WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.084
Volume 11, Issue 16, 337-343. Review Article ISSN 2277– 7105

A REVIEW ON ETHNOPHARMACOLOGICAL USES, PHYTOCHEMISTRY AND PHARMACOLOGY OF *ADIANTUM LUNULATUM* (PTERIDACEAE)

Suhail*, Arthi I., Reeha P. H. and Donna Mary Johnson

Department of Pharmacognosy and Phytochemistry, College of Pharmaceutical Sciences, Government Medical College, Kannur, Kerala- 670503.

Article Received on
02 October 2022,
Revised on 23 Oct. 2022,
Accepted on 13 Nov. 2022
DOI: 10.20959/wjpr202216-26177

***Corresponding Author**
Suhail
Department of Pharmacognosy and Phytochemistry, College of Pharmaceutical Sciences, Government Medical College, Kannur, Kerala-670503.

ABSTRACT

Adiantum lunulatum (Pteridaceae) is an important fern used in traditional systems of medicine.[1] Medicinal value of *Adiantum lunulatum* is due to the presence of the phytochemicals and these phytochemicals have major role in the antioxidant and antibacterial activity. Some of the Phytochemicals Present are Tannins, Flavonoid, Steroids, Saponin, Anthocyanin, Coumarin, Emodin, Phlobatannins, Terpenoids, Anthraquinones, Alkaloids, Glycosides and Phenols. DPPH assay and antibacterial activity analysis help to identify the medicinal potential of this fern. DPPH assay help to identify the free radical scavenging activity of plant extract. The result indicates that increase in concentration of extract has direct influence corresponding to the percentage of free radical scavenging activity.[2] *Adiantum lunulatum* have several Pharmacological Activities like Antioxidant, Antibacterial, Antidiabetic, Antifertility and Thrombolytic in action.[3]

KEYWORDS: *Adiantum lunulatum*, *Adiantum philippense*, Flavonoids, Triterpenoids, Antioxidant, Pteridaceae.

INTRODUCTION

Adiantum lunulatum (Pteridaceae), has been used from ancient times medicinally, being mentioned by Dioscorides. It is antidysenteric, antiulcer, antihyperglycemic, antimicrobial antitumor, antiviral and also used as astringent, demulcent, diuretic, emmenagogue, expectorant, tonic.[1] *Adiantum* species are a rich source of triterpenes with various structural skeletons. Flavonoids, phenyl propanoids and sterols also have been isolated from the genus

Adiantum. These compounds have been reported to show various bioactivities, such as analgesic, antinociceptive, anti-implantation, and antimicrobial activities.[4] Compounds derived from *Adiantum lunulatum* have been shown antibacterial activity against Gram positive and negative bacteria and anti-fertility on reproductive organs of male albino rats.[5]

Ethnopharmacological uses

These are commonly known as maidenhair ferns and several have been used medicinally in different parts of the world. They exhibit antidysentery, antiulcer, antimicrobial, antitumor and antiviral activities. The traditional uses of Adiantum species are known to be for respiratory problems such as cough cold, fever, pneumonia and mucous formation. They are also Used to treat epileptic fits, muscular pain and febrile afflictions, in traditional Indian medicine.[3]

Adiantum lunulatum Burm.f. - Fresh leaf juice is given as a diuretic for one week, twice a day. Ground fresh leaves with coconut oil treated externally for skin diseases.[6]

Acute abdominal cramps, Hansen's disease, and flu are treated by this plant. For a centipede bite, fronds and rhizomes are mixed together into a paste. Rhizomes are recommended for strange symptoms and fever caused by elephantiasis. Loose motion, soreness, and discomfort are treated with crushed leaves and juice.[7]

Chronic nasal congestion, cough, bronchitis, swelling of the throat, and swollen glands of the face can be treated with the plant. The fresh frond extract is used for treating dysentery, blood diseases, ulcers, and burning sensations. For immediate relief from gastric problems, fresh frond paste about 1 gm can be given twice daily on an empty stomach for two weeks.

Curing glandular swelling with rhizome is an effective remedy. A powdered rhizome of about one gram combined with water can be used as a contraceptive by tribal women once every 3 to 5 days during menstruation.

Menstrual irregularities are treated with fresh leaf extracts. In addition to treating respiratory diseases, it also helps in treating pyrexia, Hansen's disease and thinning hair. This substance is found in Hansraj, the Indian cough medicine. As a remedy for pyrexia and Filariasis, rhizome is considered useful. Also, rhizome is used as an antidote when treating Snakebite envenoming and dog bites.[7]

Pharmacognostic features

The Herb is grown on moist Surface and near water source. It grows up to a height of 1-1.5 feet. The Stem is Smooth and reddish black in colour. The leaflet is Curvy and oval shaped have a length of 0.5-1 inch.[8]

Microscopic features

The outline of stipe is more or less circular and the outer epidermis is Thick walled, Single layered with Cuticle and is dark brown in Colour. The ground tissue is formed of outer 3-4 layered sclerenchymatous cells followed by thin walled Parenchymatous cells with rich tannin content. Endodermis is Single layered, formed of thick-walled cells followed by a Uni layered Pericycle. The Xylem is diarch, exarch and is arranged in a V shaped manner. The two arms are more turned inwards. The metaxylem seen towards the centre and protoxylem arranged on the arms. The xylem is surrounded by the phloem.[9]

Phytochemical Study

Phytochemical tests were carried out using different solvent extracts using standardized procedures to identify the constituents. Solvents like methanol, ethanol, n-hexane, chloroform and water are used.[10] The different qualitative chemical tests were performed for establishing the profile of given extracts to detect various phytoconstituents present in *Adiantum lunulatum.*

Test for Tannin: 4ml extract was treated with 4 ml $FeCl_3$, formation of green colour indicates presence of tannin.

Test for Flavonoids: Pew's Tests was performed; To 2-3 ml extract, added zinc powder in a test tube, followed by drop wise addition of concentrate HCl. Formation of purple red or cherry colour indicates the presence of flavonoids.

Test for Steroid: 1ml extract was dissolved in 10 ml of chloroform & equal volume of concentrated H_2SO_4 acid was added from the side of test tube, The upper layer turns red and H_2SO_4 layer showed yellow with green fluorescence. This indicates the presence of steroid.

Test for Saponin: Foam Test was performed; The extract was diluted with 20 ml of distilled water and it was shaken in a graduated cylinder for 15 minutes. A 1 cm. layer of foam indicated the presence of Saponin.

Test for Anthocyanin: 2 ml of aqueous extract is added to 2 ml of 2N HCl & NH_3, the appearance of pink red turns blue violet indicates presence of Anthocyanin.

Test for Coumarin: 3 ml of 10% NaOH was added to 2 ml of aqueous extract, formation of yellow colour indicates coumarins.

Test for Emodin: 2 ml of NH_4OH and 3 ml of benzene was added to extract, appearance of red colour indicates presence of emodin.

Test for Phlobatannins: aqueous extract of each plant sample is boiled with 1% aqueous HCl, deposition of red ppt was taken as evidence for presence of Phlobatannins.

Test for Terpenoid: 2 ml extract, 2 ml methyl alcohol treated with 2-3 drops of H_2SO_4, formation of deep red colour indicates the presence of Terpenoid.

Test for Anthraquinones: 2 ml extract, 3ml Benzene treated with 10% NH_3, Formation of Violet colouration in ammoniacal layer indicates the presence of Anthraquinones.

Test for Alkaloids: Dragendorff's Test was performed; To 2-3 ml extract, add few drops Dragendorff's reagent Formation of orange brown precipitate indicates the presence of alkaloids.

Test for Glycosides: Concentrate H_2SO_4 Test was performed; To 5ml extract, add 2ml glacial acetic acid, one drop 5% $FeCl_3$ and conc. H_2SO_4. Brown ring appears indicates the presence of glycosides.

Test for Phenols: Ellagic Acid Test was performed; The test solution was treated with few drops of 5% (w/v) glacial acetic acid and 5% (w/v) $NaNO_2$ solution. The solution turned muddy or Niger brown precipitate occur.[10]

There are several Triterpenoid present in *Adiantum lunulatum*. Most of them are Hopane derivative; Mollugogenol A, Adiantone, Fernene, Filicenol B, 6α-Acetoxy-16β,22-dihydroxy-3-ketoisohopane, 3β-Acetoxy-6α-hydroxy-hop-15,17(21)-diene, 3β-Acetoxy-21α-H-hop-22(29)-ene, 22,29ξ-Epoxy-30-norhopane-13β-ol, Fern-9(11)-en-28-ol, Fern-9(11)-en-25-oic acid, Fern-9(11)-en-6α-ol.[3]

Sr.No	Phytochemical Constituents	Result		
		Methanol Extract	n-Hexane Extract	Water Extract
1	Tannin	+	+	-
2	Flavonoid	+	+	-
3	Steroid	+	+	-
4	Saponin	-	-	+
5	Anthocyanin	+	+	-
6	Coumarin	-	-	-
7	Emodins	-	-	+
8	Phlobatannins	-	+	-
9	Alkaloids	+	+	+
10	Phenols	-	+	-
11	Terpenoid	-	+	-
12	Anthraquinones	+	-	-
13	Glycosides	+	-	-

The table was obtained from Mengane S. Phytochemical Analysis of *Adiantum lunulatum*. Int J Curr Microbiol Appl Sci. 2016 Nov 10; 5:351–6.

Pharmacological Study

Antioxidant activity

Methanolic extract of different concentration (0.2, 0.4, 0.6, 0.8 and 1 mg/ml) was prepared and its antioxidant activity analysed by using DPPH and the phosphomolybednum method. The preparation was kept for 60 minutes at room temperature. Absorbance was measured by spectrophotometrically at 517 nm. Blank preparation contains methanol and DPPH. Ethanolic extract contain effective antioxidant activity (31%-71%) with respect to increase in concentration.[2]

Antibacterial activity

Bactericidal activity of *Adiantum* extract was analysed by agar well diffusion method using ethanol, methanol, and chloroform and aqueous extracts (10 g/100 ml). Minimum inhibitory concentration method was preferred. *Adiantum lunulatum* extracts contains effective antibacterial activity against selected pathogenic bacterial strains and by forming clear zone of inhibition on bacterial culture. Different pathogenic bacterial strains *Staphylococcus aureus, Klebsiella pneumonia, Proteus vulgaris* and *Escherichia coli* show growth inhibition in presence of extract.[2]

The methanolic extracts of selected *Adiantum* species exhibited maximum zone of inhibition against the studied UTI pathogens. The methanolic extracts of *A. lunulatum* demonstrated 14 .7 ± 0.37 mm zone of inhibition against *S. aureus*.[5]

Antidiabetic activity

The antidiabetic potentials of ethanolic and aqueous extracts of *A. philippense* (250 and 500mg/kg) were evaluated in alloxan monohydrate induced hyperglycaemia in rats. Standard reference drug, Glibenclamide was given at a dose of 5 mg/kg orally per day. Both the extracts treated groups exhibited significant hypoglycaemic effects which was evident from Plasma Glucose levels and OGTT values.[3]

Antifertility activity

Results have revealed that *A. lunulatum* can act as an antiandrogenic agent and can be used to alter the physiology and metabolism of the reproductive organs viz. testis, epididymis, vas deferens and accessory sex organs like seminal vesicle and prostate. Administration of 50% alcoholic and decoction extract of *A. lunulatum* at 500 mg/kg for 30 days resulted in the arrest of spermatogenesis at secondary spermatocytes stage.[3]

Cytotoxic and Thrombolytic activity

In cytotoxicity assay the LC_{50} values of the methanolic extract of the fronds of *A. philippense* was 106.41±0.78 µg/mL whereas for standard vincristine sulphate (as positive control) it was 08.50±0.24 µg/mL. The extract showed 12.86±1.02% clot lytic activity whereas standard streptokinase showed 30.86±0.44% clot lytic activity in thrombolytic assay.[3]

ACKNOWLEDGEMENT

The Authors in this Article are Thankful to the Respective Contributors of the Cited Articles and their Publishers.

CONFLICT OF INTEREST

Nil.

REFERENCES

1. Singh S, Khatoon S, Singh H, Behera SK, Khare PB, Rawat AKS. A report on pharmacognostical evaluation of four *Adiantum* species, Pteridophyta, for their authentication and quality control. Rev Bras Farmacogn, 2013 Mar; 23(2): 207–16.

2. Jenat P J and Suresh S N. Antioxidant Activity and Antibacterial Activity of *Adiantum lunulatum* Burm. f. International Journal of Pharmacy and Biological Science, Dec 2018; 8(4): 779-82.
3. Rastogi S, Pandey MM, Rawat AKS. Ethnopharmacological uses, phytochemistry and pharmacology of genus *Adiantum*: A comprehensive review. J Ethnopharmacol, 2018 Apr; 215: 101–19.
4. Pan C, Chen Y, Ma XY, Jiang JH, He F, Zhang Y. Phytochemical Constituents and Pharmacological Activities of Plants from the Genus *Adiantum*: A Review. Trop J Pharm Res., 2011 Nov 7; 10.
5. Johnson M, Jeevas, Mahesh M, Janaki Raman M. Antibacterial Potentials of *Adiantum* Species against the UTI Pathogens. J Microbiol Exp [Internet]. 2017 Feb 21 [cited 2022 Jun 24]; Volume 4(Issue 1). Available from: https://medcraveonline.com/JMEN/JMEN-04-00104.pdf
6. R Devaki, R Santhosh Kumar. Ethno Medicinal Plants of Salem District, Tamilnadu,India - A review. World Journal of Pharmaceutical Research, 2022 Apr; 11(5): 646-52.
7. Bandyopadhyay A, Dey A. Medicinal pteridophytes: ethnopharmacological, phytochemical, and clinical attributes. Beni-Suef Univ J Basic Appl Sci., 2022 Sep 5; 11(1): 113.
8. Hamsapadi *Adiantum lunulatum* Uses, Research, Remedies, Side Effects [Internet]. Easy Ayurveda. 2017 [cited 2022 Jun 16]. Available from: https://www.easyayurveda.com/2017/10/22/hamsapadi-adiantum-lunulatum/
9. S Reshmi, V P Thomas, V K Sreenivas. Anatomical studies of selected species of *Adiantum lunulatum* in Kerala. South Indian Journal of Biological Science, 2016; 2(1): 115-118.
10. Mengane S. Phytochemical Analysis of *Adiantum lunulatum*. Int J Curr Microbiol Appl Sci., 2016 Nov 10; 5: 351–6.