WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.453
Volume 14, Issue 5, 1300-1316. Research Article ISSN 2277–7105

UNVEILING THE MEDICINAL SECRETS OF *ADIANTUM INCISUM* AND *SELAGINELLA MARGINATA* A COMPARATIVE STUDY

[1]*Santhosh Kumar S., [2]Prabhu V., [3]Dhinesh V. and [4]Suresh M.

[1]Department of Botany, Nehru Memorial College Puthanampatti, Trichy Tamil Nadu, India.

[2]Assistant Professor, Botany Nehru Memorial College Puthanampatti, Trichy, Tamil Nadu, India.

[3]Assistant Professor, Soil Science and Agricultural Chemistry, Kumaraguru Institute of Agriculture, Erode, Tamil Nadu, India.

[4]Assistant Professor, Botany, Nehru Memorial College Puthanampatti, Trichy, Tamil Nadu, India.

Article Received on
17 January 2025,

Revised on 06 Feb. 2025,
Accepted on 27 Feb. 2025

DOI: 10.20959/wjpr20255-35796

***Corresponding Author**
Santhosh Kumar S.
Department of Botany,
Nehru Memorial College
Puthanampatti, Trichy Tamil
Nadu, India.

ABSTRACT

Adiantum incisum and *Selaginella marginata* are perennial climbing ferns belonging to the Pteridaceae and Selaginellaceae families, respectively. These ferns are recognized for their various pharmacological benefits, primarily in enhancing digestion, increasing energy levels, and boosting immunity due to their rich phytoconstituents. In a phytochemical analysis of in vitro cultured *Adiantum incisum* using acetone extract, UV-Vis spectroscopy revealed peaks at 233.5, 278.6, 398.8, and 664.5 nm, which corresponded to absorbance values of 4.000, 1.941, 3.850, 1.779, and 0.446, respectively. These peaks indicate the presence of carbonyl and nitroso groups in the organic chromophores found in the plant extract. Additionally, Fourier-transform infrared (FTIR) spectroscopy confirmed the existence of carbonyls, alkynes, phenols, dialkyl groups, aromatic ethers, and aliphatic fluoro compounds within the extract. Regarding antibacterial activity, the acetone extract of in vitro cultured *Adiantum incisum* demonstrated the highest inhibition rate against *Proteus vulgaris*, measuring 15.16 ± 4.80 mm. The petroleum ether extract of the fern also showed significant inhibition against *Aeromonas hydrophila*, with a measurement of 13.66 ± 7.18 mm.

KEYWORDS: *Adiantum incisum* and *Selaginella marginat, In vitro* culture, acetone extract, phytochemical analysis, antimicrobial studies.

INTRODUCTION

Pteridophytes, which include ferns and fern-allies, represent the earliest vascular plants to have emerged on Earth, emerging in the midst of the Paleozoic era during the Silurian period approximately 438 million years ago. These plants marked a significant milestone in the evolution of vascular systems, possessing both xylem for water transportation and phloem for nutrient transport, earning them the designation of vascular cryptogams (Dudani *et al*., 2014). While recent studies in ethnobotany, phytochemistry, and pharmacology have highlighted the medicinal and pharmaceutical potential of numerous pteridophyte species, there remains a gap in the evaluation of certain species utilized by indigenous tribes for their pharmaceutical properties and the isolation of their active compounds (Pradeep Parihar and Leena Parihar, 2006).

For thousands of years mankind is using plant source to alleviate or cure illnesses. Plants constitute a source of novel chemical compounds which are of potential use in medicine and other applications. Plants contain many active compounds such as alkaloids, steroids, tannins, glycosides, volatile oils, fixed oils, resins, phenols and flavonoids which are deposited in their specific parts such as leaves, flowers, bark, seeds, fruits, root, etc. These active compounds are secondary products (Tonthubthimthong *et al*., 2001). The medicinal plants are useful for managing human diseases because of the presence of phytochemical constituents and the phytochemicals are primary and secondary compounds (Mengane, 2015).

Farnsworth 1985 reported that identified 119 secondary plant metabolites which were used drugs. Out of 255 drugs which are considered as basic and essential by the World Health Organization (WHO), 11% are obtained from plants and a number of synthetic drugs are also obtained from natural precursors. Phytochemicals are known to possess antioxidant (Wong *et al*., 2009) antibacterial (Nair *et al*., 2005) antifungal (Khan *et al*., 1987) antidiabetic (Singh *et al*., 2007), anti-inflammatory and radio-protective activity (Jagetia *et al*., 2005) and due to these properties they are largely used for medicinal purpose. The development undesirable side effects of certain antibiotics have led to the search for new antimicrobial agents, mainly among plant kingdom.

It is a major avenue to screen plants for the presence of natural products and beneficial properties. The microbes increases resistance in the antibiotics leads to increase the efforts in the development of new antibiotics. There are so many plants with antimicrobial potential but great number still remains unidentified. Many kinds of plants are prevalent in India and a large number of them have been used for antimicrobial assay (Watanabe *et al*., 2005). There is a prime need of extensive studies of medicinal plants found with a special reference to their properties to fight against microbial diseases.

Pteridophytes are one of the oldest and primitive vascular plant groups on earth. These represent over 1200 taxa, belonging to 204 genera in the world. They make an important contribution to earth's plant diversity and form a significant dominant component of many plant communities especially in the tropical and temperate regions. Pteridophytes have been poorly studied and considered economically less important group of plants in the plant kingdom. *Adiantum incisum* Burm. is a cosmopolitan fern belonging to the family Adiantaceae, and genus *Adiantum* and *Selaginella marginata* belonging to the family Selaginellacea and genus Selaginella. In India it is found very commonly in the South in plains and lower slopes of the hills and in the North along the foot of the Himalayas from East to West at an altitude of 1000- 3000 feet (Mehra, 2010).

The main purpose of the present study was screening for presence of various phytochemicals present in *Adiantum incisum*. (*A. Philippense* Linn) usually known as 'Walking Maiden hair fern' is used as an ornamental plant and widely distributed in India. It is commonly found in wet, shaded areas and on moist mud walls during monsoon. It is a drug with a significant ethno-botanical and therapeutic importance.

The dried whole plant has been used as a medicine for bronchitis and cough. It is used in bleeding diseases, burning sensation, erysipelas, epileptic fits, dysentery, strangury and elephantiasis. Few studies have been under taken till date to substantiate its pharmacological activities such as antibacterial, antifungal, antioxidant, hypotensive etc.

MATERIALS AND METHODS

Collection of plant material and extraction

Adiantum incisum and *Selaginella marginata* were collected from the pachamalai hills, Trichy (dt), Tamil Nadu, India**.** They were identified and authenticated by the Bharadhidasan university herbarium, Trichirappalli, Tamil Nadu, India.

Preparation of powder and extract

Leaves of *A. incisum* and *S. marginata* (500g) was shade dried, powdered and extracted with ethanol for 8 hours using soxhlet apparatus. The extract was then filtered through Whatmann filter paper No.1 along with 2g sodium sulfate to remove the sediments and traces of water in the filtrate. Before filtering, the filter paper along with sodium sulphate is wetted with absolute alcohol. The filtrate is then concentrated by bubbling nitrogen gas into the solution and reduce the volume to 1ml. The extract contains both polar and non-polar phytocomponents.

Preliminary phytochemical screening

Phytochemical tests were carried out using different solvent extracts using standardized procedures to identify the constituents as described by Harbone. To assess the activity of selected medicinal plant. Preliminary phytochemical analysis was carried out for the extracts namely water, methanol and n- hexane as per the standard method (Das *et al.*, 2010). The different qualitative chemical tests were performed for establishing the profile of given extracts to detect various phyto constituents present in *A. incisum* and *S. marginata***.**

Qualitative Phytochemical Screening

Detection of alkaloid

One hundred milliliter of extract was enthused with 3 ml of diluted hydrochloric acid added with filtered. The filtrate was tested carefully with reagents as follows.

Dragendorff's test

2µl liter for filtrate, 2ml of Dragendorff's reagent was added. Therefore a result of prominent yellow precipitate indicates the test was positive.

Dragendorff's reagent

Stock solution

Bismuth carbonate (5.2g) and sodium iodide (4g) were boiled for a few minutes with 50ml glacial acetic acid. After 12 hours, the precipitated sodium acetate crystals were filtered of using a sintered glass funnel. 40 ml Forty milliliter of a clear, red brown filtrate was mixed with 160ml of ethyl acetate and 1ml of distilled water; stored in amber-colored bottle.

Working solution

10 ml of the stock solution was mixed with 20ml of acetic acid and made up to 100ml with distilled water.

Detection of carbohydrate

The extract (100mg) was dissolved in 5ml of water and filtered. The filtrate was subjected to the following tests.

Fehling's test

1 ml of filtrate was boiled on water bath with 1ml each of Fehling solution I and II. A red precipitate indicates the presence of sugar.

Fehling's solution

Fehling's solution I: Copper sulphate (34.66g) was dissolved in distilled water and made up to 500ml with distilled water.

Fehling's solution II: Potassium sodium tartarate (173g) and sodium hydroxide (50g) was dissolved in water and made up to 500ml.

Detection of glycosides

50 ml of extract was hydrolysed with concentrated HCL for 2 hours on water bath, filtered and hydrolyses were subjected to the following tests.

Borntrager's test

2ml of filtrate, 3ml of chloroform was added and shaken. Chloroform layer was separated and 10% ammonia solution was added to it. Pink colour indicated the presence of glycosides.

Detection of saponins

Foam test

The extract (1mg) as dissolved in 2ml of distilled water and filtered through Whatman No.1 filter paper and filtrate was subjected to tests of proteins and amino acids.

Detection of proteins and amino acids

The extract (100mg) was dissolved in 10ml of distilled water and filtered through WhatmannNo.1 filter paper and the filtrate was subjected to tests of proteins and amino acids.

Biuret test

To 2ml of filtrate was treated with 2% of copper sulphate solution. To this, 1ml of ethanol (95%) was added followed by excess of potassium hydroxide pellets. Pink color in the ethanolic layer indicated to the presence of proteins.

Ninhydrin test

Two drops of ninhydrin solution (10 mg of ninhydrin in 200ml of acetone) were added to two ml of extract. Characteristic purple color indicated the presence of amino acids.

Detection of phenolic compounds

Ferric chloride test

The extract (50mg) was dissolved in 5ml of distilled water. To this, few drops of neutral 5% ferric chloride solution were added. To be a characteristic dark green color indicated the presence of phenolic compounds.

Test for flavonoids

2 ml of 2.0% NaOH mixture was mixed with 1ml of plant crude extract; concentrated yellow color was produced, which became colorless when we added 2 drops of diluted acid to mixture. This result showed the presence of flavonoids.

Test for terpenoids

To 5ml of methanol extract, 2ml of chloroform was added and mixed well. Add a little quantity of concentrated H_2SO_4 was carefully added to form of reddish brown layer.

Detection of steroids

2 ml of chloroform was added to the extract and a few drops of acetic anhydride were poured. Followed by the concentrated H_2SO_4.A mixture of blue and green colour showed the presence of steroids.

UV-VIS analysis

The extracts were examined under visible to the UV light for proximate analysis. For UV-VIS and FTIR spectrophotometer analysis, the extracts were centrifuged at 3000 rpm for 10 min and filtered through Whatmann No. 1filter paper by using high pressure vacuum pump. The sample is diluted to 1:10 with the same solvent. The extracts were scanned in the wavelength ranging from 200-1100 nm using Perkin Elmer Spectrophotometer and the

characteristic peaks were detected. (Antony Sandosh *et al*., 2013, Theng and Korpenwar 2015).

Fourier Transform Infrared (FTIR) Spectroscopy

Working Principle

Working Principle Infrared spectroscopy is nondestructive technique for materials analysis and used in the laboratory for over seventy years. Infrared absorption spectroscopy is the study of interaction of infrared radiation with matter as a function of photon frequency. Fourier Transform Infrared Spectroscopy (FTIR) provides specific information about the vibration and rotation of the chemical bonding and molecular structures, making it useful for analyzing organic materials and certain inorganic materials. An infrared spectrum represents a fingerprint of a sample with absorption peaks which correspond to the frequencies of vibrations between the bonds of the atoms making up the material. Because each variety material is a unique combination of atoms, no two compounds produce the exact same infrared spectrum. Therefore, infrared spectroscopy can result in a positive classification (qualitative analysis) of every different kind of material. In addition, the size of the peaks in the spectrum is a direct indication of the amount of material present. With modern software algorithms, infrared is an excellent tool for quantitative analysis.

METHODOLOGY

The dehydrated powdered of ethanol extract of *S. marginata* Herb was used for FTIR analysis. The dried 10 mg of extract powdered was mixed with KBr salt and encapsulated in 100 mg of KBr pellet in order to prepare translucent sample discs. The infrared spectrum of solid was recorded in the scan range from 4400-450 cm-1 on a FTIR spectrophotometer, Perkin Elmer Spectrum (RX1) with a resolution of 1cm-1. Perkin Elmer spectrophotometer was used to detect characteristic peak and their functional group.

Agar Well Diffusion Methods

Principle

The antimicrobials present in the given sample was allowed to diffuse out into the medium and interact in a plate freshly seeded with the test organisms. The resulting zones of inhibition will be uniformly circular as there will be a confluent lawn of growth. The diameter of zone of inhibition can be measured in millimeters.

Materials Required

Nutrient Agar medium, Nutrient broth, Whatman filter paper No. 1, Gentamicin antibiotic solution, test samples, test tubes, beakers, conical flaks, spirit lamp, double distilled water and petri-plates.

Nutrient Agar Medium

The medium was prepared by dissolving 2.8 g of the commercially available Nutrient Agar Medium (Hi-Media) in 100ml of distilled water. The dissolved medium was autoclaved at 15 lbs pressure at 121°C for 15 minutes. The autoclaved medium was mixed well and poured onto 100mm petriplates (25-30ml/plate) while still molten.

Nutrient broth

Nutrient broth was prepared by dissolving 2.8 g of commercially available nutrient medium (HiMedia) in 100ml distilled water and boiled to dissolve the medium completely. The medium was dispensed as desired and sterilized by autoclaving at 15 lbs pressure (121ºC) for 15 minutes.

Procedure

Petri plates containing 20ml nutrient agar medium were seeded with 24hr culture of bacterial strains(*Aeromonas hydrophila, Staphylococcus aureus, E.coli, Streptococcus faecalis, Proteus vulgaris, Pseudomonas aeruginosa*).Wells were cut and different concentration of sample Nio (500 µg/ml, 250 µg/ml,100 µg/ml and 50 µg/ml) was added. The plates were then incubated at 37°C for 24 hours. The antibacterial activity was assayed by measuring the diameter of the inhibition zone formed around the wells. Gentamicin antibiotic was used as a positive control. The values were calculated using Graph Pad Prism 6.0 software (USA).

RESULT AND DISCUSSION

The phytochemical screening of *Adiantum incisum* forsk extract revealed Table1 that the acetone and Petroleum ether extract contains alkaloids, carbohydrates, glycosides, flavonoids, phenols, steroids, saponis.

UV-Vis analysis of *Adiantum incisum* The UV-Vis spectrum was analyzed to identify phytoconstituents in the extract of *in vitro* cultured *Adiantum incisum*. The examination covered a range of 200 – 800 nm, revealing peaks at 233, 278, 398 and 664 nm with corresponding absorptions of 4.000, 1.941, 1.779 and 0.446. The spectrum indicates the

presence of carbonyl and nitroso group of organic chromophores in the tested plant extract. A qualitative UV-VIS profile of the methanolic extract of *Mentha spicata* was carried out across wavelengths ranging from 300 nm to 800 nm. The profile revealed peaks at 353, 407, 504, 535, 609, and 665 nm, accompanied by absorptions of 1.309, 1.463, 0.1, 0.066, 0.108, and 0.625, respectively, as documented by (Jain *et al*., 2016).

Fourier Transform Infrared (FTIR) spectroscopy analysis of *Adiantum incisum* FTIR analysis performed to study the presence of functional groups in the plant material. FTIR spectrum for the acetone extract of *in vitro* cultured *Adiantum incisum* shows the peak at 3445.10CM-1 represents the N-H Medium of Primary amine 2089.22cm-1 and 1635.11cm-1 were assigned to have N=C=S and C=C stretch in the vibration of alkyne & carbonyls respectively. The peak at 1442.96cm-1 shows the combination bond Alkene. The peaks 1230.62cm-1& 1217.17cm-1 were assigned to have C-O and S=O Strong of Alkyl argl ether and Vinyl ether groups. The peak at 1151.78cm-1 and 1105.04cm-1 represent the Sulfonic acid & Secondary alcohol group. The peaks observed in 1061.26cm-1 and 673.23cm-1were assigned to have the stretches of Sulfoxide S=O and Aromatic compound C-H stretches respectively.

FTIR spectroscopy analysis of *S. marginata* FTIR analysis performed to study the presence of functional groups in the plant material. FTIR spectrum for the acetone extract of *in vitro* cultured *S. marginata* 3288.29cm-1 represents the O-H Weak of alcohol 2923.44cm-1and 1647.34cm-1 were assigned to have C=C and S=O stretch in the vibration of Alkene and Sulfonyl chloride respectively. The peak at 1159.23cm-1 shows the Strong Sulfone. The peaks 1063.35cm-1 and 819.47cm-1 were assigned to have S=O & C=C Strong of Alkene. The peak at 472.65cm-1 were assigned to have the stretches of C-C Strong Mono substitude benezene derivative.A competitive analysis between *Adiantum incisum* and *S. marginata* showed that *A. Incisum* yielded the highest amount of functional peak at 10 compound, whereas *S. marginata* yielded the highest amount of functional peak at 8 compound.

Therapeutical studies of *In vitro* cultured fern extracts

Antibacterial Activity of in vitro cultured *Adiantum incisum* and *S. marignata* for the antibacterial activity assessment, Nutrient agar was employed to prepare the medium. The antibacterial efficacy of In vitro cultured *A. incisum* exhibited a higher inhibition rate compared to acetone extracts. The maximum inhibition rate was observed with *Proteus vulgaris* (15.16±4.80mm) in the acetone extract. Following this, the petroleum ether extract of *S. marignata* (13.66±7.18mm) displayed the highest inhibition against *Aeromonas*

hydrophila. The acetone extract of *in vitro* cultured fern exhibited the maximum zone of inhibition against all tested strains. Comparative analysis of two plant species revealed that *A. incisum* yielded the maximum results. Conversely, the ethanolic extract of *In vitro* cultured fern displayed the lowest zone of inhibition against *Bacillus cereus*. According to Jeeshna (2017), the chloroform extract of the sporophyll type showed bacterial activity against *Klebsiella pneumoniae* (8.2 mm).

Numerous studies have confirmed that saponins possess the unique property of precipitating and coagulating red blood cells (Sodipo *et al*., 2000) and interestingly, both saponins and steroids are present in *Adiantum lunulatum* which is supposed to be of maximum medicinal value. Additionally, saponin is equally used in medicine and pharmaceutical industries because of its foaming ability with the production of frothy effect.

Terpenoids have been found in n-hexane extract and to be useful in the prevention and therapy of several diseases, including cancer. Terpenoids are also known to possess antimicrobial, antifungal, antiparasitic, antiviral, anti-allergenic, antispasmodic, antihyperglycemic, antiinflammatory and immunomodulatory properties. The preliminary phytochemical analysis *of Ipomoea eriocarpa* revealed the presence of alkaloids, phenols and phytosterols in all the three extracts, terpenoids in the chloroform and petroleum ether extracts and additionally saponins in the chloroform extract (Moonjit *et al*., 2015).

Table 1: Preliminary phytochemical of Acetone, Petroleum ether and chloroform extract of *A. incisum.*

Phytochemical Constituents	Result		
	Acetone	Petroleum ether	Chloroform
Alkaloids	+++	++	+
carbohydrates	+++	++	+
glycosides	++	++	-
flavonoids	++	+	-
phenolic compound	-	+	+
steroids	-	++	-
Saponins	++	+	+

Note:

+++ : Appreciable amount

++ : Moderate amount

+ : Trace amount

± : Doubtful

_ : Complete absence

Table 2: Preliminary phytochemical of Acetone, Petroleum ether and chloroform extract of *S. marginata.*

Phytochemical Constituents	Result		
	Acetone	Petroleum ether	Ethyal acetate
Alkaloids	+++	+++	++
carbohydrates	-	-	+
glycosides	-	++	-
flavonoids	-	++	+
phenolic compound	+	+	+
steroids	-	-	+
Saponins	-	+	+

Note:

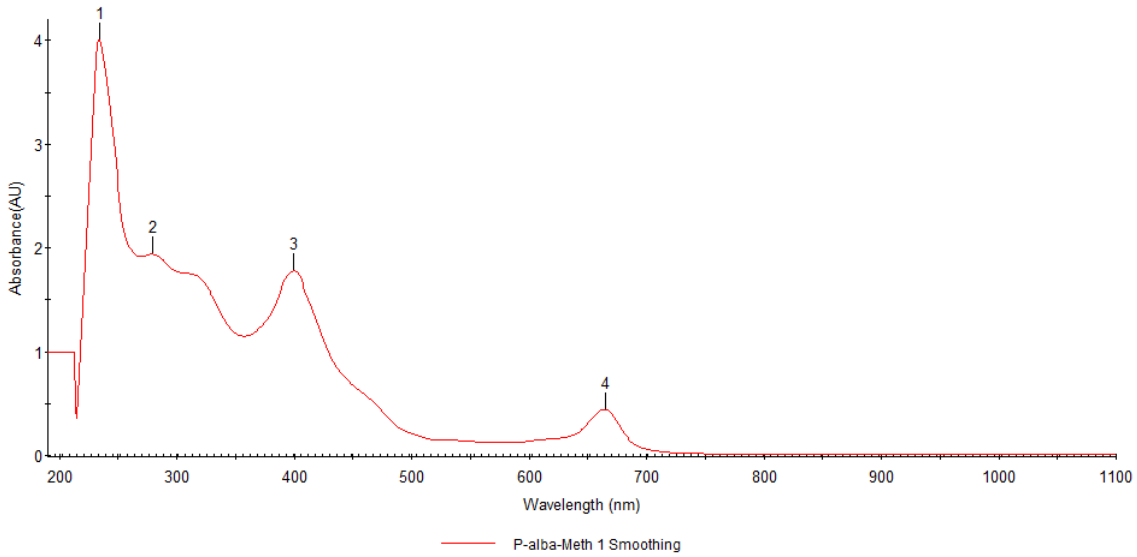
+++ : Appreciable amount

++ : Moderate amount

+ : Trace amount

± : Doubtful

_ : Complete absence



.

Table 3: V-Vis spectroscopic.

S.No	Wavelength	Absorbance
1	233.5	4.000
2	278.6	1.941
3	398.8	1.779
4	664.5	0.446

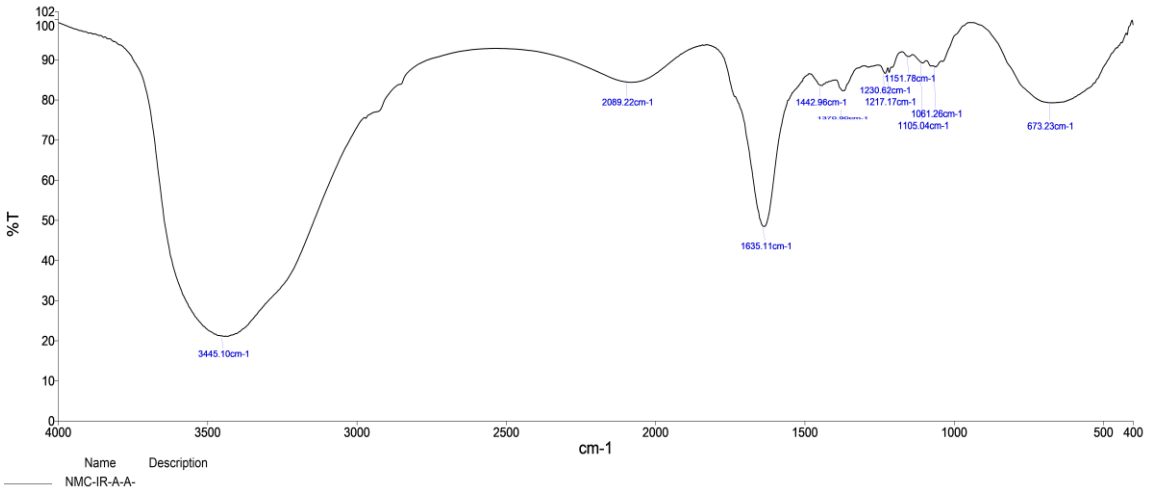


Table 4: FTIR Functional Group Compound of *A. incium*.

S.NO	VALUE	MEDIUM/ STRONG	CHEMICAL STRUCTURE	CHEMICAL COMPOUND
1	3445.10CM-1	Medium	N-H	Primary amine
2	2089.22cm-1	Strong	N=C=S	Isothiocganate
3	1635.11cm-1	Strong	C=C	Alkene
4	1442.96cm-1	Medium	C-H	Alkene
5	1230.62cm-1	Strong	C-O	Alkyl argl ether
6	1217.17cm-1	Strong	C-O	Vinyl ether
7	1151.78cm-1	Strong	S=O	Sulfonic acid
8	1105.04cm-1	Strong	C-O	Secondary alcohol
9	1061.26cm-1	Strong	S=O	Sulfoxide
10	673.23cm-1	Strong	C-H	Aromatic compound

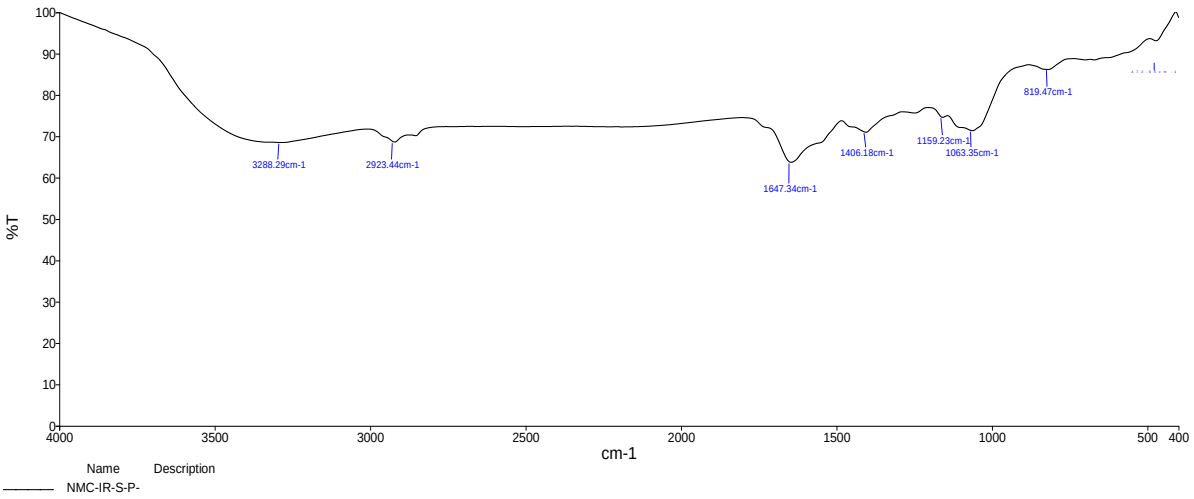
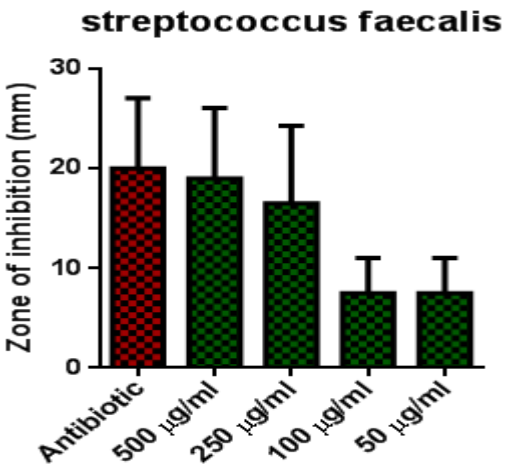


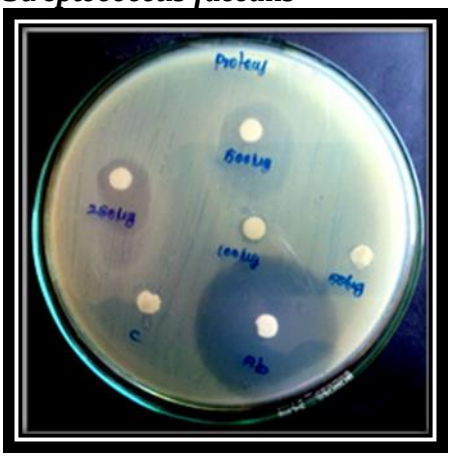
Table 5: FTIR Functional Group Compound of *S. marginata.*

S.NO	VALUE	MEDIUM/STRONG	CHEMICAL STRUCTURE	CHEMICAL COMPOUND
1	3288.29cm-1	Weak	O-H	Alcohol
2	2923.44cm-1	Medium	C-H	Alkane
3	1647.34cm-1	Strong	C=C	Alkene
4	1406.18cm-1	Strong	S=O	Sulfonyl chloride
5	1159.23cm-1	Strong	S=O	Sulfone
6	1063.35cm-1	Strong	S=O	Sulfoxide
7	819.47cm-1	Medium	C=C	Alkene
8	472.65cm-1	Strong	C-C	Benezene derivative

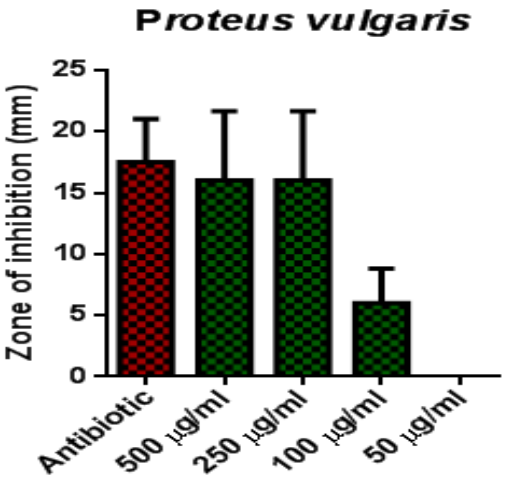
Table 6: antibacterial activity of *Adiantum incisum and Selaginella marignata.*

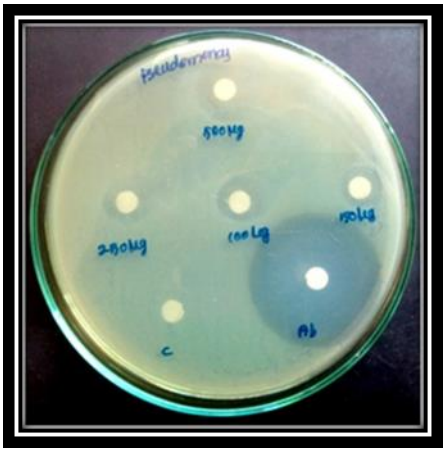
Adiantum incisum* against *Streptococcus faecalis



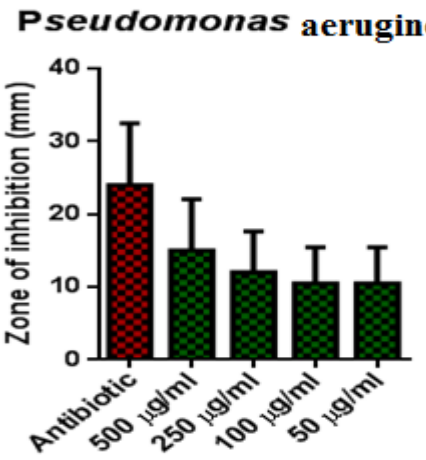


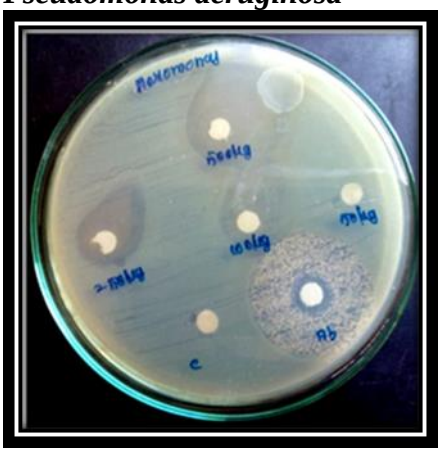
Adiantum incisum* against *Proteus vulgaris



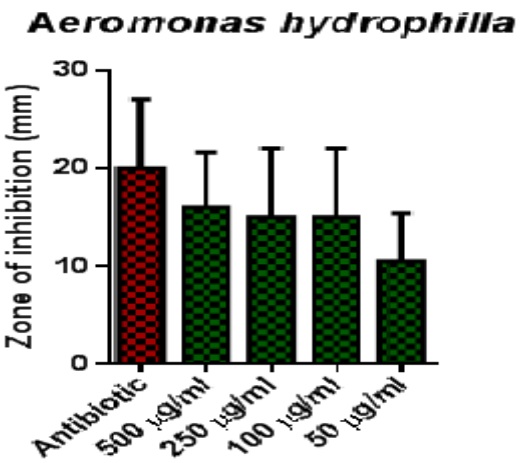


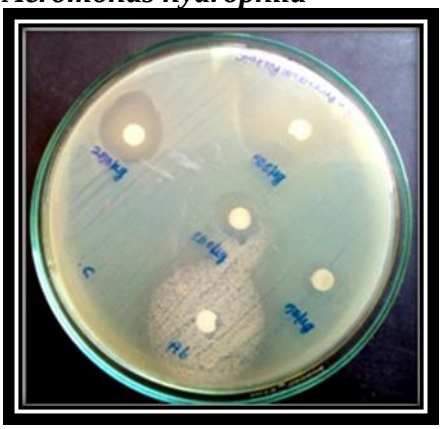
Adiantum incisum* against *Pseudomonas aeruginosa



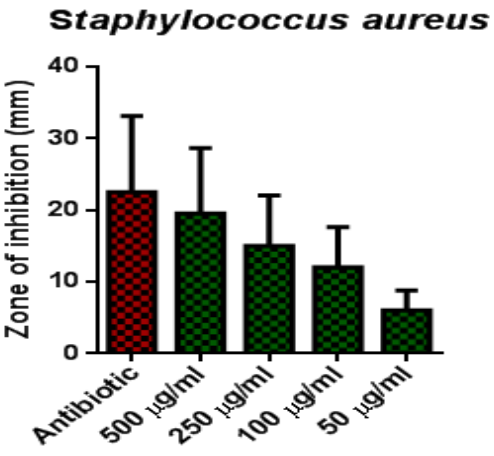


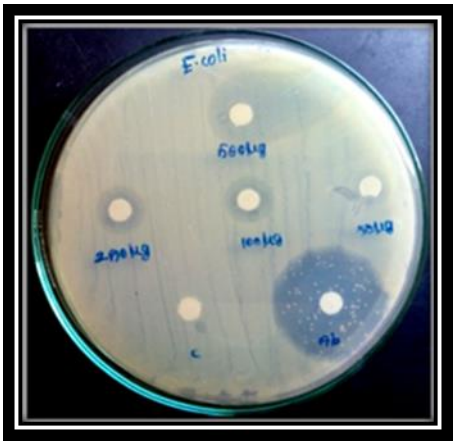
Selaginella marignata* against *Aeromonas hydrophila

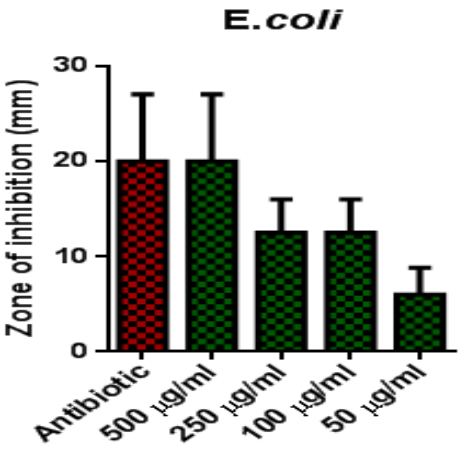




Selaginella marignata* against *Staphylococcus aureus







Selaginella marignata* against *E.coli

Table 7: Means of zone of inhibition obtained by sample *A. incisum* and *S. marignata* against *Aeromonas hydrophila, Staphylococcus aureus, E.coli, Streptococcus faecalis, Proteus vulgaris and Pseudomonas aeruginosa.*

S.NO	Name of the test Sample	Name of the test Micro organism	Zone of inhibition* (mm)				
			500µg/ml	250µg/ml	100µg/ml	50µg/ml	Control #
1.	*A. incisum* (solvent acetone)	*Streptococcus faecalis*	11.66±3.55	11.53±3.10	11.33±3.21	11.83±2.75	19
2.		***Proteus vulgaris***	**15.16±4.80**	**13.83±2.92**	**10.89±3.50**	**10.53±4.50**	21
3.		*Pseudomonas aeruginosa*	15.66±4.50	9.16±3.81	9.16±4.53	5.7±4.45	14
4.	*S. marignata* (solvent Petroliumether)	***Aeromonas hydrophila***	**13.66±7.18**	**12.16±3.88**	**10.83±3.81**	**10.16±2.75**	20
5.		*Staphylococcus aureus*	12.66±3.05	11.16±5.29	10.33±4.50	8.33±7.63	18
6.		*E.coli*	10.16±4.75	10.36±1.48	8.33±2.92	9.33±1.25	13

Note:

* Mean of triplicate

± Standard Deviation

Gentamycin.

CONCLUSION

The phytochemical analysis revealed the presence of numerous medically significant phytoconstituents in the tested *in vitro* cultured *Adiantum incisum* and *S. marignata* plant extract. The tested plant, *Adiantum incisum*, exhibited a broad spectrum of inhibitory activity against all tested pathogens, with the exception of *Pseudomonas aeruginosa*. These findings suggest that *Adiantum incisum* have proved that it has the potential to develop new antimicrobial agents. The potential of creating antimicrobials derived from lower group of plants seems promising, as it could result in the development of phytomedicine, which is effective against pathogenic microbes. Plant-based antimicrobials offer substantial therapeutic potential, presenting an option with fewer side effects compared to those commonly linked with synthetic antimicrobials.

ACKNOWLEDGEMENT

The authors would like to extend their sincere gratitude to their family for their unwavering support and Dr. V. Prabhu for his timely guidance and assistance, which were instrumental in providing the necessary resources and support to conduct this research.

REFERENCES

1. Jain PK, Soni A, Jain P, Bhawsar J. 2016. Phytochemical analysis of *Mentha spicata* plant extract using UV-VIS, FTIR and GC/MS technique. Journal of Chemical and Pharmaceutical Research, 8(2): 1-6.
2. Moonjit Das, Himaja Malipeddi. 2015. Phytochemical Analysis, Anti-Arthritic and Anti-Diabetic Activities of the Leaf Extracts of *Ipomoea eriocarpa*, Int. J. Pharm. Tech. Res., 8(5): 843-847.
3. Sodipo, O.A., Akiniyi, J.A., Ogunbamosu, J.U. 2000. Studies on certain characteristics of extracts of bark of *Pansinystalia macruceras* (K schemp) *Pierre Exbeille*, Global J. Pure Appl. Sci., 6: 83-87.
4. Tonthubthimthong, P., Chuaprasert, S., Douglas, P., Luewisuttichat, W. 2001. Supercritical CO2 extraction of nimbin from neem seeds an experimental study, J. Food Engineering, 47: 289-293.
5. Mengane, S.K. 2015. Phytochemistry of some medicinal plants from Western Ghat region, J. Pharmacy, 1(9): 1-4.
6. Nair, R., Kalariya, T., Sumitra, C. 2005. Antibacterial activity of some selected Indian medicinal flora, Turkey J. Biol., 29: 41-47.
7. Wong, S.K., Lim, Y.Y., Chan, E.W.C. 2009. Antioxidant properties of *Hibiscus* species variation, altitudinal change costal influence and floral colour change, J. Tropical Forest Sci., 21: 307-315.
8. Khan, M., Wassilew, S.W. 1987. Natural pesticides from the neem tree and other tropical plants, (Eds) Schmutterer H and Asher KRS, Germany: Digitalverlag GmbH, 645- 650.
9. Singh, N. and Gupta, M. 2007. Effect of ethanolic extract of *Syzygium cumini* seed powder on pancreatic islets of alloxen diabetic rats, Indian J. Experimental Biol., 45: 861-867.
10. Jagetia, G.C., Baliga, M.S., and Venkatesh, P. 2005. Influence of Seed Extract of *Syzygium Cumini* (Jamun) on Mice Exposed to Different Doses of γ- radiation. J. Radiat Res., 46(1): 59-65.

11. Watanabe, T., Rajbhandari, K.R., Malla, K.J. and Yahara, S. 2005. A handbook of medicinal plants of Nepal. Kobfai Publishing Project, Bangkok, Thailand.
12. Mehra, P.N. 2010. Apogamy In *Adiantum lunulatum* Burm, Biomedical and Life Sciences, proceedings: Plant Sci., 8(3): 192-201.
13. Dudani SN, Mahesh MK, Chandran MS, Ramachandra TV. 2014. Pteridophyte diversity in wet evergreen forests of Sakleshpur in Central Western Ghats. Indian Journal of Plant Sciences, 3(1): 28-29.
14. Parihar P, Parihar L. 2006. Some pteridophytes of medicinal importance from Rajasthan.
15. Antony Sandosh T, Paul John Peter M, Yesu Raj J. Phytochemical analysis of *Stylosanthes fruticosa* using UV-VIS, FTIR and GC-MS. Res. J. Chem. Sci, 2013; 3(11): 14-23.
16. Theng KB and Korpenwar AN: Phytochemical Analysis of Ethanol Extract of *Ampelocissus Latifolia* (Roxb.) Planch Tuberous Root Using UV-Vis, FTIR and GC-MS. Int J Pharm Sci Res, 2015; 6(9): 3936-42.