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FTIR Spectroscopic Analysis of Epiphytic Pteridophyte: *Huperzia hamiltonii* (Spreng.) Trevis. From Northern Western Ghats of Maharashtra

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ABSTRACT

Epiphytic pteridophyte *Huperzia hamiltonii* (Spreng.) Trevis., belongs to family Lycopodiaceae a least concern (LC) species, The plant is rich in bioactive phytochemicals, including flavonoids, phenolics, and alkaloids, which contribute to its medicinal value. This study aims to identify and characterize the key bioactive compounds present in the fronds. through Fourier Transform Infrared Spectroscopy (FTIR). The FTIR Spectroscopic studies revealed different characteristic peak values with various functional compounds such as alkanes, carboxylic acid, esters, amines, nitro, alkyl halide and aromatic compounds. The FTIR method was performed on a spectrophotometer system, which is used to detect the characteristic peak values and their functional groups.

Keywords: *Huperzia hamiltonii* (Spreng.) Trevis., FTIR, Spectroscopy, Functional groups

I. INTRODUCTION

The distribution range of *Huperzia hamiltonii* (Spreng.) Trevis. has been disputed among taxonomists since its discovery. It was attached to host plants but don't harm them, getting water from rain and nutrients from decaying organic matter. In the past it has been thought to be widely distributed in the Himalaya as well as in parts of China and S.E. Asia, while some recent taxonomists think it is only a Sino-Himalayan species. [1] currently we found the new localities in northern western ghats of Maharashtra. seven *Huperzia* species (Lycopodiaceae), namely *H. brevifolia, H. columnaris, H. compacta, H. crassa, H. espinosana, H. tetragona,* and *H. weberbaueri* which are considered sacred plants by the Saraguro community, living in the Southern Andes of Ecuador; these plants are widely used in traditional medicine and ritual ceremonies [2] *Huperzia serrata* (Thunb. ex Murray) Trev, shows diverse pharmacological properties, including neuroprotective, anti-Alzheimer's, anti-epileptic, analgesic, cardioprotective, hepatoprotective, antioxidant, and anticancer activities. [3] At present, particularly in phytochemistry, FTIR has been exercised to identify the concrete structure of certain plant secondary metabolites. [4,5] FTIR is one of the most widely used methods to identify the chemical constituents and elucidate the compound structures to propose in medicinal purposes. [6,7]

II. MATERIALS AND METHODS

Collection, Identification, and Authentication of plant materials:

The epiphytic pteridophyte *Huperzia hamiltonii* (Spreng.) Trevis.were collected from Gaganbawada (16.941778° N;74.876654°E) Tal. Radhanagari Dist. Kolhapur, Maharashtra, India. The plant materials were identified at the Department of Botany, Rajarshi Chhatrapati Shahu college, Kolhapur. Voucher specimens were prepared and deposited in the herbarium of the Botanical Survey of India, Pune. Maharashtra, India for future references

Preparation of sample:

Epiphytic pteridophytes *Huperzia hamiltonii* fronds were chopped into small pieces and then shade dried. The dried samples were grind into fine powder using a mortar and pestle. Further, all the powdered sample were used for FTIR analysis.

Fourier transform infrared spectrophotometer (FTIR) analysis:

The Fourier Transform Infrared Spectrophotometer (FTIR) analysis was carried out using FTIR-7600 spectrophotometer. The fronds powder was loaded on the 100mg of KBr pellet after hydraulic press. The pellets were mounted in an FTIR spectrometer. The scan range was set within the electromagnetic spectrum of the infrared region of 5000 to 400 cm^{-1}. The absorption is written in terms of wavenumbers (cm^{-1}).

III.RESULTS AND DISCUSSION:

The FTIR spectrum was used to identify the functional groups of the active components in the plant sample based on the peak value in the region of Infrared radiation [8] FTIR (Fourier Transform Infrared Spectroscopy) is used with *Huperzia* species, especially *H. serrata*, to identify, differentiate, and analyse their chemical components, mainly Lycopodium alkaloids like Huperzine A, which are important for memory/Alzheimer's treatments, by detecting unique molecular fingerprints (vibrations) in their spectra, helping distinguish them from related species or adulterants and confirming compound presence.[9] The fronds powder of *Huperzia hamiltonii* gave the following characteristic absorption peaks (Figure-1 & Table-1). The absorption spectra of *Huperzia hamiltonii* exhibited a peak at 3284.31 represented the presence of phenolic (O-H stretch). The peak at 2918.22 showed the presence of alkanes, carboxylic acid (C-H stretch). The peak at 1733.19 showed the presence of aldehyde, saturated aliphatic, ketones (C=O stretch). The peak at 1683.77 (C=C) represented the presence of alkenes, The peak at 1559.03 represented the presence of aromatics (C-C stretch). The peak at 1374.73 exhibited the presence of alkenes (C-H stretch), The peak at 1248.58 represented the presence of aliphatic amines (C-N stretch).and the peak at 692.78 represented the presence of alkyl halides (C-Br stretch). functional group, respectively. Using FTIR spectrum, we can confirm the functional constituent's presence in the given parts and extract, identify the medicinal materials from the adulterate, and even evaluate the qualities of medicinal materials [10] FTIR spectral analysis of plant parts such as flowers, leaves, stem, and roots of *Aerva lanata* showed the presence of characteristic functional groups of alcohols, phenols, alkanes, carboxylic acids, aldehydes, alkenes, nitro compounds, alcohols, carboxylic acids, esters, ethers, aliphatic amines, and alkyl halides compounds derivatives which were responsible for medicinal properties of the plant [11].

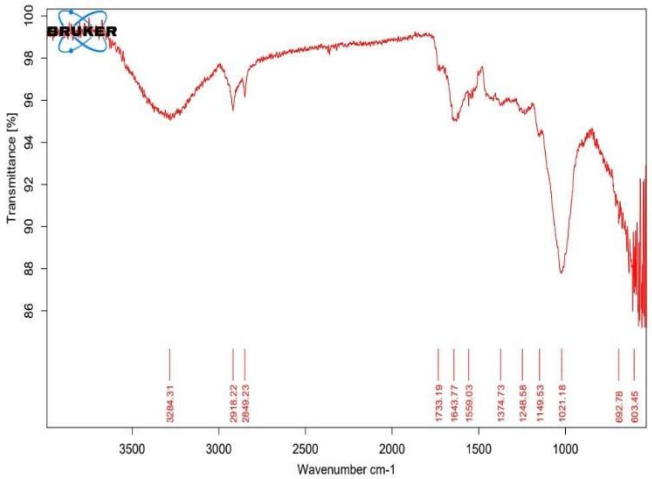

FIG.1 FOURIER TRANSFORM INFRARED SPECTRUM ANALYSIS OF *HUPERZIA HAMILTONII* (SPRENG.) TREVIS CRUDE POWDER OF FRONDS.

TABLE 1: FT-IR PEAK VALUES AND FUNCTIONAL GROUPS OF CRUDE POWDER OF *HUPERZIA HAMILTONII* (SPRENG.) TREVIS FRONDS.

Sr. No	Frequency ranges (cm^{-1})	Wave number (cm^{-1})	Assigned functional group	Compound Class
1.	3200-3500	3284.31	O-H	Alcohols, phenols
2.	2850-3000	2918.22 2849.23	C-H	Alkanes, carboxylic acid
3.	1720-1740	1733.19	C=O	Aldehydes, saturated aliphatic, ketones
4.	1640-1680	1643.77	-C=C	Alkenes
5.	1500-1585	1559.03	C-C	Aromatics
6.	1350-1450	1374.73	C-H	Alkanes
7.	1020-1250	1248.58 1149.53 1021.18	C-N	Aliphatic amine
8.	550-850	692.78	C-Br	Alkyl halides

IV. CONCLUSION:

The results of the present study showed in the presence of alkanes, amines, aldehydes, carboxylic acids, aromatic, nitro, esters, and alkyl halides in the fronds of *Huperzia hamiltonii*, with their phytoconstituents and subjecting it to biological activity will definitely give fruitful results.so it is recommended for further spectroscopic studies to elucidate the structure, identification, bioactivity, toxicity profile, effect on the ecosystem and also agricultural products.

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REFERENCES

[1]. Nawal S and Xian C.Z.2014. Is Huperzia hamiltonii (Spreng.) Trevis. A Himalayan Endemic? Indian Fern J. 31: 154-161

[2]. Armijos C, Gilardoni G, Amay L, Lozano A, Bracco F, Ramirez J, Bec N, Larroque C, Finzi P, and Vidari G. 2016. Phytochemical and ethnomedicinal study of Huperzia species used in the traditional medicine of Saraguros in Southern Ecuador; AChE and MAO inhibitory activity. J Ethnopharmacol. 4; 193:546-554

[3]. Chu Z, Sun Q, Mao M, Wu Y, Yu L, Xu J, Liu K, Qin L and Zhu B. 2025. Pharmacology, phytochemistry, and traditional uses of Huperzia serrata (Thunb. ex Murray) Trev. Fitoterapia. 180:106304.

[4]. Yang J, Yen HE. 2002. Early salt stress effects on the changes in chemical composition in leaves of ice plant and Arabidopsis. A Fourier

transform infrared spectroscopy study. Plant Physiol 130(2):1032-42.

[5]. Ivanova D.G, Singh B.R. 2003. Nondestructive FTIR monitoring of leaf senescence and elicitin induced changes in plant leaves. Biopolymers,72(2):79-85.

[6]. Marimuthu M. and Guru Moorthi P. 2013.Phytochemical screening and FTIR studies on wild and common south Indian legumes. Asian J Pharm Clin Res, 6(2):141-4.

[7]. Ashokkumar R.and Ramaswamy M. 2014. Phytochemical screening by FTIR spectroscopic analysis of leaf extracts of selected Indian medicinal plants. Int J Curr Microbiol Appl Sci,3(1):395-6.

[8]. Gupta O. P. Ali M.M. Ray B. J. and Atal C. K. 1977. Some pharmacological investigations of embelin and its semisynthetic derivatives. Indian J Physiol Pharmacol. 21(1).

[9]. Guo S. L, Li P. L, Fang F, Huang H, Cheng C. G. 2005. FTIR spectra-principal component analysis of phenetic relationships of Huperzia serrata and its closely related species,25(5):693-7.

[10]. Komal J. and Devi G. 2011. Identification and comparison of biomolecules in medicinal plants of Tephrosia tinctoria and Atylosia albicans by using FTIR. Rom J Biophys 21(1):63-71.

[11]. Yamuna M. Wesely G. and Johnson M. 2012. FTIR spectroscopic studies on Aerva lanata (L.) Juss. Ex Schult. Asian J Pharm Clin Res,5(2):82-6