tallow or dhupa fat. Dhupa oil contains more than 55.0% saturated fatty acids; it remains solid at lower temperatures and so is known as fat. Dhupa kernels contain 19-23% of a pale-yellow fat having a tallow-like consistency, which turns white on standing. Stearic acid (38-47%), Oleic acid (38-48%) and Palmitic acid (9-5%) are the major fatty acids in dhupa fat. The fatty acid composition is: C16 (9.0%), C18 (46.9%), C18:1 (41.4%), C18:2 (1.3%) and C20 (1.4%).⁶ The seeds also contain bergenin.

The investigation of phenolic constituents in *Vateria indica* afforded five resveratrol tetramers, vateriaphenols B and C, isohopeaphenol, hopeaphenol, and shoreaketone.⁸ High-performance liquid chromatography analysis showed that the extract contains bergenin, hopeaphenol, vaticanol B, vaticanol C, and ϵ -viniferin.⁷



Vateria indica Linn tree

THERAPEUTIC USES

Vateria indica Linn is a multipurpose tree that is much used locally in India. Its Resin is credited with astringent, antibacterial, antidiarrheal, emmenagogue properties and used in several diseases, such as chronic bronchitis, skin eruptions, ringworm, scrofula, tubercular glands, ulcers, wounds, boils, rheumatism, urinary discharges, amenorrhoea, piles, gonorrhoea and syphilis. Resin enters into a number of antiseptic and anti-inflammatory ointments. Tallow is used as an emollient, stimulant, antibacterial & useful application in chronic rheumatism. The bark of the plant has antidyenteric activity and also used as an alexipharmic. Leaf juice is applied to cure burns and is also used in diseases of blood. Orally administered to prevent vomiting. Oil obtained from the seeds of the plant shows antirheumatic activity.⁹

The drug *Vateria indica* can be found described in almost all Ayurvedic literatures with the name Sarja, Sarjaka, Ajakarna. It is

used to treat Kaphaja roga, Pandu roga (Anaemic disorders), Karna roga (Ear disorders), Meha (Diabetes mellitus), Kushta (Skin disorders), Visha (In Poisoning), and in Vrana (Wounds). The Ayurvedic Pharmacopoeia of India recommends the resinous exudate internally (1-2 g) in lipid disorders, anaemia, genitourinary diseases, diarrhoea and diseases due to vitiated blood; externally in gout, abscesses, skin diseases, burns and eruptions.⁷

OTHER USES

The timber is in much demand for commercial first class plywood making. Resin is mainly used in making home varnishes, incense sticks, torches & candles with coconut oil. The tallow is used for edible purposes after refining, used in confectionary and as an adulterant of ghee. Also been suggested for use in blends with cocoa butter or as its substitute. The fat is being used in making candles and soaps.⁷



Vateria indica flower



Vateria indica seed

PHARMACOLOGICAL ACTIVITIES

1. ANTI-INFLAMMATORY ACTIVITY

The current study was performed for anti-inflammatory activity of the *Vateria indica* leaves. Air dried materials were coarsely powdered and was subjected to successive solvent extraction with the help of soxhlet apparatus. The chemical screening of leaves of *Vateria indica* were performed as per the guideline of World Health Organization (WHO). The anti-inflammatory activity screening of the various extracts showed the presence of alkaloids, carbohydrates, steroids and glycosides. Anti-inflammatory activity was performed using the carrageenan induced rat paw oedema method. The ethanolic extract (400 mg/kg, p.o.) showed 36.9% inhibition and compared to the standard drug diclofenac sodium which showed 55.6% inhibition. Conclusively the result revealed that *Vateria indica* leaves have anti-inflammatory activity which may be due to the presence of alkaloids, steroids and glycosides.¹⁰

2. ANTHELMINTIC ACTIVITY

Helminthic infections are one of the frequently affecting infections to human being, which is largely affecting the world population. The present investigation was undertaken to evaluate the anthelmintic activity of ethanolic and aqueous extract of *Vateria indica* (stem bark) using Indian earthworm *Phretimaphostuma*. Different concentrations viz. (50, 25 and 12.5 mg/ml) of each ethanolic and aqueous extracts were used for bioassay, involve determination of time of paralysis (TP) and time of death (TD) of the worms. 1% gum acacia in saline solution and mebendazole (15mg/ml) were used as control and standard respectively. The result of present study indicates that the crude ethanolic extract of *Vateria indica* significantly demonstrated paralysis, and death of worms a concentration 50mg/ml compared to standard reference mebendazole.¹¹

3. ANTI-ULCER ACTIVITY

Peptic ulcer disease (PUD) is one of the most common gastrointestinal disorders, which causes a high rate of morbidity particularly in the population of non-industrial countries. The aim of the present study was designed to evaluate the anti-ulcer activity of the aqueous extract of the resin of *Vateria indica* using various experimental animal models. Anti-ulcer activity was evaluated by using two animal models. The degree of anti-ulcer activity was determined by measuring the ulcer index in Ethanol induced and indomethacin induced ulcer models. *Vateria indica* resin extract in the

higher dose (500mg/kg) witnessed a significant dose dependent anti-ulcer activity against ethanol induced gastric ulcer and indomethacin induced gastric ulcer models. It also produced a significant (** $p \leq 0.01$) reduction in the ulcer index on higher dose (500mg/kg) as well as standard (ranitidine) treated groups. The study revealed that *Vateria indica* Linn. resin extract possess significant anti-ulcer activity.¹²

4. ANTI-TUMOR EFFECT

Dipterocarpaceous plants contain various resveratrol oligomers that exhibit a variety of biological activities, such as antibacterial and antitumor effects. Previously, it was found that vaticanol C, a resveratrol tetramer, exhibits strong cytotoxicity against various tumor cell lines. In the present study, the antitumor activity of the ethanol extract from the stem bark of *Vateria indica*, which has been traditionally used for health and healing diseases as Ayurveda in India. High-performance liquid chromatography analysis showed that the extract contains bergenin, hopeaphenol, vaticanol B, vaticanol C, and epsilon-viniferin. The in vitro assay displayed the extract's anti-cancer activity against mouse sarcoma 180 cells (IC₅₀=29.5 microM). In the animal study, the tumor growth of sarcoma S-180 cells subcutaneously allografted in DDY mice was significantly retarded by oral administration of the extract (30 or 100 mg/kg body weight: $P < 0.001$). The extract did not show significant toxicity to mice even at a dosage of 1000 mg/kg body weight by daily oral administration for 28 days. These results demonstrated that the ethanol extract containing various stilbenoids from the stem bark of *Vateria indica* has the potent antitumor activity.¹³

5. ANTICANCER POTENTIAL

In the present study the anticancer potential of stem bark of *Vateria indica* against two cancer cell lines namely, rat glioma (C6) and EAC were tested. Alcoholic and aqueous extract of stem bark of *Vateria indica* exhibited considerable cytotoxic activity against the cell lines in the preliminary screening. Thus a bioactivity guided fractionation scheme was adopted where in the alcoholic extract was fractionated with solvent of increasing order of polarity like petroleum ether, ethyl acetate and acetone. These fractions were screened for their cytotoxic potential against same cell lines using two different assay methods viz., SRB assay and trypan blue dye exclusion assay. The results obtained from these two basic assays demonstrate that *Vateria indica*

acetone fraction was highly active whereas ethanolic and petroleum ether fraction were moderately active against C6 while ethanolic and ethyl acetate fractions were highly active against EAC cells as compared to petroleum ether fraction. The results suggest that not all fractions of the extract were active against the cell lines. Acetone, ethanolic and petroleum ether showed active cytotoxicity in cancer cells, the rest of the fractions were not active. Based on the present study it can be concluded that *Vateria indica* possess anticancer activity.¹⁴

CONCLUSION

The present review reveals the description, active constituents, therapeutic uses and pharmacological activities of *Vateria indica* Linn. It also reveals that *Vateria indica* contains several phytoconstituents like carbohydrate, tannin, phenols, flavonoid, phytosterols, polyphenols – dl – epi-catechin, laevorotatory isomers of fisetinidol, fzelechin, bergenin, vateriaphenols B and C, isohopeaphenol, hopeaphenol, and shoreaketone. The plant has been studied for its various pharmacological activities like anti-inflammatory, anthelmintic, anti-ulcer, anti-tumour activity and anticancer potential. *Vateria indica* has a great perspective for the treatment of diseases like chronic bronchitis, ringworm, scrofula, wounds, boils, rheumatism, urinary discharges, amenorrhoea, piles, gonorrhoea, syphilis etc. Further studies and investigations can be performed on the plant for its various pharmacological activities.

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