

SPECTRAL AND BIOLOGICAL STUDIES IN ADATHODA LEAF EXTRACT

A.JENI, A.JEENA PEARL, J.L.JEBISHA

Department of chemistry and Research centre, Scott Christian college (Autonomous), Nagercoil.

ABSTRACT

Vasaka, also called Malabar nut tree, is well known throughout India. It is tall, with several branches, dense, and an evergreen shrub. Leaves are large and lance-shaped. It has capsular four seeded fruits. The flowers are either white or purple in colour. Its trade name vasaka is based on Sanskrit name. Vasaka is Indigenous to India. It grows all over the India and in the lower Himalayan ranges. The leaves contain an alkaloid vasicine besides an essential In Ayurvedic medicine, malabar nut (*Adhatoda vasica*) has been used for a multitude of disorders including: bronchitis, leprosy, blood disorders, heart troubles, thirst, asthma, fever, vomiting, loss of memory, leucoderma. Jaundice, tumors, mouth troubles, sore-eye, fever, and gonorrhoea. *Adhatoda vasica* is useful in treating bronchitis, tuberculosis and other lung and bronchiole disorders. A decoction of the leaves of Vasaka may be used to help with cough and other symptoms of colds. The physico chemical analysis showed the presence of moisture content and percentage of total ash, acid and water insoluble ash. phytochemical screening showed the presence of phenols, terpenoids, tannins, reducing sugars, alkaloids, saponins, flavonoids, and xanthoproteins. The antibacterial and antifungal studies showed that the ethanol leaf extract of *Adhatoda vasica* has the maximum zone of inhibition than the Chloroform extract. The antioxidant studies explain that the Chloroform leaf extract was effective against DPPH and antidiabetic activity is also proved. The basic radicals present are lead, bismuth, zinc, barium, calcium, magnesium, and ammonium. The result of fluorescent analysis shows characteristic colouration of the leaf extract. UV and FT-IR spectral analysis gives the characteristic peaks which shows the presence of various functional groups. The aim of this study is to determine the bio active compounds present in the leaf extract.

Keywords:- *Adhatoda vasica*, Anti-bacterial, Anti-fungal, Anti-Diabetic, Anti-oxidant, UV, IR, Bioactive compounds, cough, decoction

INTRODUCTION

Plants are believed to be important source of new phytochemical with potential therapeutic effects. Traditional medicinal plants should be able to play a greater role in the modern primary oral healthcare system of many countries.[1-2] Many of the existing medicinal system such as Ayurveda, Unani, Homeopathy, Naturopathy, Siddha and other alternative medicinal system have been utilizing plants as effective medicines to cure many harmful diseases.[3] India is rich in natural resources with variety of medicinal plants. In developing countries, plants are the main source of medicine.[4] Nowadays in many more drugs are being synthesized from medicinal plants. Medicinal plants are plants which have medicinal

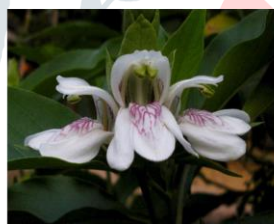
properties. Plants are used medicinally in different countries of world and as source of many powerful drugs.[5] A wide range of medicinal plant parts is used for extraction of raw drugs as they possess varied medicinal properties. [6]Almost all our present medicines come from medicinal plants which are derived from research based medicinal plants medicinal plants herbs, spices and herbal remedies are known to Ayurveda. Plant products derived from bark, flowers, roots, leaves, seeds, fruits are the part of phytomedicines. Bioactive constituents of plants known as phytochemical components such as tannins, carbohydrates, alkaloids, terpenoids, phenolic compounds, steroids and flavonoids are responsible for various pharmacological activities of plants[7]. These phytochemical compounds are synthesized by primary or secondary metabolism of living organisms[8]. In India over 7,000 medicinal plant species are known to exist[9]. Many medicinal plants have been used a dial, such as onion, garlic, turmeric etc, are known to have medicinal properties[10].

Botanical Description

Justicia adhatoda of the Acanthaceae family is a well-known plant drug in Ayurvedic and Unani medicine . The plant has been used in the indigenous system of medicine in India for more than 2000 years. widespread throughout the tropical regions of Southeast Asia. [11] It is commonly known as Vasaka or Malabar nut.



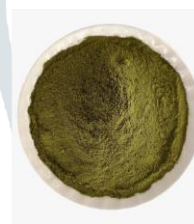
A dathoda Leaf



A dathoda flower



Dried leaf



Leaf powder

GENERAL DESCRIPTION

It is an evergreen shrub, about 2.2-3.5 meters high, with long leaves and white flowers in axillary spike. Shrub is highly branched, woody and has opposite ascending branches with white, pink or purple flowers. Root is normal with secondary and tertiary rootlets. [12]Leaves are large, lance-shaped, opposite and exstipulate. Flower spikes or panicles.[13] The leaves, roots and young plants of AV contain the quinazoline alkaloids vasicine, 7- hydroxyvasicine, vasicinolone, 3-deoxyvasicine, vasicol, vasicoline, vasicolinone, triterpenes, anisotine) betaine, steroids carbohydrate and alkanes.[14] In the flowers triterpenes (a-amirine), and flavonoids (Apigenin, astragalinal, kaempferol, quercetin, vitexin) have been found *Adhatoda vasica*, also known as Malabar nut tree .[15]

USES:-

In Ayurvedic medicine, malabar nut (*Adhatoda vasica*) has been used for a multitude of disorders including: bronchitis, leprosy, blood disorders, heart troubles, thirst, asthma, fever, vomiting, loss of memory, leucoderma. Jaundice, tumors, mouth troubles, sore-eye, fever, and gonorrhoea. *Adhatoda vasica* is useful in

treating bronchitis, tuberculosis and other lung and bronchiole disorders.[16-17] A decoction of the leaves of Vasaka may be used to help with cough and other symptoms of colds.[18]

SCOPE OF THE WORK

Pharmacognostic study is the only one way to remove the confusion of misidentification and adulteration of medicinal plants. It is essential to give details of anatomy of different parts used in the official preparation, chemical composition and fixing identity of the plant source. Objective of the present investigation is to perform a systematic pharmacognostical determination such as Physico Chemical Characters Such As Moisture Content, Total Ash, Acid Insoluble Ash, Residue On Ignition, Phytochemical analysis, Basic radicals, Antibacterial activity, Antifungal activity, Antioxidant activity, Antidiabetic activity, UV spectroscopy, IR spectroscopy, Fluorescent study.

MATERIALS AND METHODS

SAMPLE COLLECTION:

The fresh leaves of *Justicia adhatoda* was collected from our garden, koottamavu, kanyakumari district, Tamilnadu state, India.

Processing of plant material

The collected plant material, i.e. *J.adhatoda* leaves, were shade dried for about a week and grinded in the form of powder.

Preparation of plant extract

The dried plant leaves were powdered and extracted (10g) exclusively with 50 ml each of Chloroform and ethanol in soxhlet extractor 4 hrs. The extracts were concentrated to dryness under reduced pressure and controlled temperature (40-50C). All the extracts were preserved in a refrigerator until further use.

RESULT AND DISCUSSION

Physico chemical Analysis

| | |
|---------------------|----------|
| Moisture content | 23.23g |
| Acid Insoluble ash | 1.586g |
| Water insoluble Ash | 19.3257g |
| Total Ash | 4.212g |

The physicochemical studies showed that the moisture content of the leaf and also the ash content present in it. The dried and powdered leaf was green in colour and has a bitter taste in nature. The leaf powder has a strong odor. Physicochemical parameters like loss on drying, ash values, acid insoluble ash and extractive values

are given in a table:-

Phytochemical Tests:-

| COMPOUNDS | ETHANOL EXTRACT | CHLOROFORM EXTRACT | Basic radicals | Inference |
|----------------|-----------------|--------------------|----------------|-----------|
| Alkaloids | – | ++ | Lead | + |
| Terpenoids | – | – | Bismuth | – |
| Flavonoids | – | + | Copper | + |
| Tannins | + | + | Zinc | + |
| Steroids | – | – | Cadmium | – |
| Saponins | + | + | Iron | + |
| Phenols | + | ++ | Cobalt | – |
| proteins | ++ | ++ | Manganese | + |
| xanthoproteins | – | + | Nickel | – |
| Anthocyanin | + | – | Ammonium | + |
| Reducing sugar | – | + | | |

The phytochemical analysis of leaf extract of *Adathoda vasica* showed the presence of various bioactive compounds such as phenol, terpenoids, tannins, carbohydrates, alkaloids, saponins, xanthoproteins.

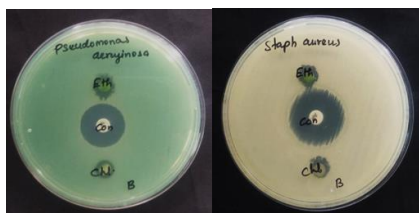
Qualitative analysis of basic radicals gives the list of basic radicals present in the *Adathoda vasica* leaf extract. The basic radicals present are bismuth, zinc, barium, calcium, magnesium and ammonium.

ANTI BACTERIAL ACTIVITY

Anti bacterial activity of leaf extract against bacterial microbes *pseudomonas aeruginosa* and *staph aureus*. The antibacterial studies showed that the Ethanol extract of the *Adathoda vasica* leaf has the maximum microbial activity than the chloroform extract.

Showing Zone of Inhibition of Adathoda vasica

| s.no | Name of organism | Zone of inhibition | | control |
|------|------------------------|--------------------|------------|---------|
| | | Ethanol | chloroform | |
| 1 | pseudomonas aeruginosa | 12mm | 9mm | 21mm |
| 2 | staph aureus | 12mm | 11mm | 28mm |

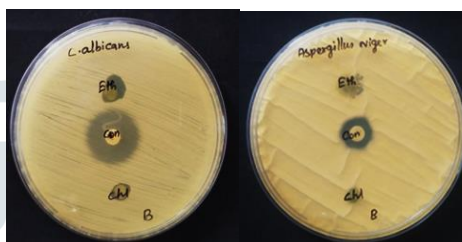


ANTI FUNGAL ACTIVITY

The antifungal studies explain that the ethanol extract shows the maximum zone of inhibition than chloroform extract of Adathoda vasica leaves.

Showing Zone of Inhibition of Adathoda vasica

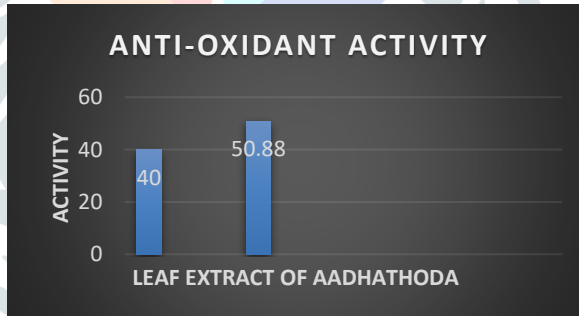
| s.no | Name of the organism | Zone of inhibition | | Control |
|------|----------------------|--------------------|------------|---------|
| | | Ethanol | Chloroform | |
| 1 | Candida albicans | 14mm | 10mm | 21mm |
| 2 | Aspergillus niger | 12mm | - | 16mm |



ANTIOXIDANT ACTIVITY

Antioxidant studies explain that the chloroform extract was proved to be effective against DPPH than the ethanol extract.

| Extracts | IC50(µg/ml) |
|------------|-------------|
| | DPPH |
| Ethanol | 40±3.8 |
| chloroform | 50.88±1.6 |

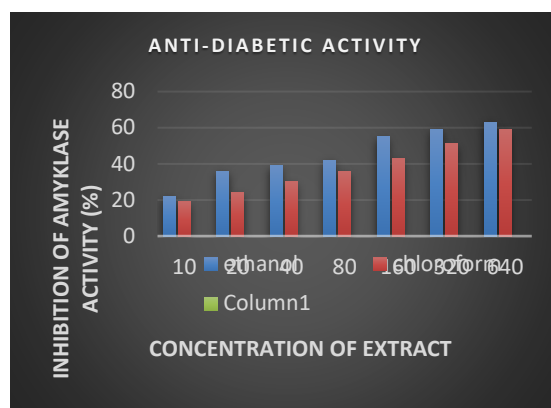


ANTIDIABETIC ACTIVITY

Antidiabetic activity proved that the amylase activity of Adathoda vasica shows better activity with that of ethanol extract than that of chloroform extract.

| Concentration of chloroform extract(µg/ml) | Inhibition of amylase activity (%) |
|--|------------------------------------|
| 10 | 19 |
| 20 | 24 |
| 40 | 30 |
| 80 | 36 |
| 160 | 43 |
| 320 | 51 |
| 640 | 59 |

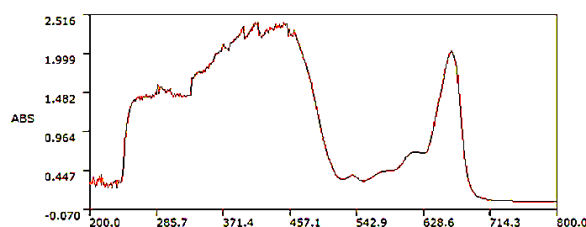
| Concentration of ethanol extract (µg/ml) | Inhibition of amylase activity (%) |
|--|------------------------------------|
| 10 | 22 |
| 20 | 36 |
| 40 | 39 |
| 80 | 42 |
| 160 | 55 |
| 320 | 59 |
| 640 | 63 |



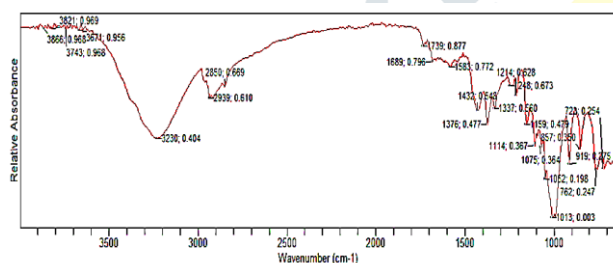
UV SPECTROSCOPY

UV spectra shows the maximum peak at 664.4 nm. It is used to find out the different analytes present in the leaf extract.

| Wavelength (λ) | ABS |
|----------------|-------|
| 664.4 | 2.037 |
| 294.8 | 1.526 |
| 452.0 | 2.406 |
| 621.2 | 0.693 |
| 221.6 | 0.282 |



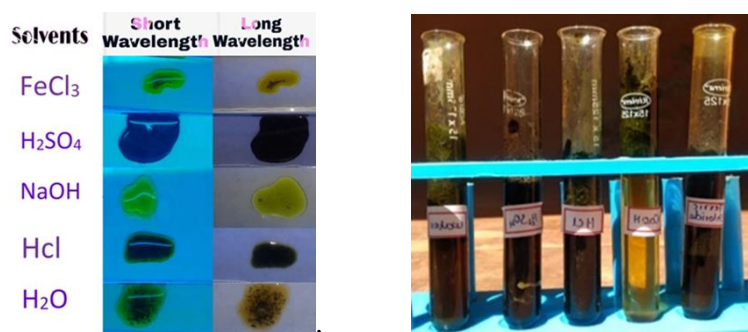
FTIR – ANALYSIS



FT-IR studies was also used to analyse the various functional group present in the leaf extract such as C-H stretching of acetyl group, C=O stretching of saturated aldehydes, C=C stretching due to alkenes, C-H stretching due to cycloalkanes, C-C deformation due to meta disubstituted groups, C-H deformation due to methyl group and C-F stretching.

FLOURESENT STUDY

The result of fluorescent analysis of leaf extract shows characteristic colouration in treatment with various chemical reagents such as FeCl₃, H₂SO₄, NaOH, Hcl and water.



Reference:-

1. Weijden VD, Timmer CJ, Timmerman MF, Reijerse E, Mantel MS and Velder U Velden. The effect of herbal extracts in an experimental mouth rinse on established plaque and gingivitis, *Journal of Clinical Periodontal*, 1998; 25: 399-403.
2. Mullally BH, Prasad SHKR, Swapna NL, Prasad M. 2011. Efficacy of *Euphorbia tirucalli* (L) towards Microbial activity against Human Pathogens. *Int. J. Pharma. Biosci.*, 2: 229-235. James JA, Coulter WA and Linden GJ, The efficacy of herbal based tooth paste and control of plaque and gingivitis, *Journal of Clinical Periodontal*, 1995; 22: 686-689.
3. Prasad SHKR, Swapna NL, Prasad M. 2011. Efficacy of *Euphorbia tirucalli* (L) towards Microbial activity against Human Pathogens. *Int. J. Pharma. Biosci.*, 2: 229-235.
4. T. Ogasawara, K. Chiba, M. Tada. *Medical and aromatic plants*. Vol(10). 978-98221. Rhagav Ram, David Catlin Juan Romera. "Sesame New Approaches for Aup Improvement" vol(8) 331-340
5. M.K. Unal, H. Yalesn. Proximate composition of sesame seeds and characterization of their oils vol (59) 23-26
6. O.A. Dyedeji, LA Areez and B.G. Osifade *Journal of chemical and Nutritional Composition of forest seed and seeds oil* vol (10) 16-20
7. Y.S. Shyu and L.S. Hwang. Antioxidative Activity of the Crude Extract of lignin Oxidation products from unroasted Burma Black sesame meal. *Food Research International* Vol (35) 357-365
8. P. Thunyarat. T. Suparek. R. J. E. Determination of phytic acid in sesame seed. vol () 13-20.
9. H.O. Edeoga DEku and B.O. Mbaeble. Phytochemical constituents of some Nigerian medicinal plants. vol(14) 7
10. Chakraborty, A. and Brantner, A.H. Study of alkaloids from *Adhatoda vasica* Nees on their anti-inflammatory activity. *Phytother. Res.*, 2001; 55: 235-41.
11. Kirtikar KR, Basu BD. *Indian Medicinal Plants*. Vol. I. 2nd edn. International Book Distributors, Dehradun, India. 2005; p. 2392-93.

12. 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; 12:285-293.
13. Joshi BS, Bai Y, Puar MS. ¹H and ¹³C NMR assignments for some pyrroloquinoline alkaloids of *Adhatoda vasica*, *J Natural Product*. 1994; 57:553-962.
14. Prajapati ND, Purohit SS, Sharma DD, Tarun K. *A Handbook of Medicinal Plants*. 1st Edn, agrobias, Jodhpur, India. 2003, 13-14. .
15. Bjjaj M, Williams JT. *Healing Forests-Healing People* (report on workshop on medicinal plants, L; Calicut), IDRC, New Delhi, 1995, 62.
16. Pandey R, Mishra A. Antibacterial activities of crude extract of *Aloe barbadensis* to clinic ally isolated bacterial pathogens. *Applied biochem. Biotechnol*. 2010; 160:1356-1361
17. Amin AH, Mehta BR. Bronchodialator alkaloid(vasicinone) from *Adhatoda vasica*. *Nature*. 1959;184:1317.
18. Dastur JF. *Medicinal plants of India and Pakistan*, DB Taraporevala Sons and co. pvt. Ltd., Bombay 1985.

