A complete over review on Adhatoda vasica a traditional medicinal plants

Ms. Shweta Dilip Chaudhari[1]. Ms. Snehal Someshwar Jamdade[2]

M.Pharmacy
Department of Pharmaceutical quality assurance
Dattakala college of Pharmacy

***Abstract*: Herbal products are the most important source for discovery of new and effective drug molecules. They mainly provide better cultural acceptability, better compatibility with the human body and lesser side effects .Adhatoda vasica is a familiar drug in Ayurvedic system of medicine. The plant has been found to possess varying number of pharmacological activities .The aim of present paper gives an updated information on its phytochemical and pharmacological activities have been isolated from plant. It possesses important activities like antitussive, antibacterial, anti-inflammatory abortifacient, antiulcer and various other activities like radiomodulation, hypoglycaemic, cardiovascular protection, antitubercular, antiviral, hepatoprotective, and antimutagenic, reproductive action have been reported. It is a valuable antiseptic, antiperiodic and anthelmintic. Several important bioactive compounds have been reported in various part of Adhatoda vasica are essential oils and quinazoline alkaloids. So this plant can form one of the best options for developing novel compounds having medicinal value.**

***Keywords*: Adhatoda vasica, Phytoconstituents, Pharmacological activity**

INTRODUCTION

Plants have played an important role in maintaining human health and civilizing the quality of human life for thousands of years. Adhatoda vasica is commonly known as Basak in Bangla, Adosa in Hindi, Malabar Nut in English, and Vasaka in Sanskrit (family Acanthaceae). It is a medicinal plant native to Asia, widely used in Ayurvedic and Unani system of medicine.It is a perennial shrub having height1 to 3 feet which grows commonly in open plains, especially in the lower Himalayas, India, Sri Lanka, Burma and Malaysia. Leaves of A. vasica are ovate-lanceolate, entire, 6-30 cm long, hairy, leathery, light green above, dark below. Flowers are large having white with red- or yellow-barred throats, large bracts. Adhatoda vasica has been used for a variety of respiratory disorders including; cold, cough, asthma, whooping cough, chronic bronchitis, leprosy as well as blood disorders, heart troubles, thirst, fever, vomiting, loss of memory ,speeding childbirth .The powder of herb when boiled with sesame oil is useful in healing ear infections and arrest bleeding and boiled leaves are help to treat rheumatic pain and urinary tract infections.The whole plant or its roots, bark, flowers and leaves are used in various medicinal preparations. Principle constituents of A.vasica are the several alkaloids present and chief principle being quinazoline alkaloid, vasicine, vasicinone. A considerable difference in chemical composition is found, which may be due to their occurrence in different eco-climatic zones and changes in edaphic factors. The plant is recommended for first-aid medicine in primary health care and can be used in both adults and children, for a long period without any restriction of use.

Plant profile:

Taxonomical Classification:

Kingdom : Plantae.
Subkingdom : Tracheobionta.
Division : Magnoliophyta.
Class : Magnoliopsida.
Subclass : Asteridae.
Order : Lamiales.
Family : Acanthaceae.
Genus : Adhatoda.
Species : vasica.

Synonyms:

China - Ya-Zui-Hua.
Hindi – Arusha.
Bengali – Basok.
Manipuri - Nongmangkha-agouba.
Gujarati – Alduso.
Telugu : Adasaram.
Malayalum : Ata-lotakam.
Marathi : Vasuka.
Oriya : Basanga.
Punjabi : Bhekar, Vansa, Arusa.
Sanskrit : Amalaka, bashika.
Tamil : Vasambu, Adathodai.
Urdu : Adusa, Basa.

Species:

Adhatoda aspera Nees
Adhatoda auriculata Nees.
Adhatoda bojeriana Nees.
Adhatoda capensis Nees.
Adhatoda ciliata Nees.
Adhatoda gilliesii Nees
Adhatoda martiana Nees
Adhatoda nuda Nees
Adhatoda pilosa Nees
Adhatoda spicata Nees

Morphology Plant:

Plant Type: Shrub or small

Origin: Adhatoda vasica Nees. Is native to India.

Height: 1 to 3 feet

Stem- Stem herbaceous above and woody below.

Leaves- Leaves are large and lance-shaped. Leaves opposite and exstipulate.

Flower-Flower spikes or panicles, bisexual, hypogynous and small irregular zygomorphic .K4-5, C5,imbricate, A, epipetalous ,didynamous, G (2), two celled. Style simple, two unequal size of stigma ,capsular four seeded fruits. The flowers are purple or white in colour.

Fig. 1 whole plant

Fig. 2 steam, Flower and leaf

Phytoconstituents:

Adhatoda vasica leaves have been found to be a rich source of two major alkaloids of which vasicine and vasicinone and also contains alkaloids such as deoxyvasicine, vasicol, adhatodinine, adhavasinone, adhavasine and vasicinol . Other constituents include saponins, vitamin C, steroids as well as flavonoids and fatty acid. Vasicine is useful in bronchodilatory, respiratory stimulant, and uterine stimulant effects. In roots vasicinolone, vasicol, peganine, sitosterol, β-glucoside-galactose and deoxyvasicine and 2'hydroxy-4- glucosyl-oxychalcone these phytoconstituents are present. The flowers contain kaempferol, its glycosides, quercetin and b-sitosterol-D-glucoside . Minor alkaloids include vasinol, adhatonine.

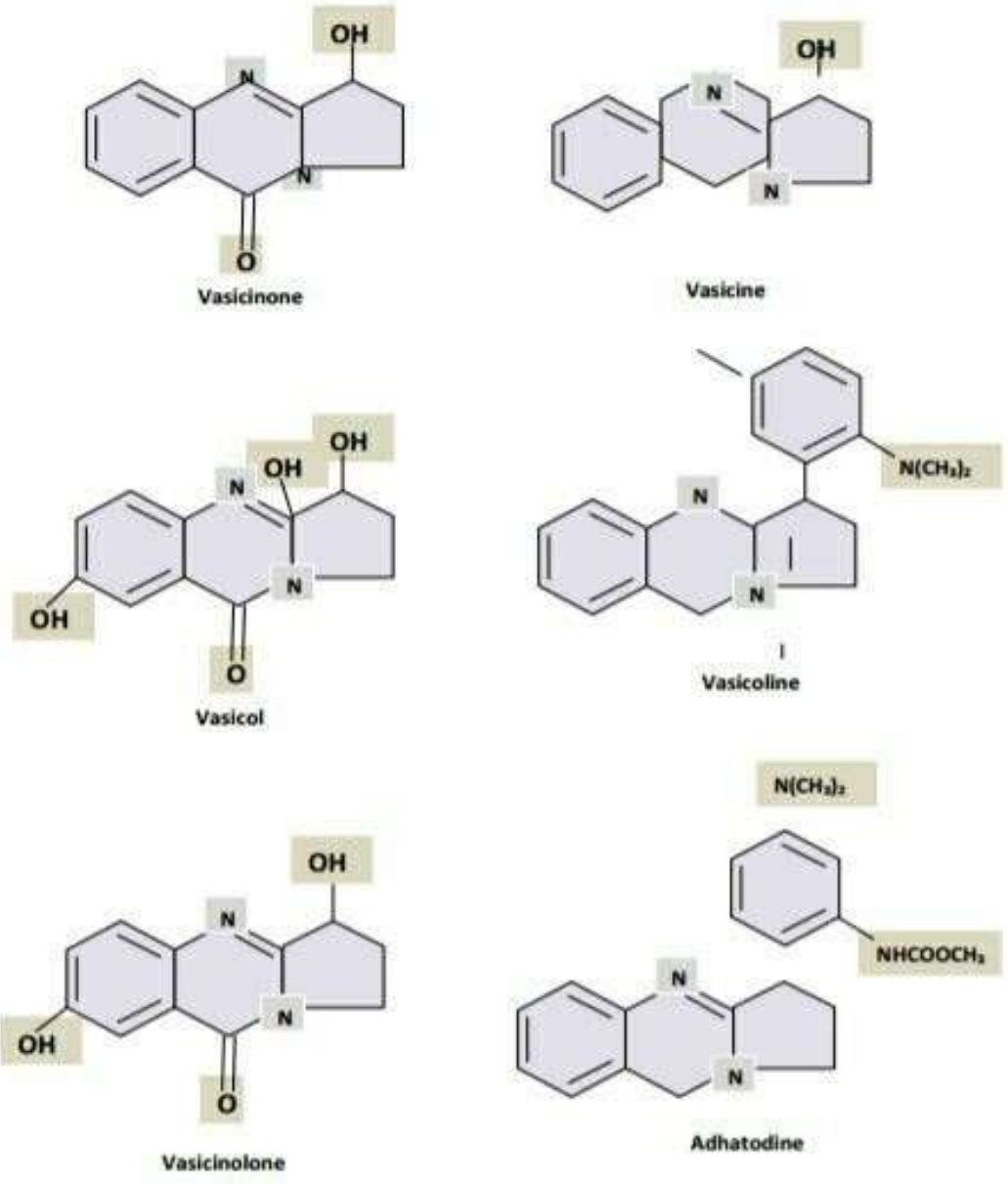

Fig. 3 chemical constituents

Use:

Ethnomedicinal uses

A.Vasica has been used in Ayurvedic system of medicine for the treatment of various ailments of respiratory tract in both children and adults. Various parts of the plant are used for the treatment of asthma, lumber pain, joint pain, sprains, eczema, cold, cough .It is also used for treatment of rheumatism, malaria, swelling, venereal diseases and It was said to be beneficial in intermittent, typhus fever and Diphtheria.

Whole plant

The plant is used for treatment of excessive phlegm and menorrhagia in Sri Lanka. It is also used for the treatment of bleeding piles and sexual disorders.

Leaves

The various preparation of leaves are used for haemorrahge, curing bleeding, skin diseases, wounds, head-ache and leprosy. Usually, yellow leaves are exploited for cough and smoke from leaves is used for asthma. The leaf powder boiled in sesame oil is used to stop bleeding, earaches as well as pus from ears and jaundice. Decoction and ash of leaves are used for tuberculosis, asthma, antipyretic and relieve acidity.

Root

The extract of roots of A. Vasica is commonly used by rural population against cough, diabetes, and certain liver disorders. The paste, powder and decoction of root is used for curing tuberculosis, malarial fever, and diphtheria, leucorrhoea and eye diseases in Southeast Asia.

Flower

The fresh flowers are used for ophthalmic and various preparations of flowers are used for treatment of cold, cough, asthma, phthisis, fever, antispasmodic and gonorrhea .The flowers are used as antiseptic to improve blood circulation.

Fruit

The fruit of A. Vasica are used for, antispasmodic, curing cold, Jaundice, bronchitis, Diarrhea, Fever, Dysentery and as laxative.

Biological Activity:

1. Antitussive:
The effect of the ethanol extracts of Adhatoda Vasica *and* glycyrrhiza glabra on SO2 gas induced cough in experimental animals have very significant effects at the level of $P<0.01$ in inhibiting the cough reflex at a dose of 800 mg/kg and 200 mg/kg body wt. p.o., in comparison with the control group. Mice showed an inhibition of 35.62%, in cough on treatment with Glycyrrhiza glabra and 43.02% inhibition on treatment with Adhatoda vasica within 60 min of the experiment. The antitussive activity of the extract was comparable to that of codeine sulphate (10, 15, 20 mg/kg body wt.), a standard antitussive agent. Codeine sulphate, as a standard drug for suppression of cough, produced 24.80%, 32.98%, and 45.73% inhibition in cough at a dose of 10 mg/kg, 15 mg/kg and 20 mg/kg respectively, whereas, codeine sulphate (20 mg/kg) showed maximum 45.73% ($P<0.001$) inhibition at 60 min of the experiment . [1]

2. Electrophoresis:
A capillary electrophoresis was developed for the quantitative determination of vasicine and vasicinone from Adhatoda vasica. The electrophoretic separation was performed using a 47cm_50 mm ID (38.5 cm effective length) fused silica capillary. The samples were injected by pressure for 3 s at 50 mbar and the running voltage was 19 kV at the injector end of the capillary. The capillary temperature was maintained at 40 _C. The separation of the alkaloids has been achieved within 11 min with good repeatability. The method was validated in terms of accuracy, reproducibility, linearity, and applied for the quantitative determination of vasicine and vasicinone in A. vasica plant samples/extracts. Parameters affecting the resolution such as temperature, pH, buffer concentration, organic modifier and capillary dimensions were reported. [2]

3. Antimicrobial activity:
Alcoholic extracts of leaves and roots of Adhatoda vasica showed antibacterial activity against Staphylococcus aureus and Escherichia coli, as well as water extracts showed activity against S. aureus only.[3] The in vitro antimicrobial activity of Adhatoda vasica extracts were also studied against Bacillus subtillus, Pseudomonas aeruginosa, Escherichia coli, Salmonella typhimurium and Staphylococcus aureus by using agar well diffusion assay. The study indicates that Adhatoda vasica present a remarkable potential of antibacterial activities.[4] Two natural compounds, 2-acetyl benzylamine, vasicine acetate were isolated from the A.vasica. They were bioassayed against Mycobacterium tuberculosis. The two compounds showed strong antimycobacterial activity. 2-acetyl benzylamine and Vasicine acetate isolated from hexane extract of *A. vasica* leaves, significantly inhibited M. tuberculosis and one multi-drug-resistant (MDR) strain and one sensitive strain at 200 and 50 µg/ml, respectively. [5]

4. Anti-allergy activity:
The plant extract containing the alkaloid vascinol and 20% vasicine inhibited ovalbumin-induced allergic reactions by about 37% at a 5 mg of concentration.[6] Vasicinone has been shown to be a potent anti-allergen in tests on mice, rats and guinea pigs.[7]

5. Antidiabetic Activity:
Adhatoda vasica has been used for its anti-glucosidal activity. In screening experiment, 40 medicinal herbs were tested for rat intestinal α-glucosidase. The methanolic extract from the leaves of A .Vasica showed the highest sucrose inhibitory activity. [8]

'Diabetic encephalopathy' refers to diabetes associated cognitive decline (DACD), which involves oxidative-nitrosative stress, cholinergic dysfunction and information. [9]

6. Anti tuberculer activity:

A chemical constituents of one of Adhatoda alkaloids, vasicine, produce bromhexine and ambroxol-two widely used mucolytics. [10]

Both of these chemical have a PH-dependent growth inhibitory effect on mycobacterium tuberculosis. Adhatoda shows indirect effects on tuberculosis include increased rifampicin level in bronchial secretions and lysozyme, lung tissue and sputum, suggesting that Adhatoda may play an important adjunctive role in the treatment of tuberculosis. [11]

7. Hepatoprotective Activity:

A hepatoprotective activity of vasicinone has been reported in CCl4-induced acute hepatotoxicity model in mice. Pretreatment with vasicinone significantly decreased the liver enzyme levels and normal hepatic architecture when compared to silymarin suggesting pronounced recovery from CCl4-induced liver damage. [12]

In another experiment, AV leaf showed significant hepatoprotective effect at doses of 50– 100 mg/kg on liver damage induced by D-glucosamine in rats. [13]

8. Anti-inflammatory activity:

The main alkaloid of Adhatoda vasica is vasicine it showed anti-inflammatory activity. [14] The antiinflammatory activity of the methanol extract, the non-alkaloid fraction, the alkaloids and the saponins were evaluated by the modified hen's egg chorioallantoic membrane test. The alkaloid fraction showed potent activity at a dose of 50 /pellet equivalent to that of hydrocortisone while the MeOH extract and the other fractions showed less activity. [15] Singh and Sharma tested the anti-inflammatory activity by using carrageenan and CFA-model induced paw oedema. The observed results revealed that vasicine showed most potent anti-inflammatory effects (59.51%) at the dose of 20.0mg/kg at 6h after carrageenan injection and maximum inhibition rate was observed of vasicinone (63.94%) at the dose of 10.0mg/kg at 4 days after CFA injection. [16]

9. Bronchodilatory activity:

Adhatoda has been used in traditional medicine to treat respiratory disorders[17]

Extract A. Vasica leaves and roots are useful in treating bronchitis, bronchiole and other lung disorders, as well as common coughs and colds. A decoction of the Adhatoda vasica leaves has a soothing effect on irritation in the throat, and acts as an expectorant to loosen phlegm in the respiratory passages. [18]

Both vasicine and vasicinone, the primary alkaloid constituents of Adhatoda are well-known for their therapeutical respiratory agents. Vasicinone, the main metabolite of vasicine, showed bronchodilatory activity in vitro but bronchoconstrictory activity in vivo, suggesting that it is probably biotransformed in vivo, causing bronchoconstriction. [19]

10. Effect on Reproductive System:

A.vasica used as an antifertility drug in combination of few other medicinal herbs. A survey organized in Lucknow and Farrukhabad, two towns of Uttar Pradesh, India, from March 1987 to July 1987 reveled that AV was one of the well known herb used by women for its anti-reproductive potential. In support of the survey, an experimental study was conducted. Aqueous and 90% ethanol extracts of AV was administered orally for 10 days after insemination to note effects on fetal development. Leaf extracts of AV were found to be 100% abortive at doses equivalent to 175 mg/kg. [20]

In another experiment various extracts of one hundred and eight medicinal plants were screened for their anti-implantation activity in female albino rats. Out of these, ethanolic extract of AV showed 60–70% anti-implantation activity. [21]

Gupta et al.also had reported promising uterotonic abortifacient activity of AV. [22]

Although AV has been claimed to pose abortifacient activity one controversial study has been reported in this context. Burgos et al. administered the extract of AV leaf between day 1 and 9 of pregnancy but did not produce abortion. [23]

11. Radioprotection Activity:

In an experimental study, mice pretreated with ethanolic A.vasica leaf extract for 15 consecutive days and then exposed to 8 gyradiations. Death of AV pretreated irradiated mice was reduced to 70% at 30 days when compared with non-treated animals. The non-treated mice showed radiation-induced sickness including marked changes in histology of testis and chromosomal aberrations in bone marrow cells with 100% mortality within 22 days. The study suggests, AV pretreatment significantly prevented radiationinduced chromosomal damage in bone marrow cells and has radioprotective effects on testis. [24]

Furthermore, Kumar et al reported the restoration of hematological changes caused by irradiation in Swiss albino mice by AV. [25]

12. Anti Pyorrhoeal activity:

In a study 25 patients with complain of pyorrheal was taken, and were selected randomly. The leaf extract was massaged on inflamed gums twice a day for three weeks. There was a reduction and complete relief in the inflammatory and bleeding conditions of gums [26]

13. Antigingival Activity:

An experiment was conducted to investigate the oral hygiene and gingival health benefits of toothpaste formulated with a mixture of the herbs of which A.vasica was one. One milliliter of resting saliva was collected to ascertain anaerobic and aerobic bacterial counts, plaque index, percentage sites with bleeding on probing and pocket depth at 6 sites/tooth were recorded at baseline.

Significant reduction was noted in test sample treated group indicating the beneficial effects of this herbal toothpaste containing AV on oral hygiene and gingival health. [27]

14. Thrombolytic Activity

Prasad *et al*. and Ratnasooriya *et al*. reported the thrombolytic potential of crude extract of roots of AV using *in vitro* clot lysis model. In another experiment, at 5 mg/ ml concentration of root extract of AV showed 19.63% clot lysis activity which was highly significant comparing with negative control, normal saline.[28]

15. Antiulcer property:

Adhatoda vasica leaf powder showed anti-ulcer activity in experimental rats when compared with a control. The highest degree of activity (80%) was observed in the ethanol-induced ulceration model (Shrivastava et al., 2006). Results of the study suggest that in addition to its classically established pharmacological activities. The plant also has immense potential as an antiulcer agent of great therapeutic relevance. [29]

16. Immunomodulatory activity

Methanolic, diethyl ether and chloroform extracts of leaves of Adhatoda vasica were pharmacologically validated for its immunomodulatory properties in experimental animals. Oral administration of extracts at a dose of 400 mg/kg in adult male Wister rats increased the percentage neutrophil adhesion to nylon fibers (P<0.001). It extracts were also found to induce Delayed Type Hypersensitivity reaction by sheep erythrocytes (P< 0.001). The observed results at different doses were significant when compared to control groups. These findings suggested that the extracts of this plant, A. vasica Linn positively modulates the immunity of the host. [30]

CONCLUSION: I concluded from my review that Adhatoda vasica Nees. Traditionally widely used medicinal plant. Adhatoda vasica is a common ornamental evergreen shrub. It shows a wide range of biological activities that helps to utilize the medicinal benefits of this plant. However, here remains an immense scope for further exploration of this plat and needs the attention of scientists to exploit the full potential activities of this plant.

ACKNOWLEDGEMENT: Nil CONFLICT OF INTEREST: Nil

REFERENCES:

[1] Jahan Y, Siddiqui HH. Study of Antitussive Potential of Glycyrrhiza Glabra and Adhatoda Vasica using a cough model induced by Sulphur Dioxide gas in mice. IJPSR, 2012; 3(6):1668-1674.
[2] Avula B, Begum S, Ahmed S, Choudhary MI, Khan IK. Quantitative determination of vasicine and vasicinone in Adhatoda vasica by high performance capillary electrophoresis. Pharmazie. 2008; 63:20-22.
[3] George, M., Venkatraman, P. R. and Pandalai, K. M. 1947. Investigations on plant antibiotics, Part II, a search for antibiotic substances in some Indian Medicinal Plants. J. Sci. Ind. Res., 6(B): 42-46.
[4] Zabta, K.S., Irfan, K., Shamma, N. and Altaf, H. 2009.Assessment of antibacterial activity of three plants used in Pakistan to cure respiratory diseases. Afr. J. Biot., 8 (24): 7082-7086.
[5] Ignacimuthu, Shanmugam 2010. Antimycobacterial activity of two natural alkaloids, vasicine acetate and 2-acetyl benzylamine, isolated from Indian shrub Adhatoda vasica Ness. Leaves. Journal of Biosciences; vol. 35; nb. 4; 565 – 570.
[6] Paliwa JK, Dwivedi AD, Sihgh S, Gupta RC. Pharmacokinetics and in-situ absorption studies of a new anti-allergic compound 73/602 in rats. Int J Pharm 2000; 197(1-2):213-20.
[7] Wagner H. Search for new plant constituents with potential antiphlogistic and antiallergic activity. Planta Med 1989; 55(3):235-41.
[8] Gao H, Huang YN, Li BG, Inagaki C, Kawabata J. Inhibitory effect on α-glucosidase by Adhatoda vasica nees. Food Chem 2008;8:965-72.
[9] Mohan Y, Patil R, Vadivelan SP, Dhanabal MN, Kumar S. Anti-oxidant, anti-inflammatory and anticholinergic action of Adhatoda vasica Nees contributes to amelioration of diabetic encephalopathy in rats: Behavioral and biochemical evidences. International Journal of Diabetes in Developing Countries. 2014; 34(1):24-31.
[10] Grange JM, Snell NJC. Activity of bromhexine and ambroxol, semi-synthetic derivatives of vasicine from the Indian shrub Adhatoda vasica, against Mycobacterium tuberculosis in vitro. Journal of Ethnopharmacology. 1996; 50(1):49
[11] Narimaian M, Badalyan M, Panosyan V, Gabrielyan E, Panossian A, Wikman G. 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. 2005; 12(8):539-47.
[12] Sarkar C, Bose S, Banerjee S. Evaluation of hepatoprotective activity of vasicinone in mice. Indian J Exp Biol 2014;52:705-11.
[13] Bhattacharyya D, Pandit S, Jana U, Sen S, Sur TK. Hepatoprotective activity of Adhatoda vasica aqueous leaf extract on D-galactosamine-induced liver damage in rats. Fitoterapia 2005;76:223-5.
[14] Srmivasarao, D.; Jayarraj, I.A.; Jayraaj, R.; Prabha, M.L. A studyon antioxidant and anti-inflammatory activity of vasicine against lung damage in rats. Indian J. Allergy Asthma Immunol., 2006; 20: 1-7.
[15] Chakraborty, A.; Bratner, A.H. Study of alkaloids from Adhatoda vasica Nees on their antiinflammatory activity. Phytother. Res., 2001; 15: 532-534.

[16] Singh B and Sharma RA. Anti-inflammatory and antimicrobial properties of pyrroloquinazoline alkaloids from Adhatoda vasica Nees. Phytomedicine., 2015;20(5):4415doi:10.1016/j.phymed.2012.12.015.Epub.2013 Jan 26
[17] Dorsch W, Wagner H. New antiasthmatic drugs from traditional medicine. Int Arch Allergy Appl Immunol.1991; 94(1-4):262-5.
[18] Dhuley JN. Antitussive effect of Adhatoda vasica extract on mechanical or chemical stimulationinduced coughing in animals. J Ethnopharmacol. 1999; 30:67(3):361-5.
[19] Lahiri PK, Pradhan SN. Pharmacological investigation of vasicinol, an alkaloid from Adhatoda vasica Nees. Indian J. Exper. Biol. 1964; 2:219-223.
[20] Nath D, Sethi N, Singh RK, Jain AK. Commonly used Indian abortifacient plants with special reference to their teratologic effects in rats. J Ethnopharmacol 1992;36:147-54.
[21] Prakash AO, Saxena V, Shukla S, Tewari RK, Mathur S, Gupta A, et al. Anti-implantation activity of some indigenous plants in rats. Acta Eur Fertil 1985;16:441-8.
[22] Gupta OP, Anand KK, Ghatak BJ, Atal CK. Vasicine, alkaloid of Adhatoda vasica, a promising uterotonic abortifacient. Indian J Exp Biol 1978;16:1075-7.
[23] Burgos R, Forcelledo M, Wagner H, Müller A, Hancke J, Wikman G, et al. Non-abortive effect of Adhatoda vasica spissum leaf extract by oral administration in rats. Phytomedicine 1997;4:145-9.
[24] Meenal K, Ravindra S, Madhu K, Senthamil R, Begraj S, et al. Protective effect of Adhatoda vasica nees against radiation-induced damage at cellular, biochemical and chromosomal levels in Swiss albino mice. eCAM 2007;4:343-50.
[25] 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;12:285-93.
[26] Doshi JJ, Patel VK, Venkatakrishna BH: Effect of Adhatoda vasica massage in Pyorrhoea. Int J Crude Drug Res. 1983; 21:173-176.
[27] Jayashankar S, Panagoda GJ, Amaratunga EA, Perera K, Rajapakse PS. A randomised double-blind placebo-controlled study on the effects of a herbal toothpaste on gingival bleeding, oral hygiene and microbial variables. Ceylon Med J 2011;56:5-9.
[28] Fahad H, Ariful I, Latifa B, Mizanur RM, Mohammad SH. In vitro thrombolytic potential of root extracts of four medicinal plants available in Bangladesh. Anc Sci Life 2014;33:162-4.
[29] Srivastava, Banerjee, Nivsarkar, Manish, 2006. Anti-ulcer activity of Adhatoda vasicaNees. Journal of Herbal Pharmacotherapy; vol. 6; nb. 2; 43 – 49.
[30] Wasserman H, Kuo Gh. The chemistry of vicinal tricarbonyls, an efficient synthesis of vasicine, Tetrahedron Lett. 1991; 32:7131-7132.