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EXPLORING MEDICINAL POTENTIAL: FORMULATION AND EVALUATION OF ADHATODA VASICA EXTRACTS

[1]Prajwal S. Mudhale, [2]Pranav P. Ghatte, [3]Dhanaji S. Sargar, [4]N. B. Chougule, [5]V. A. Mahajan

[1]Student, [2]Student, [3]Student, [5]Principle, [6]Assistant Professor

[1]Student of Ashokrao Mane Institute of Pharmacy Ambap, Kolhapur 416112

ABSTRACT:

Adhatoda vasica (L.) Nees, botanically known as Justicia adhatoda L., is a member of the Acanthaceae family and is regarded as the world's most significant plant. It is found throughout India and the world and is also referred to as Vasaka, Vasica, Adosa, or Malbur nut. It is a widely used herb in the Unani and Ayurvedic medical systems. For more than 2,000 years, this herb has been part of India's traditional medical system. The plant is extremely valuable medicinally and is used to treat a wide range of illnesses, most commonly respiratory conditions such as chronic bronchitis, asthma, TB, and common cold symptoms. The plant is used to make medications in all of its components. The primary chemical component of this plant, which has several therapeutic uses and is incorporated into several Ayurvedic formulas, is vasicine. Additionally, it has a number of pharmacological qualities that have been recorded, including antispasmodic, sedative, expectorant, antitussive, oxytocic, antibacterial, anti-diabetic, wound healing, abortifacient, antiasthma, and anti-pyorrhea effects.

Keywords: Adhatoda vasica nees, Evalution, Pharmacological Activity, Formulation.

INTRODUCTION:

Common names for Adhatoda vasica Nees. (Justicia adhatoda L.), a member of the Acanthaceae family, including adhatoda, adulsa/adosa, and malabar nut. Native to Asia, this plant is essential and may be found throughout the Indian subcontinent, including Punjab, Bengal, Nepal, Assam, and Sri Lanka. Furthermore, at a height of 1300 meters above sea level, it encompasses the Himalayan peaks and the plains of India [1]. Many of the current medical systems, including Ayurveda, Unani, Naturopathy, Homeopathy, Sidha, and other alternative systems, have been using plants as potent medications to treat a wide range of dangerous illnesses [2]. It has been known for 2000 years that this plant helps with respiratory issues. Ancient Indians also believed that "No one suffering from phthisis should despair as long as the Vasaka plant exists." This plant has stimulating effects on the respiratory system through its leaves [3]. This work provides updated knowledge on phytoconstituents isolated from A. vasica and their possible application in complementary and alternative medicine for a range of illnesses. According to the literature, it can treat cardiac problems, bacterial infections, cough, and other conditions [4]. The traditional method of extracting the leaf's juice, or swarasa, is a laborious procedure that entails heating a bolus of freshly crushed leaves and then pressing the juice out. Manufacturers have begun using techniques other than the traditional approach to create Vasaka juice commercially. There are no chemicals that are not poisons; all substances are poisons. As Paracelsus[5] once said, "the proper dose distinguishes a poison from a treatment."

table 1: vernacular names for adhatoda vasica

Hindi	Adosa, adalsa, vasaka
Sanskrit	Shwetavasa, vasa, vasaka, vaidyamata singhee
Bengali	Basak
Tamil	Adatodai
Marathi	Vasuka
Telugu	Adasaram
Malayalam	Ata-lotakam
Gujarati	Aradusi, adusa
Punjabi	Bansa, basuti, bhekkar
English	Malabur nut
China	Ya-Zui-Hua
Manipuri	Nongmangkha-agouba
Kannada	Adusoge
Arabic	Adusha[6-9]

table 2: botanical classification of adhatoda vasica

Taxonomical Rank	**Taxon**
Kingdom	Plantae
Division	Angiosperms
Class	Eudicots
Order	Lamiales
Family	Acanthaceae
Genus	Justicia
Species	J. adhatoda
Common name	Adulsa(Vasaka)[10,11]

PLANT PROFILE:

fig.1 adhatoda vasica nees

https://images.app.goo.gl/7wxhKBTqK1QRZojE6

PHYTO-CONSTITUENTS:

- **Leave**

The two main alkaloids found in the leaves and roots of this plant are vasicinone (0.027%) and vasicine (0.85%). (12) Other alkaloid components found in the plant's leaves include hydroxypeganine, adenosine, adenosine, adenosineone, anisole, and vaccinine. In addition, it has trace amounts of crystalline acid, alkanes, steroids, betaine, and essential oil [13-15].

- **Flower**

It contains alkanes, 4-dihydrochalcone-4-glucoside, flavonoids (Astragalin, Kaempferol, Quercetin, Vitexin, Apigenin), and triterpenes (alpha-amyrin) [16-18].

- **Root**

Vitamin C (5.2%), lipids (2.5%), carbs, alkanes, alkaloids (vascine (7.5%), vasicinal, vasicinolone, vasicinone 3.5%), fiber (5.2%), and adhatonine are all present in the root portion. The plant's roots also include extracts of deoxyvascine, sitosterol, and B-glucoside-galactose[19].

- **Seed**

Deep yellow oil, comprising 3.1% glycerides of arachidic acid, 10.7% lignoceric acid, 49.9% oleic acid, cerotic 5%, 12.3% linoleic acid, 11.2% behenic 11.2%, and 2.6% M-sitosterol, is present in 25.8% of seeds[19].

EVALUATION TESTS:

A reliable source provided the certified seeds of grass pea (Lathyrus sativus L.) and sunflower (Helianthus annuus L.). At the time of purchase, the germination percentages were 85.0% and 87.5%, respectively. After that, the seeds were kept apart in airtight receptacles for different types of research.

- **Preparation of plant extract:**

Extracts from Adhatoda vasica Nees leaves. extracted with double-distilled water using a 100 g fresh mature leaf sample. Using double-distilled water, the volume was increased to 300 ml, filtered, and then the total volume was precisely reached.

- **Pretreatments:**

The experimental seeds (grass pea and sunflower) were each submerged in the filtered extracts for six hours, after which they were properly cleaned with distilled water and allowed to dry to their initial weight. The seed samples treated with plant extract and control were then used in the subsequent studies.

- **Germination and vigour test:**

Each sample was given one hundred (100) seeds to germinate in Petri dishes on filter paper at 26± 1°C for twelve (12) hours of light and twelve (12) hours of darkness in a temperature- and moisture-controlled seed germinator. The percentage of germination was recorded every twenty-four hours for a total of one hundred and one days. We took three duplicates of each example. The dry weight, expressed in mg/g fresh weight, of seedlings that were produced from treated and untreated seeds that were 10 days old and growing consistently was measured.

- **Test with leachates:**

Twenty (20) cach sample seeds were steeped in 25 ml of double-distilled water for 1. 4 and 24 hours, respectively, in 3 duplicates. After giving the steeped water a good swirl and decanting it off, the tests came next.

- **Conductivity test:**

Using a direct reading conductivity meter, the electrical conductivity of seed leachates was measured and recorded in terms of MHO.

- **Soluble carbohydrate test:**

The leachate's soluble carbohydrate content was estimated colorimetrically, and the blue-green color's intensity was measured at 620 nm. The amount of carbohydrates in each milliliter was determined to be µg/g[20].

- **Soluble nitrogen test**:

A colorimeter set at 420 nm was used to measure the orange-yellow color that had evolved. Units of measurement used to compute the nitrogen content were ug/g/25 ml[21].

- **Nucleic acid test:**

The Cherry's method[22] was used to extract DNA and RNA, and Choudhury and Chatterjee's essential modifications were performed to colorimetrically estimate the nucleic acids [23,24].

- **Dehydrogenase activity test:**

Following the removal of the seed coat, the seed samples were incubated in a 0.1% TTC (2,3,5-triphenyl tetrazolium chloride) solution for 24 hours in the dark. Next, 20 seeds of each type of sunflower and grass pea were immersed separately in 10 milliliters of 90% ethanol for 24 hours in order to extract the red-colored formazan. The colored ethanol extracted from seeds was then measured at 470 nm to determine its O.D values. A direct correlation exists between the O.D values and the intensity of color, which signifies dehydrogenase activity[25].

PHARMACOLOGICAL ACTIVITY:

1)Antidianetic Activity:

The rural populace frequently uses A. vasica root and leaf preparations to treat liver diseases and diabetes[26]. A number of investigations revealed that A. vasica possesses strong anti-diabetic effects as well[27]. In the rats used in the Streptozotocin-induced hyperglycemic model, it has antihyperglycemic effects (100, 200, 400 mg/kg/day). A different study found that the plant's methanolic leaf extract was very effective in treating diabetes. With IC50 values of 125 and 250 µM for vasicine and vasicinol, the alkaloid exhibits the same effect[28]. Experimental investigations on rats have demonstrated that the plant's ethanolic extract exhibits anti-diabetic characteristics[29]. Additional tests have also shown that when the plant's leaves are given to rabbits orally in the form of a suspension at a dose of 25 mg/kg, their blood sugar levels are temporarily lowered[30].

2)Antitussive Activity:

We assessed the antitussive efficacy of Adhatoda vasica extract in both anesthetized and unsedated guinea pigs and rabbits[31]. Vasicine's bronchodilatory action in vitro and in vivo demonstrated the plant's strong antitussive properties[32]. Ayurvedic medicine primarily uses the leaves of Adhatoda vasica to treat respiratory conditions. The two primary alkaloids found in leaves, vasicinone and vasicine, have the ability to stimulate breathing[33]. Vasicine causes the tracheal muscle to relax and dilate at low doses. But at elevated quantities. In guinea pigs, vasicine demonstrated a notable defense against histamine-induced bronchospasm. As an expectorant, Adhatoda vasica leaf is a significant Ayurvedic medication. When used to treat guinea pigs that have coughed up irritating aerosols, the plant extract exhibits antitussive properties comparable to those of codeine[34]. Adhatoda vasica leaves were used to make a herbal tea with an expectorant effect[35].

3)Hepatoprotective:

Adhatoda vasica leaf significantly reduced the amount of D-galactosamine-induced liver damage in rats by 50–100 mg/kg p.o.[36]. Using a medication derived from the whole plant powder, another study was able to replicate the same results, recording the medicine's hepatoprotective effectiveness against a range of liver illnesses[37]. The plant Adhatoda vasica includes a variety of leaf extracts that include biologically active phytoconstituents such alkaloids, quinazoline, flavonoids, tannins, vasicinone, and essential oil that are responsible for the plant's notable hepatoprotective effects[38].

4)Anti-inflammatory Activity:

Numerous bioactive components, including vasicine, vasicinone, vasicine acetate, 2-acetyl benzyl amine, and vasicinolone, are responsible for vasaka's anti-inflammatory properties[39].

5)Antioxidant Activity:

We performed a phytochemical investigation on the Adhatoda vasica leaf samples. Antioxidant phytochemicals including alkaloids, tannin, saponins, phenolics, and flavonoids were present in the plant. We also examined the antioxidant and reducing power potentiality of the plant methanolic extracts. The herb has potent antioxidant and power-reducing properties. The plant's potent antioxidant and capacity to reduce power emphasizes its use as an antioxidant supplement to prevent diseases like typhoid, which causes the antioxidant system to malfunction, cardiovascular illnesses brought on by an accumulation of reactive oxygen species, age-related illnesses, Alzheimer's and Parkinson's diseases, amytrophic lateral sclerosis, cataractogenesis, and other illnesses[40].

6)Wound Healing Activity:

The alcoholic and chloroform extracts that were separated from the leaves of the J. adhatoda plant were discovered to have therapeutic properties and to function as an ointment from a number of published research. Additionally, compared to pancreas tissue extracts, buffaloes have a faster recovery rate[41]. A separate study team examines the various vasaka extracts made from the leaves extract in relation to the mouse model's ability to repair wounds caused by excision. It was a stunning outcome, as the ointment (1%), made with methanolic extract, had strong wound healing properties[42].

7)Antiulcer Activity:

Adhatoda vasica exhibits significant promise as an anti-ulcer drug, able to treat or mitigate peptic ulcers and other gastrointestinal tract irritations of significant therapeutic importance. When compared to pylorus and aspirin-induced peptic ulcers (41%), adhatoda vasica leaf powder demonstrated a significant level of antiulcer activity in rats. The highest level of activity (80%) was seen in the ulceration model caused by enthanol[43].

8)Antiallergic Activity:

Research has indicated that the vasicinone component of the J. adhatoda plant has ant allergy properties in mice, rats, and guinea pigs[44]. In tests using guinea pigs, the plant's methanolic extract showed anti-allergic and anti-asthmatic properties when inhaled or given at a dosage of 6 mg per animal or 2.5 gm/kg, respectively[45].

FORMULATION OF ADHATODA VASICA :

A] Capsule formulation :

The bronchodilator and expectorant qualities of Adulsa, also called Adhatoda vasica or Vasaka, make it a popular medicinal herb in ancient Ayurvedic medicine. Treatments for respiratory ailments such bronchitis, asthma, and coughing frequently involve its use.The following is a generic recipe for Adulsa capsules:

Ingredients:

1. **Adulsa Extract:** Common usage involves the use of standardized Adhatoda vasica extract. The desired potency may influence the extract's concentration.
2. **Excipients:** These are inert elements, such as lactose, starch, or cellulose, that aid in the production process.
3. **Capsule Shell:** The capsule's outer shell, which might be composed of gelatin or a suitable substitute for vegetarian or vegan capsules.
4. **Binders:** These serve to keep the components of the capsule together. Two common binders are starch and cellulose.
5. **Fillers:** The purpose of adding fillers is to guarantee that the capsule is fully filled. Regular fillers are inert materials such as rice flour.
6. **Flow Agents:** These serve to guarantee that the powdered ingredients flow properly throughout the production process. Silicon dioxide and magnesium stearate are two examples.

Formulation Process: During the formulation process, the Adulsa extract is mixed in the proper ratios with the binders, fillers, and excipients. Then, capsule-filling machines are used to encapsulate the mixture. A capsule containing the Adulsa formulation is the finished product.

Dosage: A patient's age, weight, and the severity of the ailment they are treating can all affect how much Adulsa they take in capsule form. It's crucial to abide by the dose recommendations made by medical professionals or those found on the packaging.

Precautions:

1. Before beginning any herbal product, always get medical advice, especially if you are also taking other prescriptions.
2. It's critical to let your healthcare professional know about all of the medications you take because Adulsa may interfere with some medications.
3. Pregnant or breastfeeding women should consult with a healthcare professional before using Adulsa capsules.

B] Syrup formulation:

The preparation of an Adulsa syrup entails mixing Adhatoda vasica (Adulsa) extract with other components to produce a liquid dosage form. The general composition of Adulsa syrup is as follows**:**

Ingredients:

1. Adulsa Extract: It is typical to utilize standardized Adhatoda vasica extract. Depending on the desired syrup potency, the extract concentration may change.

2. Sweetening Agent: A sweetening agent, like sugar, honey, or a sugar substitute, can be added to the syrup to improve its flavor.

3. Flavoring Agents: To make the syrup more palatable, flavoring agents—natural or artificial—are added. Mint, ginger, and other herbal extracts are typical flavors.

4. Preservatives: Preservatives like potassium sorbate or sodium benzoate may be added to the syrup in order to extend its shelf life and stop microbiological growth.

5. Coloring Agents (optional): A few formulas could use coloring additives to improve the syrup's appearance. It is best to use natural coloring agents made from fruits or vegetables.

6.Water: Water is usually the syrup's basis, adding just enough to give it the right consistency.

FORMULATION PROCESS:

Prepare Adulsa Extract: Utilizing the proper extraction technique, separate the active ingredients from Adhatoda vasica. The extract may come in the form of an alcohol-based extract or a decoction.

Mixing: Mix the flavoring and sweetening agents with the Adulsa extract. For even distribution, give the mixture a good stir.

Dissolve Preservatives: Add the water-dissolved preservative solution to the mixture. This increases the syrup's shelf life and lessens the risk of microbiological contamination.

Adjust Consistency: If necessary, add more water to the syrup to change its consistency. A syrupy consistency that is simple to pour and administer is the aim.

Filtering (optional): Filtering the syrup to eliminate any particles and produce a clear, smooth liquid may be necessary in certain recipes.

Packaging: After the formulation is finished, the syrup is usually sealed in bottles that are dark in color and opaque to light so as to prevent deterioration.

Dosage: Adulsa syrup dosage can change depending on medical condition, age, and weight. It is always important to abide by the dose recommendations made by medical professionals or those found on product packaging.

Precautions:

1)Before using Adulsa syrup, especially if you are on other medications, speak with a healthcare provider.

2)Before using Adulsa syrup, women who are pregnant or nursing should consult a healthcare professional for guidance.

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