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Fourier-Transform Infrared Spectroscopy (FTIR): Analysis of Normal and Galled Leaf of *Mitragyna parvifolia*

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Infrared spectroscopy, or FTIR, involves subjecting a material to IR radiation. The sample absorbs some of the radiations and some radiations it transmits. The consequential indication is a spectrum at the detector which represents a molecular “fingerprint” of the sample. The FTIR interferogram shows that the wavelength of light absorbed is characteristic of the chemical bond that is present. The presence of a chemical bond in a molecule could be assessed by the interpretation of the absorption spectrum. Hence the FTIR analysis is carried out for the identification of the functional groups of bioactive compounds in normal leaf and leaf galls depending on the peaks found in the zone of infrared radiations.

Key words : Gall leaf, FTIR

1. Introduction

The *Mitragyna*is one of the most common vegetations in tropical areas. For shade, trees (vegetation) are planted across avenues, along roadsides, and in communities. For forestation programmes, *Mitragyn*a is the best option[1] [2]. It disperses a large number of leaves and rejects, which decay to improve the physio-chemical qualities of the soil beneath its canopy. This demonstrates an improvement in exchangeable bases, accessible plant nutrients, cation-exchange capacity, and soil organic carbon.

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The height of a fully grown Kadamba tree is 45 meters (148 feet). With a broad crown and a straight, cylindrical bole, this tree is enormous. It takes 6 to 8 years for this quickly growing plant with widely dispersing branches to reach maturity. Though it is usually smaller, the trunk's diameter can range from 100 to 160 cm.The length of a leaf is 13–32 cm (5.1–12.6 in). When the tree is four or five years old, it starts to blossom. The reddish-orange, fragrant flowers of kadamba have thick, globular heads that measure around 5.5 cm (2.2 in) in diameter.A fleshy yellow-orange infructescence with around 8000 seeds and tightly packed fleshy capsules is produced by Mitragyna parvifolia. As the fruit ripens, it splits open, releasing the seeds, which the wind or rain subsequently scatters.

To fully comprehend the insect-plant relationship, researchers must investigate changes in the metabolic profile of galled and normal tissues[3][4][5]. Standard procedures were used in studies involving Segregation of active ingredients present in normal and galled leaf were carried out using GC-MS, FTIR and HPTLC technique.

the altered state of metabolites in galled tissues as a result of cecidogenesis.

The Fourier Transform Infrared (FTIR) spectroscopy technique is used to create an infrared spectrum of emission or absorption of a solid, liquid, or gas sample[6].Infrared spectroscopy, or FTIR, involves subjecting a material to IR radiation. The sample absorbs some of the radiations and some radiations it transmits. The consequential indication is a spectrum at the detector which represents a molecular “fingerprint” of the sample. The efficacy of FTIR is due to the different spectral fingerprints. These fingerprints or functional groups are responsible for potential medicinal properties

2. Material and Methods

To fully comprehend the insect-plant relationship, researchers must investigate changes in the metabolic profile of galled and normal tissues. Standard procedures were used in studies

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involving the altered state of metabolites in galled tissues as a result of cecidogenesis. Segregation of active ingredients present in normal and galled leaf were carried out using GC-MS, FTIR and HPTLC technique.

To produce an infrared spectrum of emission or absorption of a solid, liquid, or gas sample, the FTIR (Fourier Transform Infrared) spectroscopy technique is used.

Preparation of Plant Extracts

Dried and powdered plant material (normal and galled leaf) were dehydrated at normal temperatures in shade and then powdered and soxhlet extracted with water. The obtained extracts were then strained using Whatman filter paper and then the solvent was dried in a rotary vacuum evaporator.

Five grams of both regular leaves and leaf galls were shade-dried at room temperature, pulverized, and extracted using the hot soxhlet extraction technique. The solvent used was methanol. After filtering the extracts via Whatman filter paper, the solvent was dried in a rotating vacuum evaporator. At a resolution of 4cm-1, Fourier-transform infrared was utilized to investigate the functional groups in the 4000-400cm-1 region.

Preparation of a Sample

An optically dense crystal is subjected to an infrared beam in the Attenuated Total Reflection (ATR) mode, and 0.1 grams of the dried crude powder was obtained for evaluation. Fourier-transform infrared with a scan range of 4000-400 cm-1 was used to analyze the functional groups of the powered sample of both sample extracts that had been fed into the FTIR spectroscope.

3. **FTIR Analysis**

The consequence of Fourier Transform (FT) is spectra that are used in the identification or quantification of the matter. This technique utilizes interferometry to document the details of

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a matter fixed in the IR beam. Using an FTIR interferogram, normal leaves and leaf galls were examined in the current study [6.].

4. Observations and Result

The FTIR analysis observations of both normal and leaf galls are presented in the interferograms (Plate 01, Fig. A-B), and Table 5.7 provides the relevant data [7].
Analysis of M. parvifolia using FT-IR Alkanes, alkenes, amines, and alcohol groups are among the functional groups that are present in normal leaves and leaf galls. Absorption bands at 3286.52, 2920.70, 2860.40, 1735.60, 1617.65, 1439.66, 1243.32, and 1038.33 cm-1 in a typical leaf extract indicated the presence of functional groups such as alkynes, alkanes, aldehydes, nitro group, esters, and ethers.The absorption band that the leaf gall extract displayed at 3445.94, 2917.33, 2849.78, 2349.1, 1730.17, 1616.53, 1385.35, 1160.35, and 1018.35 cm-1 indicated the presence of alkanes, carbon dioxide, carboxylic acids, alkanes, nitro groups, ethers, and esters in addition to phenols and alcohols.

5. Discussion

Normal leaf and leaf gall of *M. parvifolia* were analysed to find out presence of different functional groups such as alkanes, alkenes, alcohol, and amine. Alkynes, Alkanes, Aldehydes, Nitro group, Esters and Ethers were detected in normal leaf extract. In comparison to normal leaf, Phenols, Alcohols, Alkanes, Alkanes, Alkanes, carbon dioxide, Carboxylic acids, Alkanes, Nitro groups, Ethers and Esters were detected in the leaf gall extract [8].

6. Conclusion

The functional group and phytocompounds profilepresent in *M.parvifolia*normal leaf and leaf galls crude extracts confirm that it acts as an important source of drugs against various ailments. From the FTIR analysis, this could be concluded that the biosynthesis of metabolites is affected by insect attacks in the host plant. The existence of various functional groups is also

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associated with the leaf gall extract's strong antioxidant activity. Predicting the formula and structure of chemicals that may be used as pharmaceuticals or in industrial applications would be made easier with the help of this research. Nonetheless, the process of discovering a novel medication may benefit from the separation of certain phytochemical components.

PLATE-01

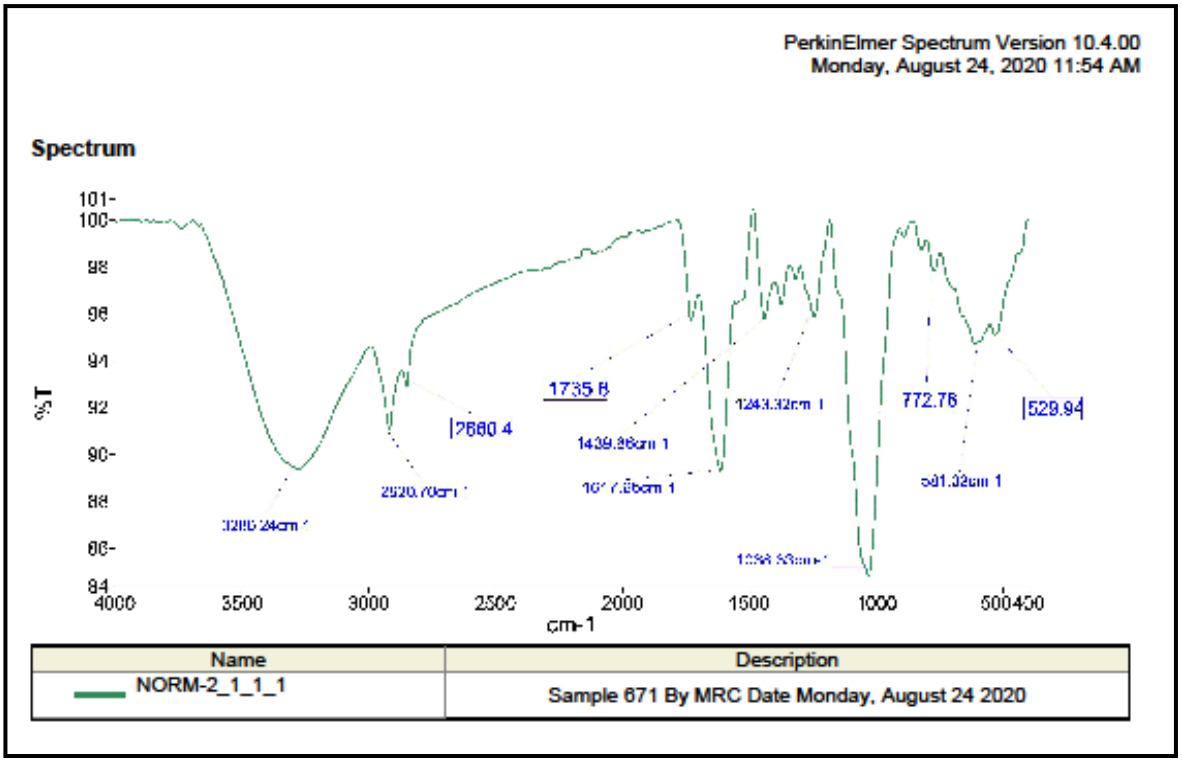

Fig. A

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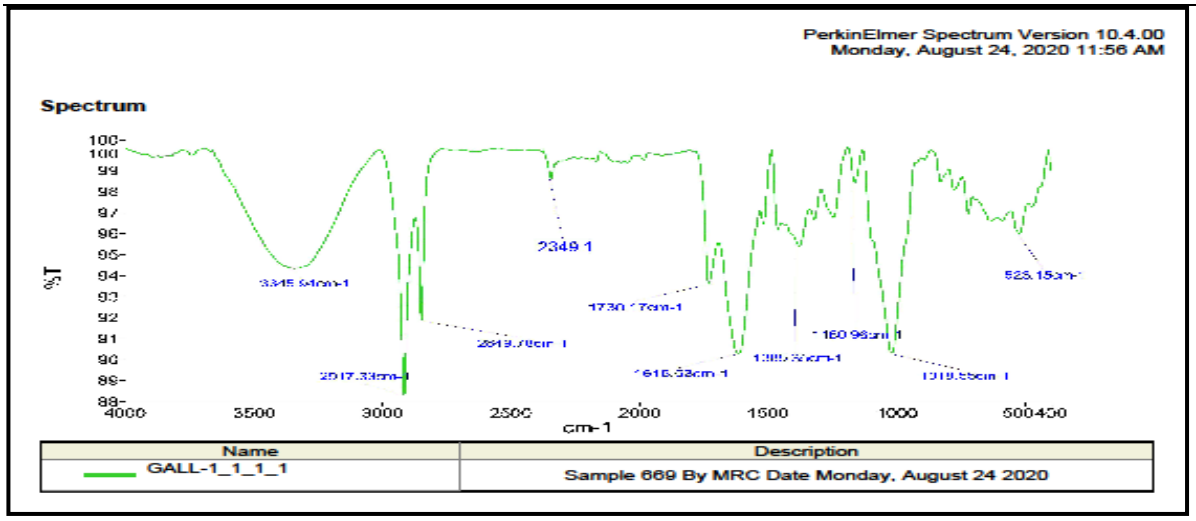

Fig. B

Plant Samples	Absorption Ranges (cm^{-1})	Functional Groups Name	Type of Vibration
Normal Leaf	3286.24	Alkynes	≡C-H stretch
	2920.70	Alkanes	H-C-H stretch
	2860.40	Alkanes	H-C-H stretch
	1735.60	Aldehydes	C=O stretch
	1617.65	Aldehydes	C=O stretch
	1439.66	Nitro group	N=O bend
	1243.32	Esters and Ethers	C=O and C-O stretch
	1038.33	Esters and Ethers	C=O and C-O stretch
Gall Leaf	3445.94	Phenols and alcohols	O-H stretch
	2917.33	Alkanes	H-C-H stretch
	2849.78	Alkanes	H-C-H stretch
	2349.10	Carbon dioxide	O=C=O stretch
	1730.17	Carboxylic acids	C=O stretch
	1616.53	Alkanes	C-C=C stretch
	1385.35	Nitro group	N=O bend
	1160.35	Ethers and Esters	C-O and C=O stretch
	1018.55	Ethers and Esters	C-O and C=O stretch

Table .01

FTIR spectrum peak absorption values and functional groups obtained for normal and leaf gall extracts

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References

[1.] Wellas, B.W. (1920) : Early stages of the developmental of certain *Pachypsylla* galls on Celtis. *Am. J. Bot*. 7 : 275-285.

[2.] Boysen-Jenson, P. (1948) : Formation of galls by *Mikiolafagi. Plant Physiol.*, 1 : 95-108.

[3.] Galls form in sugarcane stems and leaves in response to regulating drug injection, according to Arrillaga, J.G. (1949). 39: 489–4993 in Phytopathology.

[4.] Dhingra, S. (1980) : Studies on some insect and mite induced plant galls of Rajasthan. Ph.D. Thesis, Univ. of Rajasthan, Jaipur.

[5.] Gupta, J.P. (2000): Phytochemical studies on some insect and mite :induced plant galls of Rajasthan. In: Biotechnology and plant pathology. Current Trends. pp. 247-256.

[6.] Griffith, P.R. and De Haseth, J.A. (2007) : Infrared spectroscopy using Fourier transform, second edition 1-560. Wiley-Blackwell.

[7.] Oliveira, D. C., Martini, V. C., Moreira, A. S. F., Fuzaro, L., &GonÇalves, L. A. (2020) : A qualitative and quantitative structural overview of the induction of intralaminar leaf galls on Aspidospermatomentosum (Apocynaceae) by Pseudophacopteronlongicaudatum (Hemiptera). Brazilian Academy of Sciences Anais, 92

[7.] Improvements in Fourier transform infrared (FTIR) spectroscopy of biological tissues were reported by Abdullah, C.S.T., Martinez, M.A.G., Movasaghi, Z., Rehman, S., and Rehman, I.U. (2017). Apply Reviews of Spectroscopy, 52(5), 456-506.

[8.] Guedes, L. M., Torres, S., Sáez-Carillo, K., Becerra, J., Pérez, C. I., & Aguilera, N. (2022) : Espinosa nothofagi galls formed on Nothofagus obliqua buds experience less oxidative stress because to the high antioxidant activity of phenolic substances. 111–114 in Plant Science, 314.