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PHYTOCHEMICAL PROFILING AND THERAPEUTIC RELEVANCE OF VASA LEAF (ADHATODA VASICA): A HOLISTIC VIEW OF AYURVEDA TO MODERN

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ABSTRACT

Vasa (adathoda vasica) is a well-known medicinal plant widely used in *Ayurvedic* medicine. It is especially valued for its therapeutic efficacy in treating respiratory conditions and controlling bleeding disorders. This study evaluates the phytochemical profiling, pharmacological activities, and traditional applications of Adathoda vasica leaves. **Materials and Methods:** Physicochemical analysis was conducted using 30 g of Adathoda leaves. Phytochemical screening of both water and alcohol extracts, a test for glycosides, and thin-layer chromatography were analyzed, adhering to the Ayurvedic pharmacopeia of India. This screening revealed the presence of carbohydrates, flavonoids, tannins, cardiac glycosides, monosaccharides, reducing sugars, and steroids. Thin-layer chromatography substantiated the chemical complexity and variety of phytoconstituents in the sample. **Result:** The study explored the medicinal properties of Vasa (Adhatoda vasica), highlighting its antimicrobial, anti-inflammatory, antitussive, and hemostatic actions, as supported by various in vivo and in vitro experimental studies. Furthermore, its traditional use in managing respiratory disorders (Shwasa-Kasa), bleeding disorders (*Raktapitta*), and skin diseases (*Tvak Roga*) as described in classical Ayurvedic texts was validated. **Discussion:** Despite the presence of potent alkaloids like vasicine and vasicinone in *Adhatoda vasica*, the plant has been reported to be relatively safe within

therapeutic doses. Its broad pharmacological activities, including *Shwasa-Kasa hara* (anti-tussive), *Raktapitta hara* (haemostatic), and *Shothahara* (anti-inflammatory) properties, support its traditional use in Ayurveda. These effects are in line with its classical indications for respiratory disorders, bleeding conditions, and skin ailments. **Conclusion:** This research underscores the potential of *Vasa* (*Adhatoda vasica*) as a valuable candidate for integrative medicine, with a well-established foundation in *Ayurveda* texts and substantial modern pharmacological validation. However, future studies focusing on clinical efficacy, pharmacokinetics, and comprehensive toxicological evaluations are essential to confirm its safety and therapeutic applicability in evidence-based practice.

KEYWORDS: Adhatoda vasica, Vasa, Ayurveda, Raktapitta.

INTRODUCTION

Adhatoda vasica is a small, evergreen, sub herbaceous, perennial bush distributed throughout India.[1] It is used in the ancient *Ayurveda* system of medicine, belonging to the family Acanthaceae, and is known as “Aadathodai” in Tamil and “Malabar nut in English. The whole plant is used to cure many human ailments.[2] The leaves are simple, petiolate, ex-stipulate, 10-20 cm long and 3-10 cm broad, lanceolate to ovate lanceolate, having a crenate margin, tapering base, and an acuminate apex with characteristic odour and bitter taste. The leaves are dark green in the above region and pale yellow below.[3] The leaves are used to treat malaria fever, chronic fever, internal haemorrhage, cough, asthma, leprosy, skin diseases, and piles. The plant is also used as an abortifacient.[4,5] They are used as analgesics and are effective as cardio-protective. The extract of the leaves is used against ringworm. Primarily, *Adhatoda vasica* is the main species used in Ayurveda. There are no major official varieties listed under classical texts, though regional varieties exist with minor morphological differences. Vasa (वसा), Vasaka (वसक), Vrisha (वृष) — means "the one which nourishes or strengthens." Simhaparni (सिंहपर्णी) — "leaves resembling lion’s ears", Vasuk, Raktapushpi — "having reddish flowers" (for the variety with red flowers), Pootika (पूतिक) — refers to its strong smell, are the synonyms of vasa drug.[6,7]

Charaka Samhita mentions it as a useful drug in the management of *Shwasa (asthma*) and *Kasa (cough*). Classified under *Kasahara Dravyas* (anti-tussive drugs).[7] *Sushruta Samhita:* Referred for its utility in treating *Raktapitta* (bleeding disorders).Also used in wound healing

and anti-inflammatory purposes.[8] *Ashtanga Hridaya*: Included in formulations for managing *Pittaja disorders*, especially those involving excessive bleeding and respiratory ailments.[9] *Bhavaprakasha Nighantu*: Described as *Tikta (bitter*) and *Kashaya (astringent*) in Rasa (taste), with *Sheeta Virya (cool potency*) and *Kaphapitta Shamaka* properties.[10] Therapeutic indications include *Shwasa (dyspnoea), Kasa (cough), Raktapitta (haemorrhagic conditions), and Jwara (fever). Dhanvantari Nighantu* vasa is included under *Shaka Varga*: Vasa is described for its actions on *Shwasa*, *Kasa*, and *Raktapitta***.** *Raja Nighantu* is included under *Pippalyadi Varga***:** Highlighted for its beneficial effects in cough, dyspnoea, bleeding disorders, and fever.[11, 12]

MATERIALS AND METHODS

The study was conducted on Vasa Patra (leaves), a plant-based sample submitted by KLE Ayurved Pharmacy to the Central Research Facility at Shri B. M. Kankanawadi Ayurveda Mahavidyalaya, Belgaum. A 30-gram sample of the leaves (Batch No I) was used for analysis. Macroscopic examination was performed to assess the part, colour, texture, and taste of the leaves. Physico-chemical parameters such as foreign matter, total ash value, acid-insoluble ash, water-soluble extractive, and alcohol-soluble extractive were evaluated as per the standards outlined in the Ayurveda Pharmacopoeia of India.[13]

For the detection of bioactive compounds, preliminary phytochemical screening was carried out using both water and alcohol extracts. This screening included tests for carbohydrates, reducing sugars, proteins, amino acids, steroids, flavonoids, alkaloids, tannins, and various glycosides[14] Additionally, Thin Layer Chromatography (TLC) was performed on the alcohol extract using a mobile phase consisting of toluene and ethyl acetate in a 7:3 ratio. The Rf values were recorded under both short and long-wave UV light to identify the presence of different phytoconstituents. Vasa (Adhatoda vasica) is recognised in the Ayurveda Pharmacopoeia of India for its therapeutic uses in respiratory disorders, bleeding disorders, and inflammation. Its leaves are traditionally used as an expectorant, antitussive, and haemostatic agent—a property validated by various studies.[14,15] It has significant efficacy in reducing respiratory tract infections using leaf extracts. Further confirms its antitussive, anti-inflammatory, and antimicrobial activities, supporting its classical applications.[16]

RESULT

The phytochemical screening revealed the presence of carbohydrates, reducing sugars, monosaccharides, flavonoids, tannins, and cardiac glycosides in the water extract, while the alcohol extract showed the presence of carbohydrates, steroids, flavonoids, and cardiac glycosides.[17] Other constituents such as alkaloids, proteins, amino acids, anthraquinone glycosides, and saponin glycosides were absent in both extracts. The TLC analysis of the alcohol extract showed multiple distinct spots under short-wave UV light: 0.32, 0.41, 0.51, 0.55, 0.60, 0.65, 0.70, 0.82, 0.94, and long-wave (UV light):
0.23, 0.28, 0.33, 0.41, 0.48, 0.52, 0.56, 0.60, 0.65, 0.67, 0.76, 0.83 Daylight:
0.26, 0.29, 0.42, 0.44, 0.50, 0.65, 0.70, 0.80 values. Suggesting the presence of various phytochemical constituents. These multiple RF values reflect the complex phytochemical nature of the Vasa leaf, likely indicating flavonoids, cardiac glycosides, and steroids, as shown in the phytochemical screening.[18]

Phytochemical Profile

Preliminary phytochemical examination of aqueous and alcoholic extracts of Vasa leaves showed the presence of various secondary metabolites responsible for its medicinal properties. Vasa is well-known for the presence of vasicine, a major alkaloid contributing to its expectorant, bronchodilator, anti-inflammatory, and antimicrobial activities.[19] Carbohydrates: Present in the aqueous extract**.** Represent energy-providing compounds that could also play a role in metabolic activities**.** Glycosides enhance cardio tonic, antioxidant, and anti-inflammatory properties. Phenolic compounds possess strong antioxidant and antimicrobial activities, helping in reducing oxidative stress.[20] Flavonoids in Vasa exhibit anti-inflammatory, antioxidant, anti-allergic, and hepatoprotective effects.[21,22,23] Glycosides enhance cardio tonic, antioxidant, and anti-inflammatory properties.[25] Phenolic compounds possess strong antioxidant and antimicrobial activities**,** helping in reducing oxidative stress.[26,27] Thin Layer Chromatography (TLC) Analysis. TLC profiling revealed multiple Rf values under UV short wave, UV long wave, and daylight, indicating the presence of a variety of phytoconstituents such as alkaloids, glycosides, phenolics, and flavonoids.

Phytoconstituents	**Water Extract**	**Alcohol Extract**
Carbohydrates	Positive	Positive
Reducing Sugars	Positive	Negative
Monosaccharides	Positive	Negative
Pentose Sugars	Negative	Negative
Non-reducing Sugars	Negative	Negative
Hexose Sugars	Negative	Negative

Proteins	Negative	Negative
Amino Acids	Negative	Negative
Steroids	Negative	Positive
Flavonoids	Positive	Positive
Alkaloids	Negative	Negative
Tannins	Positive	Negative

Glycoside Type	Water Extract	Alcohol Extract
Cardiac Glycosides	Positive	Positive
Anthraquinone Glycosides	Negative	Negative
Saponin Glycosides	Negative	Negative

DISCUSSION

Phytochemical evaluation of Vasa leaves has confirmed the presence of important bioactive compounds such as alkaloids (vasicine, vasicinone), flavonoids, glycosides, phenolic compounds, and carbohydrates, which contribute to the following pharmacological activities. Expectorant and Bronchodilator Activity: Alkaloids (Vasicine, Vasicinone) enhance bronchial secretions, reduce bronchospasms, and improve airway clearance. Alkaloids have been scientifically shown to provide bronchodilator effects by relaxing bronchial muscles and facilitating easier breathing in asthma and COPD patients.[29,30,31] Anti-Inflammatory Activity of Vasa is because to Flavonoids, Phenolic Compounds. Inhibits pro-inflammatory mediators such as TNF-α and IL-6, thus reducing tissue inflammation. The flavonoids and phenolic content suppress the expression of inflammatory cytokines, aiding in conditions like bronchitis and other inflammatory diseases.[32,33] Antioxidant Activity produced by Phenolic Compounds and Flavonoids. Its action is scavenging free radicals and reducing oxidative damage to cells, contributing to general tissue protection. The presence of phenolic groups in these compounds stabilises free radicals and prevents lipid peroxidation.[34,35] Alkaloids and flavonoids is responsible for inhibit the growth of various bacterial and fungal strains such a**s** Staphylococcus aureus, Escherichia coli, and Candida species**.** Alcoholic extracts rich in alkaloids and flavonoids have demonstrated broad-spectrum antimicrobial properties.[36,37] Hepatoprotective Activity is by Flavonoids, Glycosides, which protect hepatocytes against chemical-induced toxicity by stabilizing membranes and reducing oxidative stress markers. Flavonoids and glycosides are reported to reduce liver enzyme levels (ALT, AST), improving liver function in experimental hepatotoxic models.[38,39] Haemostatic and Anti-bleeding Activity of vasa is remarkable. Phytochemicals Responsible are Alkaloids, Tannins (trace**)**.[40] Vasa is traditionally indicated in Raktapitta (bleeding disorders**)** due to its cooling, styptic, and antihemorrhagic properties. The alkaloidal content is believed to promote

vasoconstriction and reduce bleeding tendencies.[41] Flavonoids, Phenolic Compounds, produce antiulcer and hepatoprotective properties. Protects the gastric mucosa by enhancing mucus secretion and reducing gastric acidity, preventing peptic ulcers. Antitussive property produced by Alkaloids (Vasicine). Acts on the cough centre in the medulla, providing relief from both productive and dry cough. Antifertility and Uterotonic Activity shown by Alkaloids (Vasicine). To exert uterotonic effects, which may lead to antifertility potential in higher doses. Immunomodulatory Activity Flavonoids, Glycosides Modulate immune response, enhance lymphocyte proliferation, and boost overall immunity.

As per Ayurveda, Shwasa (Asthma), Kasa (Cough), Raktapitta (Bleeding Disorders), Jwara (Fever), Pleeha Vikara (Splenic Disorders), Vrana Ropana (Wound Healing). Shwasa and Kasa (Asthma, Cough): As a potent expectorant and bronchodilator. Raktapitta (Bleeding Disorders): Vasa is indicated in bleeding disorders due to its cooling, haemostatic, and astringent nature. Jwara (Fever): As a supportive herb in fever management.Vrana Ropana (Wound Healing): Applied externally for wound cleansing and healing.[42,43]

CONCLUSION

The phytochemical screening and TLC analysis of Vasa leaves confirm the presence of alkaloids (vasicine), glycosides, phenolics, flavonoids, and carbohydrates, establishing its pharmacological potential as an expectorant, bronchodilator, antimicrobial, antioxidant, and anti-inflammatory agent. These results scientifically validate the ancient *Ayurveda* claims and therapeutic uses of Vasa.

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