



PHYTOCHEMICAL ANALYSIS OF *PHYLLODIUM PULCHELLUM* L. DESV. LEAF BY UV-VISIBLE SPECTROSCOPY AND FTIR

G. Velmurugan^{1*} and S.P. Anand²

^{1,2}PG and Research Department of Botany, National College (Autonomous), Tiruchirappalli-620001
Tamil Nadu, India

*Corresponding Author Email: velmuruganbotany@gmail.com

ABSTRACT

The present study investigates the characterization of the bioactive constituents showing antimicrobial activity present in the leaf extract of *Phyllodium pulchellum* using UV-VIS and FTIR spectroscopy. The ethanolic leaf extract of *P. pulchellum* prepared to analyze under ultraviolet and visible light. The scanning of the crude extract was done at the range from 380 to 900 nm through UV Visible spectrophotometer system and the characteristic peaks were detected. FTIR study was done on ranging 4000-400 cm⁻¹ which revealed the characteristic peak values showing the absorption and functional groups present in leaf extract. The UV-VIS profile showed the peaks at 382.70, 413.68, 536.18, 610.37 and 664.61 nm with the absorption 2.7930, 2.5932, 0.3114, 0.4185 and 1.5966. The result of FTIR spectra confirms the presence of alcohols, phenol, alkenes, aromatics, alkyl halides, primary and secondary amines compounds. The results of our study generated the UV-VIS and FT-IR spectrum profile of medicinally important plant *P. pulchellum*. In future, it can be used in the pharmaceutical industry for treating various diseases.

KEY WORDS

UV-VIS Spectroscopy; FTIR Spectroscopy; *Phyllodium pulchellum*; leaf extract

INTRODUCTION

Plants with medicinal properties are gaining a lot of importance due to their role in various health concerns of human population in different nations. There is an exponential growth in the need of the plant based drugs in the international market because of high effectiveness, easily available, economical, evidently negligible toxicity, as side effects and proving to be a good substitute for allopathic medicines.¹ Medicinal plants provide raw materials for indigenous health care systems such as Ayurveda, Unani and Siddha and also for modern medicines. Some estimates indicate that, over 25,000 effective plant based formulations are available in Indian medicine, 1.5 million practitioners use medicinal plants in preventive, promotional and curative applications.² Phytochemical characterization of plant material is important as it relates to the nature and extent of therapeutic action possible with its use. Among the thousands of naturally occurring

constituents so far identified in plants and exhibiting a long history of safe use, there are none that pose- or reasonably might be expected to pose- a significant risk to human health at current low levels of intake when used as a flavoring substance.³ The unknown organic compounds in a complex mixture can be determined by the interpretation and also by matching the spectra with reference spectra.⁴ FT-IR Spectroscopy has demonstrated to be a reliable and sensitive method for finding out the functional groups, present in plant samples using IR region in the range of 400 to 4000 cm⁻¹. For most common plant compounds, the spectrum of an unknown compound can be identified by comparison to a library of known compounds.⁵ UV-VIS spectroscopy uses light in the visible ranges or its adjacent ranges. The color of the chemicals involved directly affects the absorption in the visible ranges. Molecules undergo electronic transitions in these ranges of the electromagnetic spectrum.⁶

Phyllodium pulchellum L. Desv. is a perennial plant with slender, branching stems that become more or less woody. It can grow 50 - 250 cm tall. The plant is harvested from the wild for local use as a medicine. The plant is classified as 'Least Concern' in the IUCN Red List of Threatened Species. The roots and leaves are used for reducing fever and as an antiphlogistic and diuretic. The whole plant is used in a post-partum treatment; to treat rheumatic fevers; to cure toothache; to help dissolve internal blood clots; and is also considered a remedy for convulsions in infants. In recent years, in order to detect the quality of medicines plants, many studies have been carried out to understand the variation of chemical information caused by these factors.^{7,8} The biological activities and phytochemical constituents of this expensive resource belonging to the plant kingdom have remained undocumented, so long and in order to correct the situation, the present research work has been taken up to produce the UV-VIS and FTIR spectrum profile of *Phyllodium pulchellum*.

MATERIALS AND METHODS

Plant Material

The fresh leaf of *Phyllodium pulchellum* (Threatened plant) was collected from Jambhuthu hamlet, Bodamalai, Namakkal district, Tamil Nadu. The leaf was washed with running water and then with distilled water. 10 g of air-dried powder was taken with 100 ml of organic solvent (ethanol) in a conical flask, plugged with cotton wool and then kept on a rotary shaker at 190-220 rpm for 24 h. After 24 hours the supernatant was collected, and the solvent was evaporated to make the final volume one-fourth of the original volume and stored at 4°C in airtight bottles.⁹

RESULTS AND DISCUSSION

Spectral studies

UV-VIS and FTIR analysis

The qualitative UV-Vis spectrum profile of *P. pulchellum*, ethanolic leaf extract was selected at wavelengths from 380 to 900 nm, due to sharpness of peaks and proper baseline. The profile showed the peaks 382.70, 413.68, 536.18, 610.37 and 664.61 with absorption 2.7930, 2.5932, 0.3114, 0.4185, 1.5966 respectively (Table 1 & Fig 1).

The characteristic absorption bands exhibited at 3432.65 cm⁻¹ for O-H stretch, H-bonded, 1642.61 cm⁻¹ for C=C stretch, 1445.74 cm⁻¹ for C-C stretch (in-ring), 1296.18 cm⁻¹ for C-H wag (-CH₂X), 666.90 cm⁻¹ for N-H wag. The absorption bands at 3415 cm⁻¹ (OH) and 1064 cm⁻¹ (O-H bending) are due to the hydroxyl group. The functional groups were present in plants extract of alcohols, phenol, alkenes, aromatics, alkyl halides, primary and secondary amines (Table 2 & Fig 2). Lakshmi *et al.*, reported the presence of alcohols, phenols, alkanes, primary, secondary, aromatic, aliphatic amines, carboxylic acids, nitro compounds, alpha, beta-unsaturated esters and alkyl halides as functional groups during Fourier Transform Infrared (FT-IR) Spectroscopic study of *Clitoria ternatea* and its different leaf extracts.¹⁰ Lakshmi *et al.*, during FT-IR analysis of *Acacia catechu* seed was revealed that powder showed lipids, carboxylic acids, aliphatic, aromatic nitro compounds, alkanes, alkyl halides, aliphatic amines and esters.¹¹ Analysis of the leaf extract of sample under FTIR and UV-VIS spectroscopic technique showed that the presence of phenolic compound and flavonoid which can be isolated and further screened for different kind of biological activities depending their therapeutic uses.

Table 1: UV Visible Spectroscopic studies on the ethanolic leaf extract of *Phyllodium pulchellum*

Nanometers	Absorption
382.70	2.7930
413.68	2.5932
536.18	0.3114
610.37	0.4185
664.61	1.5966

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UV-Vis Spectrum

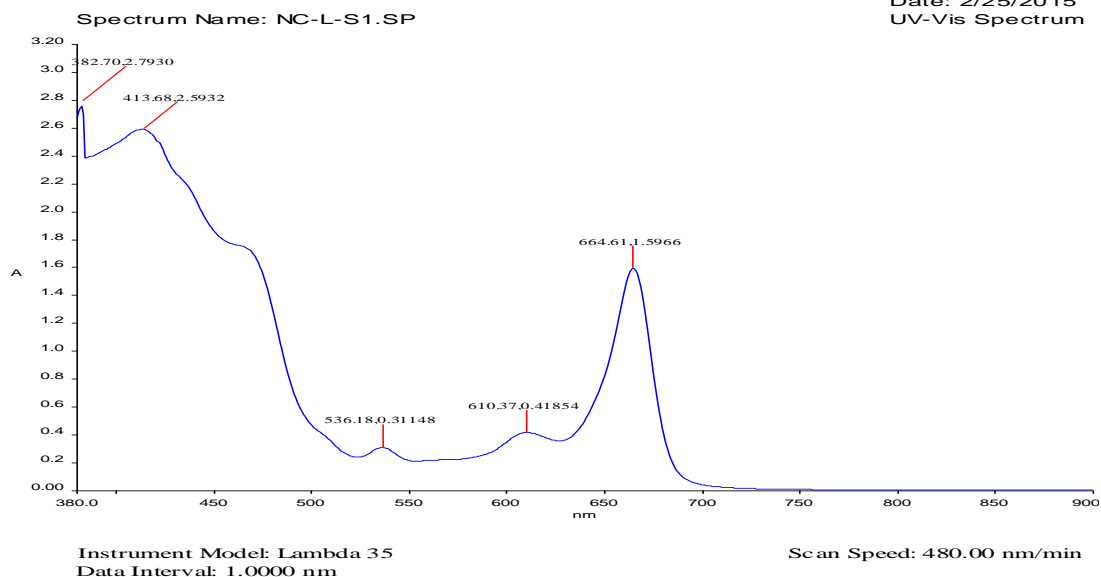


Figure 1: UV Visible Spectroscopic studies on the ethanolic leaf extract of *Phyllodium pulchellum*

Table 2: FTIR peak values and functional groups of ethanol leaf extracts of *P.Pulchellum*

Peak values	Bonds	Functional groups
3432.65	O-H stretch, H-bonded	Alcohols, phenols
2072.97	-	Unknown
1642.61	-C=C- stretch	Alkenes
1445.74	C-C stretch (in-ring)	Aromatics
1296.18	C-H wag (-CH ₂ X)	Alkylhalides
666.90	N-H wag	Primary, secondary amines

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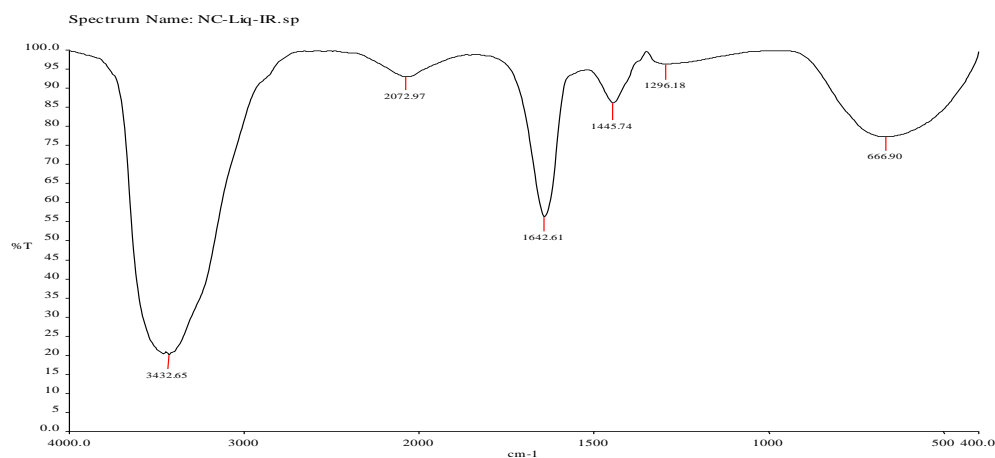


Figure 2: FT-IR Spectroscopic studies on the ethanolic leaf extract of *Phyllodium pulchellum*

Conclusion

The present study was carried to detect the spectroscopic characterization of the ethanolic leaf extract of *P.pulchellum*. The value of absorption obtained at these wavelengths indicates the presence of flavonoids and its derivatives. Furthermore, work is required to determine the structure of alkaloids and flavonoid compound by use of various more advanced analytical techniques such as Mass and NMR spectrophotometer.

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References

1. Ashis G. Herbal folk remedies of Bankura and Medinipur districts, West Bengal. Indian Journal of Traditional Knowledge. 2003; 2(4):393-396.
2. Rastogi RP, Mehrotra B and Pastogi RP. Compendium of Indian medicinal plants: Central Drug Research Institute; Publications and Information Directorate.1995
3. Akerale. Global Importance of Medicinal Plants, Conservation of Medicinal Plants. 1991
4. Hites RA. Gas chromatography mass spectrometry. Handbook of instrumental techniques for analytical chemistry. 1997: 609-626.
5. Griffiths PR, Haseth JA. Fourier Transform Infrared Spectroscopy. New York, Willey.1986
6. Gunasegaram S. UV-VIS spectroscopic analysis of blood serum. Asian J Microbiol Biotech Environ Sci. 2003; 5(4):581-582.
7. Chear NJ, Khaw KY, Murugaiyah V and Lai CS. Cholinesterase inhibitory activity and chemical constituents of *Stenochlaena palustris* fronds at two different stages of maturity. Journal of food and drug analysis. 2016: 24(2): 358-366.
8. Valares Masa C, Sosa Díaz T, Alias Gallego JC, and Chaves Lobon N. Quantitative variation of flavonoids and diterpenes in leaves and stems of *Cistus ladanifer* L. at different ages. Molecules. 2016; 21(3):275.
9. Parekh J, Jadeja D and Chanda S. Efficacy of aqueous and methanol extracts of some medicinal plants for potential antibacterial activity. Turkish Journal of Biology. 2006; 29(4):203-210.
10. Lakshmi CN, Raju BD, Madhavi T, Sushma NJ. Identification of bioactive compounds by FTIR analysis and *In vitro* Antioxidant activity of *Clitoria ternatea* leaf and flower extracts. Indo American Journal of Pharmaceutical Research. 2014; 4(9): 3894-3903.
11. Lakshmi T, Ramasamy R, Thirumalaikumaran R. Preliminary Phytochemical analysis and *In vitro* Antioxidant, FTIR Spectroscopy, Anti-diabetic activity of *Acacia catechu* ethanolic seed extract. Pharmacognosy Journal. 2015; 7(6): 356-362.

***Corresponding Author:**

G. Velmurugan*

Email: velmuruganbotany@gmail.com