



## An Updated Review: *Adhatoda vasica*

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### ABSTRACT

The present review mainly focuses on the morphological and pharmacological activities of the *Adhatoda vasica* belonging to the family Acanthaceae, which is commonly referred to as Adosa or Adsogi. It also focuses on the evidence based therapeutic uses of *A.vasica* in various experimental models. This plant is found in all the ecosystem in India and other parts of the world as well. Because of its greater availability and multitude of pharmacological activities, the plant is being used in the treatment of numerous diseases. Extracts of various parts of the plants such as bark, root, leaf, flower, fruit and many a times, the whole plants are used in the management of pain, inflammation, asthma, cold, cough, diabetes, bronchitis, diarrhea, dysentery and other upper respiratory diseases and it is also used to heal wounds; is utilised as an insecticide, and also used as abortifacient. In asthma and acute stages of bronchitis, the extract of *vasica* offers an unflagging result by decreasing the thickness of the sputum. Because of the above mentioned reasons the plant has greater importance in the various systems of medicines such as Ayurveda, Siddha, and Unani. According to the texts, the plant has greater power on asthma, abortifacient and uterotonic. Numerous trials have been conducted to prove the effects of *A.vasica* on asthma which led to its inclusion in WHO manual. According to the present day studies the alkaloids such as vasicinone, vasicine, and oxyvasicine which are present in *A.vasica* are responsible for most of the activities. But extensive studies need to be conducted to understand the constituent responsible for abortifacient and uterotonic activity.



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### INTRODUCTION

Humans have made use of the flora and fauna over eons as food as well as medicines. All system of

medicines, like Ayurveda, Siddha, Naturopathy, etc. make extensive use of plants and herbs. World Health Organization (WHO) states that plants are being used as therapeutic agents for most of the primary health care requirements by  $\frac{3}{4}$  of the over-all population (Bruneton, 1995). *Adhatoda vasica* has a common name as malabar nut, white vasa, and yellow vasa and it has some regional name in Kannada as *adusoge*, in Sanskrit *isatarusa*, in Telugu, it is *addasaramu*, in Hindi it is *arusa*, in Bangla it is *basak*. *Adhatoda vasica* belonging to the family *Acanthaceae*. It is disseminated throughout India, mainly available in lower Himalayas and also in other areas like SriLanka, Burma, and Malaysia, etc., (Prajapati et al., 2003) Height of this plant ranges from 1.5-2.0 cm, leaves are about a width of 0.5cm and 10-15 cm. The flowers that bloom

to this plant are mostly in white with purple dots. *Adhatoda vasica* plant is mainly used in the treatment of respiratory disorders like chronic bronchitis, asthma, cold, and cough. The whole plant can be used to get rid of intestinal parasites. *Adhatoda Vasica* offers unflagging relief from thick and sticky sputum in acute stages of bronchitis. Malabar nut was being used in the treatment of con-course disorders which covers heart troubles, bronchitis, blood disorders, leucoderma, fever, jaundice, vomiting, and leprosy, loss of memory, leucoderma, tumors, sore-eye, mouth troubles, and gonorrhoea. The leaves of *vasica* can be used as a cataplasm on wounds and used as an external application because of the anti-inflammatory and anti-bacterial properties also relieves rheumatic pain and inflammation. It also helps to cease internal and external bleeding caused because of peptic ulcer, bleeding gums, and piles ([Sen and Ghosh, 1925](#)).

## MATERIALS AND METHODS

### Classification

Kingdom-Plantae

Subkingdom-Trachebionta

Division-Angiospermae

Super division-spermatophyta

Class-Dicotyledoneae

Subclass-Asteridae

Order-Tubiflorae

Family-Acanthaceae

Genus-Adhatoda

Species-Vasica Nees.

### Regional Names

English-Malabar Nut

Telugu-Addasaramu

Hindi-Arus

Kannada-Adusoge

Tamil-Atatotai

Gujarati-Aradusi

Malayalam-Aatalootakam

Bengali-Basak

Manipuri-Nongmangkha

Nepali-Asuro

Sanskrit-Atarusa

Oriya-Basango

Marathi-Adulasa

Konkani-Adulasha

Mizo-Kawl-dai

Assamese-Boga.

### Important formulations

Important formulations containing *Asgandof unani*, Ayurveda formulations are as follows,

Syrup Basakarista

Basadi kwath

Sarbat Ejaz

Sarbat Tulsi

Sarbat Sadar

Sarbat Vasac

Basaboleho ([Hossain and Hoq, 2016](#)).

### Chemical Constituents

It contain phenols, flavonoids, saponins, tannins, anthraquinones, amino acids, reducing sugars, triterpenes, vasicolinone, vasicol, anisotine, steroids, betaine, 7-hydroxyvasicine, quinazoline alkaloids vasicine, 3- deoxyvasicine, steroids carbohydrate and alkanes ([Kumar et al., 2005](#)).

### Ethnomedicinal uses

*Adhatoda vasica* is being used to treat various diseases from ancient times to treat respiratory infections in both adults and children's. In England, the medical practitioner used this particular extract in the treatment of Antispasmodic, Expectorant, febrifuge and also in curing typhus fever and diphtheria ([Wren, 1932](#)).

### Whole plant

Various formulations are prepared from the *Adhatoda vasica* plant by compounding with ginger and tulsi for using them as an expectorant and antispasmodic. In Srilanka, the whole pant of *Adhatoda vasica* was used in the treatment of multiple issues such as menorrhagia, excessive phlegm, bleeding piles, sexual disorders and impotence ([Dymock et al., 1890](#)). The whole plant is shown in Figure 1.

### Root

Various formulations such as powder, decoction and paste were prepared from the roots of *Adhatoda vasica* and used in the treatment of a broad spectrum of diseases such as diabetes, cough and certain liver disorders, tuberculosis, diphtheria, malarial fever, leucorrhoea and eye diseases. The extract obtained from the maceration of the root is used in the pubic and vagina region. The extract helps during childbirth for the extrusion of the baby from the vagina. Gonorrhoea can also be treated by the macerated extract of the root ([Roberts, 1931](#)).



**Figure 1: whole plant of *Adhatoda vasica***

### **Fruit**

*Adhatoda vasica* fruit extract is active against like cold, fever, bronchitis, diarrhea, jaundice, antispasmodic, dysentery (Kumar et al., 2005).

### **Flower**

The *Adhatoda vasica* plant contains constituents like triterpenes flavonoids they are apigenin astragalins kaempferol vitexin quercetin. The plant blooms in January-march. In south-east Asia fresh flowers are used to cure diseases like cough, bronchitis, phthisis, asthma, and also used as antiseptic to improve blood circulation (Kirtikar and Basu, 1975).

### **Leaves**

The leaf of *Adhatoda vasica* is a dicot leaf which is covered by the single layer of epidermis on both sides of the leaves. They are amphistomatic and contain trichomes on both sides of leaves. For clearing the respiratory passages before an active yogic practice, the tender shoots of the plant with very little ginger is chewed. (Adnan et al., 2010). In most parts of Southeast Asia, various extracts are prepared from the leaves and are used in many ways such as wound healing agent, expectorant, anti-leprotic, for jaundice, for headache, for snake-bites (bruised leaves in Sri Lanka and India) and in various skin diseases (Pushpangadan et al., 1995). They are also used in the treatment of constipation, rheumatoid arthritis, gout and in constipation. The leaves are burned and the smoke from the leaves are used in treating asthma. The leaves are even used as pesticide and insecticide (Agrawal et al., 2009).

### **Ethnopharmacology**

#### **Anti-asthmatic and bronchodilator activity** <sup>10</sup>

Alkaloids present in the *Adathoda vasica* such as vasicine and vasicinone are therapeutically employed as potent respiratory agents. The extracts of the leaf and root parts of *Adathoda*

*vasica* have potential action against a multitude of lung disorders such as bronchiole disorders, bronchitis, cough, and cold. The decoction prepared from *Adathoda* leaves possess soothing effect which helps to clear throat irritation and can also act as an expectorant (Dhuley, 1999).

Dangi et al. (2015), have studied the Anti-asthmatic activity of *adhatoda vasica* by extracting the powdered leaves using ethanol and its effects on guinea pigs which were induced with bronchospasm using acetylcholine and histamine and also conducted in-vitro studies on isolated guinea-pig ileum. The extract has shown promising effects by inhibiting the bronchial constriction dose-dependently (Dangi et al., 2015).

### **Anti-bacterial activity**

The antibacterial effects of *Adathoda vasica* were identified by extracting the leaves with various solvents and testing them on microorganism streaked Petri dish. The Petri dishes after placing the extract either by disc diffusion method or well method were incubated at 37°C for 24hrs. The extract is found to be active against some of the gram-positive and negative bacterial strains (Sarker et al., 1970).

### **Wound Healing activity**

The whole plant was found to be possessing wound healing activity. The alcoholic extract of the whole plant was applied to test the animals after inducing wounds on the vertebral columns and compared with the control group which received no treatment. The groups that were treated with *Adathosa vasica* were found to have greater wound healing activity compared to that of the control group (Bhargava et al., 1988)

Gv and Sundar (2010a), have studied the wound healing effects of the *Adhatoda vasica* plant in Wistar albino rats. The plant methanol, diethyl ether, and chloroform were extracted successively, and formulated in the form of ointment. An incision was made in the animals and the ointment was applied to the incision. Among all the extracts, the methanolic extract has displayed potent wound healing activity (Gv and Sundar, 2010a).

### **Anti-tussive activity**

Srivastava and Choudhary (2016), have prepared the ethyl acetate and methanol extracts of *Adhatoda vasica* leaves for inducing cough with Sulphur dioxide and ammonium hydroxide and comparing with the standard (Codeine phosphate and dextromethorphan). Both the extracts of ethyl acetate and methanol have shown significant inhibition in cough reflexes at the dose of 500mg/kg but the results of ethyl acetate are slightly better than that

of methanol (Srivastava and Choudhary, 2016).

Chattopadhyay *et al.* (2011), isolated the pectic arabinogalactan from the aqueous extract of *Adhatoda vasica* (50mg/kg) and studied its effects on the guinea pigs by inducing cough with citric acid sprayed as an aerosol using jet nebulizer by comparing the effects of the extract against codeine phosphate (10mg/kg). The extract was found to be significant in treating citric acid-induced cough (Chattopadhyay *et al.*, 2011).

#### Anti-tubercular activity

The anti-tubercular activity of the *Adhatoda vasica* is due to the production of ambroxol and bromhexine from vascine which exhibits potent anti-tubercular activity by acting on the *Mycotubercular tuberculosis* strain (Narimanian *et al.*, 2005).

Ignacimuthu and Shanmugam (2010), have done the extraction of powdered leaves with hexane, ethyl acetate and methanol and checked the extract against *Mycobacterium tuberculosis* strain. Rifampicin (2µgm/ml) and isoniazid (0.2 µgm/ml) are taken as reference. 100µgm/ml of the extract has shown significant results when compared to other concentrations of the extract (Ignacimuthu and Shanmugam, 2010).

#### Hepatoprotective activity

Bhattacharyya *et al.* (2005), prepared the aqueous extract of *Adhatoda vasica* leaves and studied its hepatoprotective effects in D-galactosamine induced hepatotoxic Wistar Albino rats. Silymarin (25mg/kg) is taken as the reference compound. The aqueous extract of concentrations 50mg/kg and 100mg/kg and silymarin are given to the hepatotoxic rats for testing hepatoprotective activity. The concentration of 100mg/kg has shown significant results when compared with reference compound silymarin (Bhattacharyya *et al.*, 2005).

Gv and Sundar (2010b), have prepared the methanolic, diethyl ether and chloroform extracts of the leaves and checked its hepatoprotective activity in carbon tetrachloride-induced hepatotoxic Wistar rats. The hepatoprotective activity of all the extracts (200mg/kg) is compared against the reference compound silymarin (100mg/kg). Among all the extracts, the hepatoprotective activity of the methanolic extract is found to be significant (Gv and Sundar, 2010b).

#### Anti-thrombolytic activity

Uddin *et al.* (2013) have prepared the whole plant extract by using a series of solvents starting with distilled methanol followed by n-hexane and carbon tetrachloride filtered and then dried to obtain

dry extracts. The anti-thrombolytic activity is evaluated by withdrawing blood from the volunteers and allowed them to clot, and then the procedure was taken ahead by the modified Dagainawala method (Uddin *et al.*, 2013).

#### Anti-acetylcholinesterase

Ali *et al.* (2016), prepared methanol leaf extract by maceration and was purified with the HPLC method. This purified constituent was selected for docking studies and compared with tacrine acetylcholinesterase (Ali *et al.*, 2016).

#### Antimicrobial activity

Prasad *et al.* (2011), prepared the n-hexane, methanol and water extracts of the *Adhatoda vasica* leaves and tested for the antibacterial and antifungal activities of the extracts in the fungal and bacterial strains. The studies were carried out by taking Ciprofloxacin and Fluconazole as reference compounds for antibacterial and antifungal activities. All the extracts have shown satisfactory results, but the methanolic extracts had shown more promising results when compared to the other 2 extracts (Pradhan and Pradhan, 2015; Dymock *et al.*, 1890).

Sheebab and Mohan (2012), have prepared methanol, ethanol, acetone, chloroform, diethyl ether and water extracts of *Adhatoda vasica* and tested on the *Staphylococcus aureus*, *Streptococcus pyogenes*, *Proteus vulgaris*, *Escherichia coli*, and *Pseudomonas aeruginosa* and *Klebsiella pneumonia* bacterial strains for the assessment of antibacterial activity. Even though all extracts have shown better results diethyl extract has shown even more promising results (Sheebab and Mohan, 2012).

#### Antioxidant and Radical Scavenging Activity

Pant *et al.* (2015), has prepared the ethanolic extract of *Adhatoda vasica* leaves by soxhlet extraction and performed various evaluation tests for assessing the antioxidant and radical scavenging activity. DPPH scavenging activity, ABTS scavenging activity, Superoxide anion scavenging activity, H<sub>2</sub>O<sub>2</sub> radical scavenging activity, NO scavenging activity, reducing power assay, lipid peroxidation assay, TBA method were done on the extract. All the tests have shown dose-dependent results (Pant *et al.*, 2015).

#### Anti-ulcer activity

Shrivastava *et al.* (2006) prepared the extract of *Adhatoda vasica* leaf and studied the anti-ulcer effects of the extract on Sprague-Dawley rats. The ulcer was induced by two methods such as ethanol-induced ulcer, and pylorus ligation plus aspirin dose. The effects of the extract are compared with

the marketed formulation as reference. The extracts have shown significant results when compared to that of the reference compound (Shrivastava *et al.*, 2006).

Vinothapooshan and Sundar (2011) prepared the methanolic, chloroform, and diethyl ether extracts of *Adhatoda vasica* leaves and studied its anti-ulcer activity on the ulcer induced Wistar albino rats. The ulcer was induced by alcohol and aspirin. The effects of the extracts were compared with ranitidine which is taken as standard. The 200mg/kg dose of methanolic extract has shown considerable results when compared with the standard (Vinothapooshan and Sundar, 2011).

#### Insecticidal activity

Leaves of *A.vasica* are being used as an insecticide since time immemorial because of its insecticidal activity. According to the literature it was understood that the presence of vasicinol leads to insecticidal activity (Srivastava *et al.*, 1965).

Haifa and Ali (2016) have prepared the water, acetone and methanolic extracts of *Adhatoda vasica* and studied its insecticidal effects on *Brevicoryne brassicae*. The acetone and methanolic extracts had shown promising results against test species *B. brassicae* and its nymphs. The acetone is having greater mortality when compared to the methanolic extract (Haifa and Ali, 2016).

#### Abortifacient activity

The whole plant extract of *A.vasica* has been used in both helping the child's delivery by inducing uterine contractions and also for absorption before the first trimester. This is because of the presence of the phytochemical constituent vasicine which is similar to oxytocin (Claeson *et al.*, 2000).

Chandhoke (1982), has studied the abortifacient effects of the *Adhatoda vasica* leaves on the rats. The leaves of the plants were collected, dried, grounded and extracted with alcohol and water. Both the extracts were administered to the rats after 10 days of insemination. This resulted in the abortion of the fetus in the female rats. A similar study has also been done in the Guinea pig and yielded the same results (Chandhoke, 1982).

#### Anti-inflammatory activity

Among the chemical constituents present in the *Adathoda vasica*, vasicine is found to have anti-inflammatory effects. Among all the extracts of the plant, methanolic extract of the plant is showing promising anti-inflammatory activity when its activity is evaluated by modified hen's egg chorioallantoic membrane test (Chakraborty and Brantner,

2001).

#### Antidiabetic activity

Sathyamurthy (2017) has prepared the methanol extracts of the *Adhatoda vasica* leaves for 4 days by the soxhlet apparatus and the extract obtained is filtered and dried to get the dry residue. The residue was used to study the antidiabetic effects of *Adhatoda vasica*. The study was conducted on the Adipocyte 3T3 – L1 cell lines which are derived from 19 days old embryo of Murine Swiss mouse. Deoxyribose assay is performed for the identification of antidiabetic activity of *Adhatoda vasica* and compared with reference compound quercetin. The extract has shown promising results when compared with the reference compound (Sathyamurthy, 2017).

#### CONCLUSIONS

The plant of *Adhatoda vasica* is found to have a multitude of activities such as antidiabetic, anti-inflammatory, anti-tussive, wound healing activity, anti-tubercular, anti-asthmatic, antimicrobial, insecticidal, anti-ulcer, anti-oxidant and radical scavenging, hepatoprotective, anti-thrombolytic, abortifacient and anti-acetylcholinesterase activities. Because of the above-mentioned activities, the plant has been used since ancient times but the constituents regarding the activity are still unknown. Hence, further studies need to be conducted for perfectly understanding the phytochemical constituents responsible for the above-mentioned activities.

#### Conflict of Interest

None.

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#### REFERENCES

- Adnan, M., Hussain, J., Shah, M. T., Shinwari, Z. K., Ullah, F., Bahader, A., Watanabe, T. 2010. Proximate and nutrient composition of medicinal plants of humid and sub-humid regions in North-west Pakistan. *Journal of Medicinal Plants Research*, 4:339–345.
- Agrawal, S., Chauhan, S., Mathur, R. 2009. Antifertility Effects of Embelin in Male Rats. *Andrologia*, 18(2):125–131.
- Ali, S. K., Hamed, A. R., Soltan, M. M., El-Halawany, A. M., Hegazy, U. M., Hussein, A. A. 2016. Kinetics and molecular docking of vasicine from *Adhatoda vasica* : An acetylcholinesterase inhibitor

- for Alzheimer's disease. *South African Journal of Botany*, 104:118–124.
- Bhargava, M. K., Singh, H., Kumar, A. 1988. Evaluation of *Adhatoda vasica* as a wound-healing agent in buffaloes. Clinical, mechanical and biochemical studies. *Indian Veterinary Journal*, 65(1):33–33.
- Bhattacharyya, D., Pandit, S., Jana, U., Sen, S., Sur, T. K. 2005. Hepatoprotective activity of *Adhatoda vasica* aqueous leaf extract on d-galactosamine-induced liver damage in rats. *Fitoterapia*, 76(2):223–225.
- Bruneton, J. 1995. Pharmacognosy, phytochemistry, medicinal plants. pages 607–608, Paris. Lavoisier Publishing.
- Chakraborty, A., Brantner, A. H. 2001. Study of alkaloids from *Adhatoda vasica* Nees on their anti-inflammatory activity. *Phytotherapy Research*, 15(6):532–534.
- Chandhoke, N. 1982. Vasicine, the alkaloid of *Adhatoda vasica*. *Indian Drugs*, 24:425–426.
- Chattopadhyay, N., Nosál'ová, G., Saha, S., Bandyopadhyay, S. S., Flešková, D., Ray, B. 2011. Structural features and antitussive activity of water extracted polysaccharide from *Adhatoda vasica*. *Carbohydrate Polymers*, 83(4):1970–1974.
- Claeson, U. P., Malmfors, T., Wikman, G., Bruhn, J. G. 2000. *Adhatoda vasica*: a critical review of ethnopharmacological and toxicological data. *Journal of Ethnopharmacology*, 72(1-2):1–20.
- Dangi, A., Patel, P. S. S., Yaduvanshi 2015. Phytochemical Screening and Assessment of *Adhatoda vasica* (leaf) for Antiasthmatic Activity. *Panacea J Pharm & Pharmaceut Sci*, 4(3).
- Dhuley, J. N. 1999. Antitussive effect of *Adhatoda vasica* extract on mechanical or chemical stimulation-induced coughing in animals. *Journal of Ethnopharmacology*, 67(3):361–365.
- Dymock, W., Waeden, C., Hooper, D. 1890. *Pharmacographia Indica*, A history of the principal drugs of vegetable origin. pages 50–54, London. Paul, Trech, Trubner and Co. Ltd.
- Gv, V., Sundar, K. 2010a. Hepatoprotective activity of *Adhatoda vasica* leaves against carbon tetra chloride induced toxicity. *Pharmacologyonline*, 2:551–558.
- Gv, V., Sundar, K. 2010b. The wound-healing effect of various extracts of *Adhatoda vasica*. *Pg: P-536*, 1.
- Haifa, N. M., Ali, S. M. 2016. Insecticidal effect of crude plant extract of *Adhatoda vasica* against *Brevicoryne brassicae*. *world J Exp Biosci*, 4:49–52.
- Hossain, M. T., Hoq, M. O. 2016. Therapeutic use of *Adhatoda vasica*. *Asian Journal of Medical and Biological Research*, 2(2):156–163.
- Ignacimuthu, S., Shanmugam, N. 2010. Antimycobacterial activity of two natural alkaloids, vasicine acetate and 2-acetyl benzylamine, isolated from Indian shrub *Adhatoda vasica* Nees leaves. *Journal of Biosciences*, 35(4):565–570.
- Kirtikar, K. R., Basu 1975. *Indian medicinal plants (second Ed.)* Bishen Singh Mahendra Pal Singh. volume 3, pages 1899–1902, Delhi.
- Kumar, A., Ram, J., Samarth, R. M., Kumar, M. 2005. Modulatory influence of *Adhatoda vasica* Nees leaf extract against gamma irradiation in Swiss albino mice. *Phytomedicine*, 12(4):285–293.
- Narimanian, M., Badalyan, M., Panosyan, V., Gabrielyan, E., Panossian, A., Wikman, G., Wagner, H. 2005. Randomized trial of a fixed combination (KanJang®) of herbal extracts containing *Adhatoda vasica*, *Echinacea purpurea* and *Eleutherococcus senticosus* in patients with upper respiratory tract infections. *Phytomedicine*, 12(8):539–547.
- Pant, M., Basu, S., Sindhu, R., & R, R. 2015. Antioxidant and free radical scavenging potential of ethanolic fraction of *Adhatoda vasica* in A549 cell line. *Asian J of Pharm Clin Res*, 8:244–249.
- Pradhan, R. K., Pradhan, D. 2015. Investigation of *In Vivo* Antioxidant Property of *Syzygium cumini* (L.) Skeels Fruit Seed and Peel Powders in Streptozotocin-Induced Diabetic Rats.
- Prajapati, N. D., Purohit, S. S., Sharma, D. D., Tarun, K. 2003. *A Handbook of Medicinal Plants*. 1st Edn, agrobios. pages 13–14, Jodhpur, India.
- Prasad, S., Swapna, N. L., Prasad, M. 2011. Efficacy of *Euphorbia tirucalli* (L) towards Microbial activity against Human Pathogens. *Int. J. Pharma. Biosci*, 2:229–235.
- Pushpangadan, P., Nyman, U., George, V. 1995. Glimpses of Indian Ethnopharmacology. *Tropical Botanic Garden and Research Institute*, pages 309–383.
- Roberts, E. 1931. *Vegetable materia medica of India and Ceylon*. Plate Limited, Colombo. pages 16–17.
- Sarker, A. K., Ahamed, K., Chowdhury, J. U., Begum, J. 1970. Characterization of an Expectorant Herbal Basak Tea Prepared with *Adhatoda vasica* Leaves. *Bangladesh Journal of Scientific and Industrial Research*, 44(2):211–214.
- Sathyamurthy, B. 2017. *In vitro* Studies on the Effect of *Adhatoda Vasica* Nees. in Adipocyte 3T3 - L1 Cell Lines. *world J of Pharmacy and Pharmaceutical sci*, 6(10).

- Sen, J. N., Ghosh, T. P. 1925. Vasicine: An alkaloid present in *Adhatoda vasica* Nees. *J Indian Chem Soc*, 1:315-335.
- Sheebab, J., Mohan, S. T. 2012. Antimicrobial activity of *Adhatoda vasica* against clinical pathogens. *Asian Journal of Plant Science and Research*, 2(2):83-88.
- Shrivastava, N., Srivastava, A., Banerjee, A., Nivsarkar, M. 2006. Anti-ulcer activity of *Adhatoda vasica* Nees. *Journal of herbal pharmacotherapy*, 6(2):43-49.
- Srivastava, A. S., Saxena, H. P., Singh, D. R. 1965. *Adhatoda vasica*, a promising insecticide against pests of storage. *Lab. Dev*, 3(2):138-138.
- Srivastava, S., Choudhary, G. P. 2016. The activity of Ethyl Acetate Anti-Tussive and Methanol Extracts of *Adhatoda Vasica* Nees. *Int J of Pharm Sci and Res*, 33:4180-83.
- Uddin, M., Mahmuduzzaman, M., Islam, M., Parvin, S., Shahriar, M. 2013. 1. Phytochemical screenings and thrombolytic activity of the leaf extracts of *adhatoda vasica*. The experiment. 7:438-441.
- Vinothapooshan, G., Sundar, K. 2011. Anti-ulcer activity of *Adhatoda vasica* leaves against gastric ulcer in rats. *J Global Pharma Technol*, 3:7-13.
- Wren, R. C. 1932. Potter's cyclopedia of Botanical drugs and preparations. London. Potter and Clarke.