

Vasaka (*Adhatoda vasica*): A Comprehensive Review on Its Phytochemistry, Pharmacology and Therapeutic Potential

Padwal Prachi Nandkumar ^{1,*}, Bhor Neha Mahendra ², Lokhande Rahul Prakash ¹, Lamkhade Ganesh Jayram ¹, Bhujbal Sayali Vilas ² and Bhujbal Shreya Ravindra ²

¹ Department of Quality Assurance Technique, Samarth institute of pharmacy, Belhe, pune, Maharashtra.

² Student, Samarth institute of pharmacy, belhe ,pune, Maharashtra.

World Journal of Biology Pharmacy and Health Sciences, 2025, 24(01), 441-447

Publication history: Received on 10 September 2025; revised on 19 October 2025; accepted on 22 October 2025

Article DOI: <https://doi.org/10.30574/wjbphs.2025.24.1.0911>

Abstract

The shrub *Adhatoda vasica* (L.), Nees, is a member of the Acanthaceae family and has opposite ascending branches. For for 2500 years, the plant has been a part of India's traditional medical system. In Ayurvedic and Unani medicine, this plant is widely used as a medication. In traditional medical systems, vasaka is a well-known herb for its therapeutic properties, especially in treating bronchitis. The leaves, bark, fruit, flowers, and root bark of Vasaka are helpful in getting rid of intestinal parasites. Vasaka plant is used to cure persistent coughing, colds, and Both asthma and bronchitis.

Keywords: Alkaloids; *Adhatoda Vasica*; Ayurveda; Phytochemistry Medicinal Qualities

1. Introduction

A medicinal plant called vasaka (*Adhatoda vasica*) contains medication to treat a number of respiratory conditions. The bioactive alkaloid vasicine, which gives vasaka its therapeutic qualities, is found in its leaves. It is a useful substance for pharmaceutical applications because of its bronchodilatory, anti-inflammatory, and antimicrobial properties. *Adhatoda vasica*, sometimes called Malabar Nut or Vasaka, is a tiny tree or perennial shrub that is a member of the Acanthaceae family. It is indigenous to Southeast Asia, India, and Sri Lanka. Asia, and is usually found in plains, hills, and woods in tropical and subtropical climates. *Adhatoda Vasica* has simple, opposite, lanceolate leaves that are 3-6 cm wide, 10-20 cm long, and have a rounded base and a sharp tip. The leaf surface has a complete edge and is glabrous and dark green. Customarily, *Adhatoda Vasica* leaves have been used to treat skin conditions including eczema and acne, cough, cold, fever, respiratory disorders like bronchitis and asthma, and wound healing. Regarding quality control, the authentication of *Adhatoda Vasica* leaves entails chromatographic, microscopy, and macroscopic analysis, along with testing for pesticide and heavy metal contamination. Standardization guarantees that the extract has the required vasicine concentration. The FDA, WHO, and Indian Ayurvedic pharmacopeia are among the regulatory bodies that overuse plants. (1)

The plant's botanical description is as follows: Plantae, Kingdom; Angiosperms, Division Division: Eudicots Order number: Lamiales The family Acanthaceae Sort by Genus: *Justicia Adhatoda* is the species (*Adhatoda vasica*). (2)

* Corresponding author: Padwal Prachi Nandkumar



Figure 1 Vasaka Plant

2. Plant profile

Botanical Description: *Adhatoda vasica* is a tiny, evergreen plant that belongs to the Acanthaceae family. Its broad, lanceolate leaves are 5 cm wide and 10 to 16 cm long, with sharp, lance-like points. When dried, they turn greenish-brown and taste harsh.

They smell a much like strong tea. The stem's soft wood is an excellent source of charcoal for gunpowder. The bloom features big, lovely white petals with purple striations on the underside. The fruit has four seeds and is a tiny capsule [7]. Anti-inflammatory, analgesic, hepatoprotective, sedative, antispasmodic, anthelmintic, antimicrobial, antidiabetic, wound-healing, infertility, antiulcer, antibacterial, antihistaminic, moderately hypotensive, and thromboplegic effects are all exhibited by *Justicia adhatoda* Linn.

The alkaloids vasicine and vasicinone (quinazoline ring derivatives) found in the leaves have been shown to have respiratory stimulant activity throughout the past three decades of research, while vasicinolone, vasicol, and peganine are found in the roots [17, 18]. Peganine [19] is another name for vasicine (1,2,3,9-tetrahydropyrrolo [2,1-b] quinazolin-3-ol, C₁₁H₁₂N₂O). Other chemical components of this plant include deoxyvasicinone, which is produced from leaves, and vasicinone (3-hydroxy-2,3-dihydropyrrolo[2,1-b]quinazolin-9(1H)-one, C₁₁H₁₀N₂O₂), which is extracted from leaves, stem, and roots [20]. In vitro and in vivo, recent studies on vasicine revealed bronchodilatory action similar to that of theophylline. When combined, the two alkaloids exhibited strong bronchodilatory effects.



Figure 2 Vasaka Plant

Adhatoda Vasica has the following health advantages:

For thousands of years, Adhatoda Vasica has been utilized to treat respiratory conditions in traditional Indian medicine.

Adhatoda Vasica helps treat a variety of lung and bronchiole conditions, including TB and bronchitis. A herbal remedy for coughing and other cold symptoms can be made from a decoction of the leaves. Adhatoda is an effective treatment for sore throats because of its calming properties, which reduce throat irritation, and its expectorant properties, which assist remove phlegm buildup in the airway.

Adhatoda Vasica has been used to treat bleeding gums, piles, and peptic ulcers, among other internal and external bleeding conditions.

The plant may reach elevations of 1300 meters across the Indian peninsula. *Justicia adhatoda* L. and *Adhatoda zeylanica* Medic. are used interchangeably. It is also referred to by the Sanskrit name Vasaka and the popular name Malabar nut tree. For more than two millennia, the herb has been utilized in India's traditional medical system (Atal, 1980). In Ayurvedic and Unani medicine, it is a well-known medication (Manjunath, 1948).

3. Phytochemistry

vasica is used in phytochemistry in Ayurveda because of its mucolytic and expectorant qualities. As said by Charaka Bioactive components are the cause of these activities, Samhita. Phytochemicals include phenolic acid, sterols, glycosides, and alkaloids are found in *A. vasica*.

The most prevalent components are alkaloids (quinazoline) (vasicine, vasicinone, 7-hydroxyvasicine, vasicinolone, 3-deoxyvasicine, vasicolinone, vasicol, and vasicoline), betaine, steroids, carbohydrates, and alkanes. The plant's alkaloidal content, particularly its 7.5% vasicine, is responsible for the majority of its pharmacological effects. In addition to vasicine, the leaves contain betaine, steroids, alkanes, kaempferol, quercetin, and alkaloids (Vasicinone, Adhatodine, Vasicinol, Adhvasinone, Anisotine Adhatonine, and Hydroxypeganine) .

4. Traditional uses

4.1. Ayurvedic traditional uses

Vasaka has a long history in traditional medicine, particularly in Ayurveda, where it is categorized as a renewing herb, or Rasayana. Vasaka is the Sanskrit name for the plant, meaning "remover of bodily toxins," which reflects its Ayurvedic purifying qualities. Formulations for a variety of medical conditions use the different portions of the Vasaka plant. Respiratory health: This is one of the main areas where Vasaka is used. Bioactive substances with bronchodilator and expectorant qualities, such as vasicine and vasicinone, are found in the leaves.

4.2. Extraction methods

4.2.1. Soxhlet extraction

According to Azmir et al. (2013), Soxhlet extraction is a continuous solvent extraction technique that uses solvents at room pressure and boiling temperature to selectively extract target molecules from solid materials.

Another popular technique for removing bioactive substances such lipids, sterols, and fatty acids is soxhlet extraction (Kim, Murthy, Hahn, Lee, & Paek, 2007) As an alternative to the conventional liquid/liquid extraction of fatty acids from R] using organic solvents, Antinelli et al. (2002) presented a novel solid/liquid extraction technique that makes use of the Soxhlet method with refluxing diethyl ether. The findings indicated that there was no discernible difference between the fatty acid content that was separated using the two methods, which ranged from 3.5% to 4.2%.

4.3. TLC METHOD

4.3.1. Phytochemical Screening

Thin layer chromatography: TLC was carried out on a precoated silica gel 60OF254 plate using vasicine as a reference standard Mobile phase: Chloroform: Methanol (9.0:1.0) Test solution: To 3gm of substance being examined add 25ml of methanol heat on a water bath for 10-15 min cool and filter. Standard solution: Dissolve 10mg of vasicine in 10ml of methanol. Procedure: Apply 10, 1 each of the test and standard Solutions on a TLC plate as bands of 10 mm. developed the plate in air and examine under 254nm. Spray the plate with a solution of anisaldehyde sulphuric acid reagent. Heat the plate at 110 Celsius for about 5 minutes till the bands are clearly visible.

4.4. Identification test

Alkaloids can be detected using the following tests

4.5. Mayer's Test

Mayer reagent (potassium mercuric iodide solution), this test solution produces a cream-colored precipitate that shows the presence of alkaloids.

4.6. Wagner's Test

Iodine potassium iodide solution, or Wagner reagent, the test solution yields a reddish-brown. Use the Wagner reagent to precipitate, which shows the presence of alkaloids.

5. Hager's test

Hager's reagent, which is a saturated solution of picric acid, causes a yellow precipitate to form in test solutions, indicating the presence of alkaloids.

5.1. Test for Proteins and Amino acids

Millon's test: Add around 2 milliliters of the millon reagents to the test solution. If no white precipitate forms, there are no amino acids present.

Biuret test: One milliliter of diluted sodium hydroxide was added to the powdered drug's alcoholic extract. This was followed by the addition of a single drop of extremely diluted copper sulphate solution. The absence of proteins was indicated by the lack of violet color.

5.2. Test for Glycosides

5.2.1. Test

This is the general test.

After being heated over a water bath, 200 mg of the powdered medication was extracted using 5 ml of diluted sulfuric acid, filtered, and neutralized with a 5% sodium hydroxide solution. After adding 0.1 ml of Fehlings solutions A and B, it was heated for two minutes in a water bath until it became alkaline.

5.2.2. Test

instead of using sulfuric acid, 5 milliliters of water were used to extract 200 milligrams of the powdered medication. The sodium hydroxide solution was boiled and an equivalent volume of water was added. Next, 0.1 milliliters of after adding Fehlings solutions A and B, it was heated for two minutes in a water bath until it became alkaline.

The presence of glycosides is shown by the fact that test A produced more red precipitate than test B.

5.3. Test for Anthraquinones Glycosides

- The Borntrager test: - Involved boiling the powdered leaf in diluted sulfuric acid, filtering it, adding benzene, and giving it a good shake. After separating the inorganic layer, ammonia solution was added. slowly. The absence of anthracene-derived glycosides is shown by the ammoniacal layer's lack of red color.
- A modified version of Borntrager's After two minutes of boiling 0.1 g of the powdered leaf in diluted hydrochloric acid, a few drops of ferric chloride solution were added, filtered while still hot, and allowed to cool. After using benzene to remove the filtrate, the benzene layer was separated. The benzene extract was mixed with an equal volume of diluted ammonia solution and thoroughly shaken.
- The absence of color in the ammoniacal layer suggested that the glycosides were not produced from anthracene. Fluorescence was not observed indicating the absence of coumarin glycosides.

6. Test for Steroid and Triterpenoids

Salkowski Test for Triterpenoids and Steroids To the aforesaid solution, a few drops of strong sulfuric acid were added, shaken thoroughly, and allowed to set. Put aside.

The absence of sterols was indicated by the solution's chloroform layer not turning red.

The Test of Liberman-Burchard A few drops of acetic anhydride were added to the chloroform solution and thoroughly stirred. After adding 1 milliliter of concentrated sulfuric acid through the test tube's walls, it was placed aside for a while. The absence of sterols was shown by the absence of a brown ring at the junction.

7. Result

The findings of the experimental research on *adhatoda vasica* indicate that its bronchodilator, mast cell stabilizing, and antibacterial properties may be the cause of its anti-asthmatic action. Blocking H1 and Ach receptors could be the potential mechanism of action, resulting in the inhibition of smooth muscle to react to Ach and histamine-induced spasms, which inhibits bronchoconstriction.

8. Conclusion

Vasaka (*Justicia adhatoda*), a prominent medicinal plant in traditional systems like Ayurveda and Unani, has demonstrated significant pharmacological potential, particularly for its bronchodilatory, anti-inflammatory, antimicrobial, and antioxidant properties. Its primary bioactive compound, vasicine, along with other alkaloids and flavonoids, contributes to its wide therapeutic applicability, especially in respiratory disorders. Extensive preclinical studies support its efficacy; however, more rigorous clinical trials, standardization protocols, and toxicity assessments are necessary to validate its safety and therapeutic dosage for modern medicinal use. Continued exploration of Vasaka through integrated pharmacological and phytochemical approaches may pave the way for the development of novel plant-based therapeutics.

Compliance with ethical standards

Acknowledgments

I would like to express my sincere gratitude to all those who have supported and guided me throughout the completion of this project on Vasaka (*Adhatoda vasica*).

First and foremost, I extend my heartfelt thanks to my [Teacher's/Professor's Name], whose valuable guidance, constant encouragement, and insightful feedback made this project a success.

I am also thankful to [School/College/University Name] for providing the necessary resources and a conducive environment for conducting this study.

A special thanks to the library and laboratory staff for their assistance in accessing relevant materials and helping with the practical aspects of the project.

I would also like to acknowledge the contributions of various books, research papers, and online resources that enriched my understanding of Vasaka's botanical properties, medicinal uses, and significance in traditional medicine.

Last but not least, I thank my family and friends for their continuous support and motivation.

This project would not have been possible without the contribution of all these individuals, and I am deeply grateful to each one of them.

Disclosure of conflict of interest

No conflict of interest to be disclosed.

References

- [1] Extraction of Vasaka Leaf Alkaloids : A Comprehensive Review Dinkar Pratiksha S., Gowda Aishwarya K., Bhoir Pranali S., Miss. Padwal Prachi N. International Journal of Advanced Research in Science, Communication and Technology (IJARSCT) Volume 4, Issue 3, November 2024.
- [2] Overview of Phytochemistry and Pharmacology of *Adhatoda vasica* March 2018 Ajay Sharma^{1,2}, Garima Bhardwaj^{1,2} and Damanjit Singh Cannoo¹*International Journal of Advanced in Management, Technology and Engineering Sciences Volume 8, Issue III, March/2018 ISSN NO : 2249-7455
- [3] Isolation and characterization of Vasicine from *Adhatoda vasica* Bali Reddy Keesara and Rakesh Kumar Jat International Journal of Research and Development in Pharmacy & Life Science An International Open access peer reviewed journal ISSN (P): 2393-932X, ISSN (E): 2278-0238
- [4] Indian traditional herbs *Adhatoda vasica* and its Medicinal application K. P. Sampath Kumar^{*1}, Debjit Bhowmik², Chiranjib², Pankaj Tiwari², Rakesh Kharel² ISSN No: 0975-7384 Journal of Chemical and Pharmaceutical Research
- [5] *Adhatoda vasica*: a critical review of ethnopharmacological and toxicological data Ubonwan Pongprayoon Claeson a, Torbjörn Malmfors b, Georg Wikman c, Jan G Bruhn Journal of Ethnopharmacology
- [6] Volume 72, Issues 1–2, 1 September 2000, Pages 1-20
- [7] A systematic ethnobotanical review of *Adhatoda vasica* (L.), Nees. Ambreen Shoaib*Article history: Received: September 18, 2021 Accepted: November 04, 2021 Published: December 01, 2021
- [8] Vasaka (*Adhatoda vasica* Nees): Traditional Uses and Medicinal Applications in Ayurveda Sindhu Sri, Department of Pharmaceutical Analytical Chemistry, Jawaharlal Nehru Technological University, Hyderabad, - (2023)Volume 12, Issue 4.
- [9] PHYTOCHEMICAL SCREENING AND ASSESSMENT OF ADHATODA VASICA (LEAF) FOR ANTI-ASTHMATIC ACTIVITY Panacea Journal of Pharmacy and Pharmaceutical Sciences 2015:4(3);680-704Arvind Dangi*, Shivkant Patel, P. S. Yaduvanshi ISSN: 2349 7025

- [10] edam A, Kshirsagar R, Sawate A, Patil B. Studies on physico chemical characteristics and comparative study on extraction yield of Adulasa (*Adhatoda vasica*) leaf. *J Pharmacogn Phytochem*. 2017;6(5):244-247.
- [11] Rahman S, Sen P, Afroz F, Sultana K. In vitro propagation of *Adhatoda vasica* from shoot tip. *Mol Biol Biotechnol* j. 2004;2(1&2):33-35.
- [12] Kumar M, Dandapat S, Kumar A, Sinha M. Determination of Nutritive value and Mineral elements of Five-leaf Chaste Tree (*Vitex negundo* L.) and Malabar nut (*Adhatoda vasica* Nees). *Academic Journal of Plant Sciences*. 2013;6(3):103-108.
- [13] Prajapati N, Purohit S, Sharma D, Tarun K. *A Handbook of Medicinal Plants*. 1st Edn, agrobias. Jodhpur, India.2003:13-14
- [14] P Singh T, M Singh O, B Singh H. *Adhatoda vasica* Nees: phytochemical and pharmacological profile. *The Natural Products Journal*. 2011;1(1):29- 39.
- [15] Singh SK, Patel JR, Dangi A, Bachle D, Kataria RK. A complete over review on *Adhatoda vasica* a traditional medicinal plants. *Journal of Medicinal plants studies*. 2017;5(1):175-180.
- [16] Sayeed A, Madhukar G, Maksood A, Mhaveer S. Tanvir md, Ansari SH, A phyto pharmacological overview on *Adhatoda zylanica* Medic. *Syn A vasica* (Linn) Ness Natural product radiance. 2009;8:549- 554.
- [17] Kumar A, Ram J, Samarth RM, Kumar M. Modulatory influence of *Adhatoda vasica* Nees leaf extract against gamma irradiation in Swiss albino mice. *Phytomedicine*. 2005;12(4):285-293.
- [18] Gangwar AK, Ghosh AK. Medicinal uses and pharmacological activity of *Adhatoda vasica*. *Int J Herb Med*. 2014;2(1):88-91.
- [19] Chowdhury B, Bhattacharyya P. VASICINE AND RELATED-COMPOUNDS. 4. ADHAVASINONE-A NEW QUINAZOLONE ALKALOID FROM ADHATODA-VASICA NEES. In.: SOC CHEMICAL INDUSTRY 14 BELGRAVE SQUARE, LONDON, ENGLAND SW1X 8PS; 1987. p. 35-36
- [20] Batool R, Salahuddin H, Mahmood T, Ismail M. Study of anticancer and antibacterial activities of *Foeniculum vulgare*, *Justicia adhatoda* and *Urtica dioica* as natural curatives. *Cell Mol Biol (Noisy-legrand)*. 2017;63(9):109-114. 33. Shahwar D, Raza MA, Tariq S, Riasat M, Ajaib M. Enzyme inhibition, antioxidant and antibacterial potential of vasicine isolated from *Adhatoda vasica* Nees. *Pak J Pharm Sci*. 2012;25(3):651-656.
- [21] Nithya P, Sundrarajan M. Ionic liquid functionalized biogenic synthesis of AgAu bimetal doped CeO₂ nanoparticles from *Justicia adhatoda* for pharmaceutical applications: Antibacterial and anticancer activities. *J Photochem Photobiol B*. 2020;202:111706.
- [22] Bose D, Chatterjee S. Antibacterial Activity of Green Synthesized Silver Nanoparticles Using Vasaka (*Justicia adhatoda* L.) Leaf Extract. *Indian J Microbiol*. 2015;55(2):163-167.
- [23] Bhumi G, Rao ML, Savithramma N. Green synthesis of silver nanoparticles from the leaf extract of *Adhatoda vasica* nees. and assessment of its antibacterial activity. *Asian J Pharm Clin Res*. 2015;8(3):62-67.
- [24] Dangi A. Phytochemical screening and assessment of *Adhatoda vasica* (Leaf) for antiasthmatic activity. *Panacea Journal of Pharmacy and Pharmaceutical Sciences* ISSN: 2349-7025. 2015;4(3):680-704.
- [25] Anuradha A, Rajan K, McConnell M. Feeding deterrence activity of *Adhatoda vasica* L. against *Spodoptera litura* (Fab.). *Journal of Biopesticides*. 2010;3(1):286.
- [26] Rajni S, Priyam S. Study of insecticidal activity of acetone crude leaf extract of *Adhatoda vasica* against *Callosobruchus maculatus*. *World Journal of Pharmacy and Pharmaceutical Sciences (WJPPS)*. 2014;3(9):1573-1577.
- [27] Thanigaivel A, Chandrasekaran R, Revathi K, Nisha S, Sathish-Narayanan S, Kirubakaran SA, Senthil-Nathan S. Larvicidal efficacy of *Adhatoda vasica* (L.) Nees against the bancroftian filariasis vector *Culex quinquefasciatus* Say and dengue vector *Aedes aegypti* L. in in vitro condition. *Parasitol Res*. 2012;110(5):1993-1999