

Adathoda vasica (Vasaka): Ethnobotany, Phytochemistry and Pharmacological Importance

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Abstract: *Adhatoda vasica* (L.) Nees, commonly called Vasaka or Malabar nut, is an important medicinal shrub widely used in traditional systems of medicine such as Ayurveda, Siddha and Unani. The plant is particularly valued for its effectiveness in treating respiratory disorders including cough, bronchitis, asthma and tuberculosis. Phytochemical investigations have identified several biologically active compounds such as vasicine, vasicinone, flavonoids and phenolic compounds that contribute to its therapeutic activity. Ethnobotanical studies indicate that local communities utilize the leaves, roots and flowers of the plant for a variety of ailments including fever, bleeding disorders and microbial infections. Modern pharmacological studies support many of these traditional claims and demonstrate bronchodilator, antimicrobial, antioxidant and anti-inflammatory activities. This paper reviews the taxonomy, botanical description, phytochemical composition, ethnomedicinal uses and pharmacological importance of *Adhatoda vasica* based on scientific literature.

Keywords: *Adhatoda vasica*, Ethnobotany, Phytochemistry, Pharmacological Importance Etc.

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I. INTRODUCTION

Medicinal plants have been used as a primary source of healthcare since ancient times. According to the World Health Organization, a large proportion of the global population relies on plant-based medicines for basic healthcare needs. Among these medicinal plants, *Adhatoda vasica* holds a significant place in traditional medicine because of its wide therapeutic applications. *Adhatoda vasica* belongs to the family Acanthaceae and is native to the Indian subcontinent. The plant is commonly found in India, Sri Lanka, Nepal and Southeast Asia. In Ayurveda it is known as “Vasaka” and has been traditionally used to treat respiratory diseases [1].

Historical Ayurvedic texts describe its use as an expectorant and bronchodilator for relieving breathing difficulties. Modern scientific studies have confirmed many of the traditional uses of the plant. Researchers have identified several important alkaloids including vasicine and vasicinone that are responsible for the bronchodilator and expectorant properties of the plant. Due to these medicinal characteristics, *Adhatoda vasica* is widely used in herbal cough syrups, tablets and traditional remedies [1].

The earliest documented references to *Adhatoda vasica* appear in classical Ayurvedic texts including the Charaka Samhita and Sushruta Samhita, where it is described as a potent remedy for ailments characterized by excess *Kapha*

and *Vata*, primarily involving respiratory tract diseases. The global burden of respiratory illnesses such as chronic bronchitis, asthma, and tuberculosis remains high, necessitating efficacious, affordable, and accessible therapeutic options. Synthetic bronchodilators and corticosteroids, though effective, are often accompanied by adverse effects and resistance issues. This has reignited interest in phytotherapy and plant-derived compounds, with *Adhatoda vasica* emerging as a promising candidate due to its potent bronchodilatory, expectorant, and anti-inflammatory properties. The plant's pharmacological repertoire extends beyond respiratory benefits, encompassing antimicrobial, antioxidant, uterotonic, and potential anticancer activities. Phytochemical investigations have identified a complex matrix of biologically active constituents within *Adhatoda vasica*, most notably quinazoline alkaloids such as vasicine and vasicinone, which are responsible for its characteristic pharmacodynamics. These compounds have been extensively studied in vitro and in animal models, elucidating mechanisms such as smooth muscle relaxation, mucolytic activity, and modulation of inflammatory pathways. Additionally, emerging studies employing in silico molecular docking have revealed promising antiviral activities against viruses including SARS-CoV-2, further broadening the scope of *Adhatoda vasica*'s medicinal potential. Despite its widespread traditional use and promising preclinical data, comprehensive clinical validation and standardization remain limited, hindering its full integration into evidence-based medicine.

Moreover, issues such as variability in phytochemical content, lack of standardized formulations, and safety concerns, particularly relating to its uterotonic effects, necessitate rigorous scientific scrutiny. This review aims to present an exhaustive analysis of *Adhatoda vasica*, encompassing its botanical characteristics, ethnomedicinal significance, phytochemistry, pharmacological activities [2].

➤ Taxonomy and Botanical Description

Adhatoda vasica is an evergreen shrub that typically grows between 1 and 2.5 meters in height. It thrives in warm climates and is commonly found in plains, forest margins and hilly regions of South Asia [8].

➤ Taxonomic Classification

- Kingdom: Plantae
- Division: Angiosperms
- Class: Dicotyledons
- Order: Lamiales
- Family: Acanthaceae
- Genus: Adhatoda
- Species: Adhatoda vasica (L.) Nees

The plant grows well in well drained soil and moderate rainfall conditions. The leaves of the plant are opposite, simple and lanceolate with a dark green color. They possess a characteristic bitter taste and are the most widely used medicinal part of the plant. The flowers are white with purple streaks and are arranged in dense spikes. The fruit is a small capsule containing four seeds. The plant can be propagated through seeds as well as vegetative methods such as stem cuttings. Because of its medicinal value, the plant is cultivated in herbal gardens and medicinal plant farms in many regions of India [7].

II. MORPHOLOGICAL CHARACTERISTICS

Understanding the detailed morphology of *Adhatoda vasica* is crucial for correct identification, cultivation, and quality control in herbal pharmacognosy.

➤ Habit and Habitat

Adhatoda vasica is a fast-growing, evergreen, perennial shrub, typically attaining a height of 1.5 to 3 meters, sometimes reaching up to 4 meters under optimal conditions. It exhibits a bushy and erect growth habit with multiple woody stems branching from the base. The plant is hardy, drought-resistant, and thrives in tropical to subtropical climates, commonly found at altitudes up to 1500 meters above sea level. It naturally colonizes disturbed sites such as roadsides, forest edges, wastelands, and homestead gardens. It prefers well-drained soils rich in organic matter but can tolerate a range of soil types including loamy and sandy soils with pH 6.5–7.5.

➤ Stem

The stems are quadrangular (square in cross-section), woody at the base, and green or light brown in color. Younger stems are covered with fine pubescence (soft hairs), which

decreases as the stem matures. The bark is thin and smooth, becoming slightly rough with age.

➤ Leaves

Leaves are one of the primary identification features of *Adhatoda vasica*:

- Arrangement: Opposite, decussate (each pair at right angles to the one below)
- Shape: Lanceolate to ovate-lanceolate
- Size: Typically 8–15 cm in length, 3–6 cm in width
- Margin: Entire (smooth edges)
- Apex: Acute to acuminate (tapering to a point)
- Base: Attenuate (narrowing at the base)
- Texture: Glabrous (smooth and hairless) on the upper surface; paler and slightly pubescent on the underside
- Venation: Pinnate with a prominent midrib and lateral veins visible on the underside
- Petiole: Short, about 1 cm long

The leaves emit a characteristic bitter and slightly pungent aroma when crushed, attributable to volatile oils and alkaloids present in the mesophyll cells.

➤ Inflorescence and Flowers

Adhatoda vasica produces flowers in axillary or terminal spikes or racemes, generally 6–10 cm long. The floral structure is zygomorphic (bilaterally symmetrical) and tubular, characteristic of the family Acanthaceae.

- Calyx: Five sepals fused into a tubular calyx, green in color, 1–1.5 cm long, with narrow teeth at the apex.
- Corolla: Tubular, approximately 2.5–3 cm long, bilabiate (two-lipped) with the upper lip being hooded and the lower lip spreading.
- Color: Usually white, occasionally tinged with purple or pink.
- Stamens: Four didynamous stamens (two long and two short) inserted near the corolla tube's base.
- Pistil: Single style, ending in a bifid stigma.
- Flowering Period: Mainly from August to November, varying with climatic conditions.

The flowers are hermaphroditic and entomophilous (insect-pollinated), attracting bees and butterflies [4].

➤ Fruit and Seeds

The fruit is a small, oblong, club-shaped capsule, measuring about 1.5 cm in length. It is dehiscent, splitting open on maturity to release 2 to 4 seeds.

- Seeds: Small, angular, brownish-black, with a rough surface and a hard seed coat, aiding in protection during dispersal. Seed dispersal is primarily through gravity (barochory), with occasional involvement of ants (myrmecochory).

➤ Root System

The root system is predominantly tap root type with lateral branches. The roots are cylindrical, brownish on the

outside with a white interior. They contain significant alkaloids but are less commonly used in herbal preparations compared to leaves and stems [3].



Fig 1 *Adhatoda vasica* Inflorescence

III. PHYTOCHEMICAL CONSTITUENTS

Phytochemical research has revealed that *Adhatoda vasica* contains numerous biologically active compounds. The most important chemical constituents are quinazoline alkaloids such as vasicine, vasicinone, vasicinol and vasinol. These alkaloids are considered responsible for the bronchodilator and expectorant properties of the plant.

In addition to alkaloids, the plant contains flavonoids, phenolic compounds, tannins, saponins and essential oils.

These compounds contribute to antioxidant and antimicrobial activities. Studies using modern analytical techniques such as high-performance liquid chromatography and gas chromatography have been conducted to identify and quantify these phytochemicals.

The concentration of these compounds may vary depending on environmental conditions, geographical location and seasonal variation. Leaves are generally reported to contain the highest concentration of active alkaloids, making them the most commonly used part in herbal medicine [5,6].

➤ *Ethnobotanical and Traditional Uses*

Ethnobotanical surveys conducted in different regions of India show that *Adhatoda vasica* has been used by traditional healers for centuries. The plant is especially valued for treating respiratory problems such as cough, cold,

bronchitis and asthma. Leaf extracts are commonly prepared as decoctions, syrups or herbal teas. Traditional healers often mix leaf juice with honey to treat throat infections and chest congestion. In addition to respiratory disorders, the plant is used in folk medicine for treating fever, bleeding disorders, wounds and skin infections. The roots and flowers are sometimes used in herbal preparations for tuberculosis and chronic bronchial conditions. The leaves are also applied externally to treat wounds and skin diseases because of their antimicrobial properties. These widespread traditional uses highlight the ethnomedicinal significance of the plant across different cultures and communities [9].

➤ *Pharmacological Activities*

Modern pharmacological research has validated many of the traditional medicinal uses of *Adhatoda vasica*. One of the most well-known properties of the plant is its bronchodilator activity, which helps in relaxing bronchial muscles and improving airflow in the lungs. The alkaloid vasicine has been shown to possess strong expectorant and bronchodilatory effects. These properties make the plant particularly effective in treating respiratory conditions such as asthma and bronchitis. Experimental studies have also demonstrated antimicrobial activity of plant extracts against several bacterial and fungal pathogens. Furthermore, the presence of phenolic compounds and flavonoids contributes to antioxidant activity, which helps protect cells from oxidative stress. Anti-inflammatory effects have also been observed in laboratory studies, indicating potential therapeutic applications in inflammatory diseases [10].

IV. PHARMACOLOGICAL ACTIVITIES

The pharmacological properties of *Adhatoda vasica* are attributed primarily to its quinazoline alkaloids (notably vasicine and vasicinone), flavonoids, phenolics, and essential oils. The plant demonstrates a multifaceted pharmacological profile, with significant effects on the respiratory system, immune function, oxidative stress, inflammation, and microbial pathogens [12].

➤ *Antitussive and Expectorant Activity*

Vasicine, the chief alkaloid, stimulates bronchial glands to increase secretion, thereby liquefying and expelling sputum. This expectorant activity is complemented by the antitussive effect of vasicinone, which inhibits cough reflex via peripheral and central mechanisms.

➤ *Bronchodilatory Activity*

One of the most validated effects of *Adhatoda vasica* is bronchodilation, beneficial in asthma, COPD, and bronchitis. The active compound Vasicine acts as a β_2 -adrenergic receptor agonist-like compound. The Relaxation of bronchial smooth muscle by phosphodiesterase inhibition and increased cAMP levels in smooth muscle cells.

➤ *Anti-Inflammatory Activity*

The anti-inflammatory effect of *Adhatoda vasica* is relevant for both respiratory and non-respiratory inflammatory conditions.

➤ *Antimicrobial and Antibacterial Activity*

Both alcoholic and aqueous extracts of *Adhatoda vasica* possess significant antibacterial and antifungal activities.

V. CONCLUSION

Adhatoda vasica is a highly valuable medicinal plant with significant therapeutic importance. Traditional knowledge regarding its use in respiratory diseases has been supported by modern scientific studies. The presence of alkaloids such as vasicine and vasicinone plays a crucial role in its pharmacological activities. The plant continues to be widely used in herbal medicine and pharmaceutical preparations. Further research focusing on clinical trials, standardization of plant extracts and drug development may expand its potential applications in modern medicine. Conservation and sustainable cultivation of this plant are also important to ensure its availability for future generations.

REFERENCES

- [1]. Chopra, R.N., Nayar, S.L., & Chopra, I.C. (1956). Glossary of Indian Medicinal Plants. CSIR, New Delhi.
- [2]. Dhankhar, S., *et al.* (2011). A review on *Justicia adhatoda*: A potential source of natural medicine. African Journal of Plant Science.
- [3]. Karthikeyan, A., *et al.* (2009). Pharmacological review of *Adhatoda vasica*. International Journal of Pharmaceutical Sciences.
- [4]. Kirtikar, K.R., & Basu, B.D. (1999). Indian Medicinal Plants. Dehradun: International Book Distributors.
- [5]. Kokate, C.K. (2007). Practical Pharmacognosy. Vallabh Prakashan.
- [6]. Patel, S. (2024). Phytochemical and ethnomedicinal review of *Justicia adhatoda*.
- [7]. Savitha, B., & Sreela, R. (2024). Estimation of vasicine in leaves of *Adhatoda vasica*.
- [8]. Shoaib, A. (2022). Ethnobotanical review of *Adhatoda vasica*.
- [9]. Singh, A., *et al.* (2010). Medicinal plants with bronchodilator activity. Journal of Ethnopharmacology.
- [10]. Sharma, P.V. (2001). Dravyaguna Vijnana. Chaukhambha Bharati Academy.
- [11]. WHO (2013). WHO Traditional Medicine Strategy.
- [12]. Yadav, R.N.S., & Agarwala, M. (2011). Phytochemical analysis of medicinal plants. Journal of Phytology.