

FTIR SPECTROSCOPIC ANALYSIS OF FUNCTIONAL COMPOUNDS FROM THE INFLORESCENCE OF *ANISOCHILUS SCABER* BENTH.

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ABSTRACT

Anisochilus Wall. ex Benth. is one of the largest and medicinally important genus of Lamiaceae. The plants are rich in active secondary metabolites and very important for economic, agricultural and pharmaceutical point of view. The species *Anisochilus scaber* Benth. is available in Kerala and Tamilnadu. The plant is distributed in rocky areas of moist deciduous forests and is commonly called 'sambrani poo' or 'seivenai chedi' in Tamil. An ethnobotanical study of medicinal plants used by Paliyar aboriginal community in Virudhunagar district, Tamilnadu shows that the leaves of the plant is used in witchcraft and is hanged on the lintel of the home. So far no phytochemical and pharmacological studies were reported from this species. FTIR (Fourier Transform Infrared Spectroscopy) spectrum is used to understand the functional compounds present in the inflorescence of *A. scaber* Benth. Analysis of FTIR spectrum profile provides the evidence of the presence of various chemical compounds such as alcohols (primary, secondary and tertiary), aliphatic ether, alkane, alkyl aryl ether, amine, amine salt, conjugated alkene, cyclic alkene, fluoro compounds, aromatic amines, imines, phenols and sulfones, which are medicinally important. The inflorescence of *A. scaber* Benth. may have different pharmacological properties

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due to the presence of medicinally important functional compounds. These can be identified by further studies.

Key words: *Anisochilus scaber* Benth., FTIR, fluoro compounds, aromatic amines.

INTRODUCTION

Anisochilus wall. ex Benth. is medicinally important and one of the most complex genus of Lamiaceae . It is an Asian genus with 21 species with distribution in Bhutan, Burma, Cambodia, India, Laos, Southern China, Sri Lanka, Thailand and Vietnam. Of the 21, 18 species are from India. Western Ghats with 15 species forms the major distribution area which includes more than 70% of the genus with 9 endemic species. *A.carnosus*, *A.pallidus*, *A. mitis*, *A.paniculatus*, *A. wightii*, *A. scaber*, *A. polystachyus*, *A.robustus*, *A.suffruticosus* and *A. adenanthus* are commonly distributed species in India (Somran Suddee & Alan Paton, 2009). Due to its different biological activities and taxonomical importance, the genus has been extensively studied. One of the species of *Anisochilus* available in Kerala and Tamilnadu, is described as *Anisochilus scaber* Benth. The plant is distributed in rocky areas in moist deciduous forests (Sasidharan, 2011). In Kerala, it is mainly concentrated in Palakkad, Kollam and Thiruvananthapuram districts. It is commonly called 'Sambrani poo' or 'Seivenai chedi' in Tamil. The leaf of the plant is used by Paliyar community in Tamilnadu for witchcraft practices. It is hanged on the lintel of the home for driven male witches (Maria *et al.*, 2014). We believe that inflorescence also contain various potentially active compounds as seen in vegetative parts of *A. scaber* Benth (Farsana & Viji, 2021). This analysis is to understand the different chemical compounds (functional groups) present in the inflorescence of the plant.

MATERIALS AND METHODS

Collection of the plant

Plant materials were collected from Achankovil, Kollam district in Kerala, India. (Longitude: 77.1252001, Latitude: 9.091405, Elevation: 83 m/ 272 feet, Barometric pressure: 100KPa), during October- November, the flowering season of the plant (Fig.1).



Fig.1 Habit of *A. scaber* Benth.

Identification the plant

Identification using Flora of Presidency of Madras (Gamble J. S., 1915). DNA barcoding also done in Rajiv Gandhi Centre for Biotechnology, Poojapura, Thiruvananthapuram using RBCL Primer for molecular identification.

FTIR (Fourier Transform Infrared Spectroscopy)

FTIR (Fourier Transform Infrared Spectroscopy) is a powerful tool to identify the types of chemical bonds present in the compounds. The spectrum displays specific light wavelengths absorbed by chemical bonds which can characterise them (Dietta Ami *et al.*, 2018). The inflorescence was cleaned from extraneous matter, washed properly in slow tap water before shade drying. After complete air drying the material was powdered and preserved for FTIR studies. FTIR was done using IR Prestige-21 (Shimadzu) spectrometer.

RESULTS AND DISCUSSION

Scaber Benth. is a herb with woody stems, rooting at the nodes, the branches ascending, usually with only single heads, sometimes reaching three (Gamble J. S., 1915). Corolla is purplish-white in colour with red sessile glands (Somran Suddee & Alan Paton, 2009). Analysis of FTIR spectrum profile (Fig. 2) provides the evidences of the presence of various functional groups in the inflorescence such as Alcohols (primary, secondary and tertiary), aliphatic ether, alkane, alkyl aryl ether, amine, amine salt, conjugated alkene, cyclic alkene, fluoro compounds, aromatic amines, imines, phenols and sulfones (Table. 1). Root, stem and leaf shows similarity in most of the compounds as well as difference in some others (Farsana & Viji, 2021).

Fig.2 FTIR Spectrum of *A. scaber* Benth. inflorescence

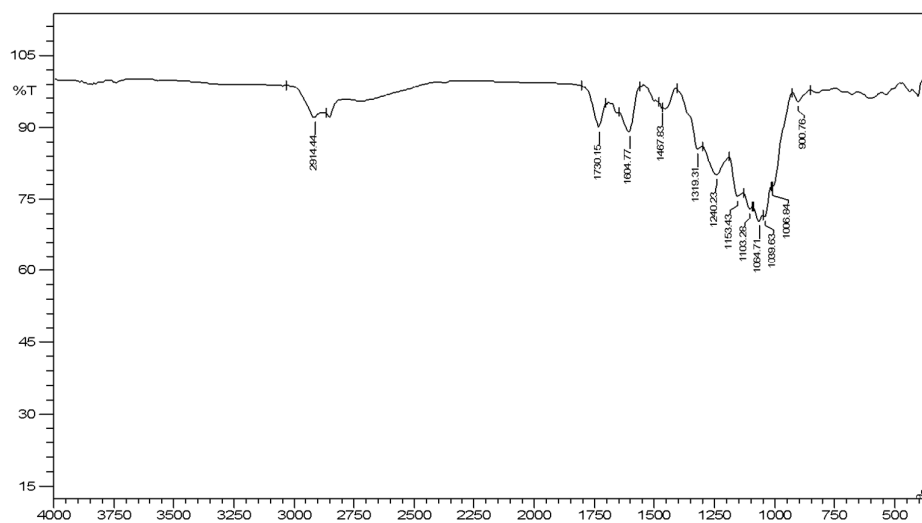


Table1: Functional compounds identified through FTIR Spectroscopic analysis in inflorescence of *A. scaber* Benth.

Sl. No.	Functional compound	Plant part	Sl. No.	Functional compound	Plant part
		Inflorescence			Inflorescence
1	Acid halide	-	32	Halo compound	-
2	Alcohols	+	33	Imine/oxime	+
3	Aldehyde	-	34	isocyanate	-
4	Aliphatic ether	+	35	Isothiocyanate	-
5	Aliphatic Ketone	-	36	Ketene	-
6	Aliphatic primary amine	-	37	ketenimine	-
7	Alkane	+	38	monosubstituted	-
8	Alkyl aryl ether	+	39	Nitrile	-
9	Alkyne	-	40	Nitro compound	-
10	Allene	-	41	Phenol	+
11	Amine	+	42	Primary alcohol	+
12	Amine salt	+	43	Primary amide	-
13	Anhydride	-	44	Secondary alcohol	+
14	Aromatic amine	+	45	Secondary amide	-
15	Aromatic compound	-	46	Secondary amine	-
16	Aromatic ester	-	47	Sulfate	-
17	Azide	-	48	Sulfoamide	-
18	Carbodiimide	-	49	Sulfonate	-
19	Carbon dioxide	-	50	Sulfone	+
20	Carboxylic acid	-	51	Sulfonic acid	-

21	Conjugated acid	-	52	Sulfonyl chloride	-
22	Conjugated acid halide	-	53	Sulfoxide	-
23	Conjugated aldehyde	-	54	Tertiary alcohol	+
24	Conjugated alkene	+	55	Tertiary amide	-
25	Conjugated anhydride	-	56	Thiocyanate	-
26	Conjugated ketone	-	57	Thiol	-
27	Cyclic alkene	+	58	Vinyl/Phenyl ester	-
28	Cyclopentanone	-	59	Vinyl ether	-
29	Ester	-	60	α,β - unsaturated ester	-
30	Esters	-	61	α,β - unsaturated ketone	-
31	Fluoro compound	+	62	δ - lactam	-

(+ : presence of compound, -: Absence of compound)

Most of the functional compounds detected by the FTIR spectroscopic analysis of *A. scaber* Benth. was detected in many medicinal plants. So the inflorescence of *A. scaber* Benth. may has certain medicinal properties. Qualitative analysis of *A. carnosus* Wall. reveals the presence of alkaloids, carbohydrates, steroids, tannins, phenols, carboxylic acid and quinone (Ditu *et al.*, 2017). Agarwal *et al.*, 2010, also reported the presence of carbohydrate, glycosides, phenolic compounds, tannins, alkaloids and flavonoids in *A. carnosus* Wall. and hepatoprotective activity of aqueous extracts of leaves. Leaves of the plant also presented good antipyretic and analgesic activity (Porika *et al.*, 2013). *A. scaber* Benth. may have similar pharmacological properties due to the presence of

identical compounds as seen in *A. carnosus* Wall. Another study, showed *A. carnosus* Wall. to exhibit antiulcer property which has potent gastric healing properties (Mohammed *et al.*, 2008). FTIR analysis of the leaf extracts of selected medicinal plants from India shows the presence of amide, alcohols, phenols, alkanes, carboxylic acids, aldehydes, ketones, primary amines, aromatics, esters, ethers, halides and aliphatic amines (Ashok Kumar and Ramaswamy, 2014). This provides evidence to the medicinal properties of the inflorescence of *A. scaber* Benth.

CONCLUSION

Lamiacea family has plants rich in pharmaceutically active secondary metabolites. Use of lamiaceae plants in herbal medicines has been practiced for centuries to treat various ailments. Most of the plants in this family have been extensively studied due to its different biological activities such as antioxidant, antifungal, antibacterial, anticancer etc. The genus *Anisochilus* Wall. ex Benth is with medicinally important species with reports of pharmacologically active compounds like phenols, flavonoids, alkaloids, glycosides, etc. FTIR analysis of the inflorescence of *A. scaber* Benth. reveals the presence of pharmaceutically active functional compounds like alcohols (primary, secondary and tertiary), aliphatic ether, alkane, alkyl aryl ether, amine, amine salt, conjugated alkene, cyclic alkene, fluoro compounds, aromatic amines, imines, phenols and sulfones. The result is more or less similar to that of functional compounds from root, stem and leaves of *A. scaber* Benth. We can believe that it may have similar medicinal properties as *A. carnosus* Wall. due to the presence of identical compounds. The pharmacological properties of the inflorescence can be evaluated in detailed investigation.

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