



Research Article

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FT-IR studies on three different traits of Vilvam leaves (Bael)

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ABSTRACT

Vilvam is an important medicinal plant, which is used to treat many ailments of human beings in the traditional system of medicine. As one of the important conservation aspect of traditional medicinal plant, it is mostly grown in the Hindu Siva temples, where the leaves are mostly used for Pooja purpose and medicinal aspects. Based on the morphological features of the leaves three different traits of plants were identified and selected for the study. In the present study an attempt has been made to establish FT-IR profile and identify the functional groups of compounds present in the three different types of Vilvam. FTIR study was performed by a Bruker Alpha T system to detect the characteristic peaks. The result shows that the functional groups present in the all three traits of Vilvam leaves are compared and the variation is due to the genetical factors.

Keywords: FT-IR, Vilvam, medicinal plant, Bael

INTRODUCTION

Since time immemorial man has used various parts of plants in the treatment and prevention of many ailments [1]. Historically all medicinal preparations were derived from plants, whether in the simple form of plant parts or in the more complex form of crude extracts of different kind of plants. Today a substantial number of drugs are developed from plants which are active against a number of diseases. Aegle marmelos is one of the most important medicinal plants used to cure most of the common ailments. Aegle marmelos Linn. is commonly called as Bael in Hindi, Vilvam in Tamil and Bilva in Sanskrit. It belongs to the family Rutaceae. It is indigenous to India and is used in folk medicines. The Ayurvedic practitioners use almost all of their parts but the greatest medicinal value ascribed to its fruits[2]. Vilvam is a perennial tree, wild in the sub Himalaya tract, Central and South India. Aegle marmelos is a medium sized armed deciduous tree grows up to a height of 9-10 meters with straight, sharp, axillary thorns and yellowish brown shallowly furrowed corky bark. The leaves are trifoliate alternate, leaflets are ovate to lanceolate with pellucid – punctuate aromatic oil glands[4]. The lateral leaves are sessile and the terminal one is long petioled. The flowers are greenish white sweet scented present in the axillary panicles. The fruits are Globus woody berry with yellowish ring, seeds numerous embedded in orange brown sweet gummy pulp. The leaves are used as astringent, laxative, febrifuge and expectorant. The leaves are useful in ophthalmia, inflammations, catarrh, diabetic and asthmatic complaints[10]. The leaves are used for the heart and brain disorders. The confection called ilakam is made of fruit is used to treat tuberculosis and loss of appetite[5]. Stress is produced during normal metabolic process in the body as well as induced by a variety of environmental and chemical factors which cause generation of various reactive free radicals and subsequent damage to macromolecules like DNA, Proteins and Lipids could be cured by Vilvam. No specific scientific evaluation of antioxidant activity of Aegle marmelos fruit pulp has been reported so far. Therefore, it was thought worthwhile to evaluate antioxidant activity of Aegle marmelos fruit pulp to confirm its

folk medicinal claim. Many naturally occurring products have been reported to contain large amount of antioxidant compounds other than vitamin C, E and carotenoid[6]. These antioxidants play a vital role in delaying, intercepting or preventing oxidative reactions catalyzed by free radical. Antioxidant activity of medicinal plants might be due to the presence of phenolic compounds such as flavonoids[3,4], Phenolic acids and phenolic diterpene[13]. Synthetic antioxidants like butylatedhydroxy anisole (BHA) butylatedhydroxy toluene (BHT), tertiarybutylated hydroxyquinone and gallic acid esters have been suspected to be carcinogenic. Hence, strong limitations have been placed on their use and there is a trend to replace them with naturally occurring antioxidants[7]. Moreover, these synthetic antioxidants also show low solubility and moderate antioxidant activity[8]. Hence, search for natural antioxidant has greatly been increased in the recent scenario. The *Aegle marmelos* contains more of natural Antioxidant in the leaves and the fruit pulp. Because of this specific property the *Vilva* is used in the treatment and preventive of all common ailment of mankind[9][10]. The three traits of *Vilva* is subjected to FT-IR studies. Fourier transform infrared spectrometry is a physico-chemical analytical technique that does not resolve the concentrations of individual metabolites but provides a snapshot of the metabolic composition of a tissue at a given time[11] (Griffiths and de Haseth 1986). FTIR can be employed to determine the structure of unknown composition and the intensity of the absorption spectra associated with molecular composition or content of the chemical group[12]. The FT-IR method measures the vibrations of bonds within chemical functional groups and generates a spectrum that can be regarded as a biochemical or metabolic “fingerprint” of the sample. By attaining IR spectra from plant samples, it might possible to detect the minor changes of primary and secondary metabolites[13][14]. At present, particularly in phytochemistry, FTIR has been exercised to identify the concrete structure of certain plant secondary metabolites[15][16] 4-6. But, on pharmacognosy FTIR is still a new tool to characterize and identify the commercial components from the adulterant. FT-IR method has been successfully utilized in the characterization of bacterial, fungal and higher plant[17][18][19]. FT-IR is one of the most widely used methods to identify the chemical constituents and elucidate the compounds structures, and has been used as a requisite method to identify medicines in Pharmacopoeia of many countries

EXPERIMENTAL SECTION

Collection and processing of plant material

The leaves of three traits of *Vilva*, were collected from, Agasthiyamalai region of South Western Ghats, Agasthiyamalai Biosphere reserve during September 2013. The collected leaves were cleaned and dried under shade. The powdered leaves were stored in refrigerator for further use

FTIR Spectroscopic Analysis

A small amount of powdered leaves samples of three traits of was respectively placed directly on the germanium piece of the Bruker Alpha T infrared spectrometer with constant pressure applied and data of infrared absorbance, collected over the wave number ranged from 4000 cm^{-1} to 500 cm^{-1} and computerized for analyses by using the IRPAL. The reference spectra were acquired from the cleaned blank crystal prior to the presentation of each sample replicate. All spectra were collected with a resolution of 4-1 cm^{-1} and to improve the signal-to-noise ratio, 256 scans were co-added and averaged. Samples were run in triplicate and all of them were undertaken within a day period.

RESULTS AND DISCUSSION

The results of three different traits of *Vilva* leaves FTIR analysis the absorption spectrum and functional groups of the trait 1 (seven Leaves) are given in figure 1 and table 1 respectively. The FT-IR absorption spectrum and functional groups of the trait 2 (three small leaves) are given in figure 2 and table 2 respectively. The FT-IR absorption spectrum and functional groups of the trait 3 (three big leaves) are given in figure 3 and table 3 respectively. The trait 1(seven Leaves) *Vilva* leaf powder confirmed the presence of Alkyl Halides, Alkenes, Alkyl Halides, Amines, Phenols, Carboxylic acid, Misc. Sulfone, Misc. Sulfone, Aromatics, Misc. Niro Comp, Misc. Niro Comp, Amines, Aldehydes, Misc. Phosphine and Alkanes compounds which shows major peaks at 656.74, 686.05, 1017.72, 1153.05, 1198.67, 1243.73, 1316.57, 1339.26, 1339.47, 1430.12, 1509.24, 1539.73, 1593.22, 1700.15, 2359.81, 2916.38 respectively. The Ttrait 2 *Vilva* leaf powder absorbance frequency confirms the presence of Alkyl halides, Alkynes, Alkanes, Aromatics, Aromatics, Misc. Esters, Esters, Amines, Amines, Amines, Misc. Amine Oxides, Amines, Misc. Sulfate, Aromatics, Alkanes, Alkanes, Misc. Nitro Comp, Carboxylic acids, Ketones, Esther, Misc. Phosphine and Alkanes compounds which shows major peaks at 564.39, 686.09, 723.23, 807.8, 832.12, 899.37, 1011.49, 1061.02, 1098.59, 1211.1, 1246.79, 1314.42, 1394.87, 1413.75, 1452.56, 1473.53, 1514.43, 1595.12, 1714.97, 1732.2, 2367.5, 2913.72 respectively. The Trait 3 of *Vilva* leaf powder

absorbance frequency confirms the presence of Alkyl halides, Alkynes, Aromatics, Alkenes, Aromatics, Misc. Esters, Alcohols, Amines, Alkanes, Aromatics, alkanes, Misc. Nitro Compounds, Amides, alkenes and amides compounds which shows major peaks at 646.45, 671.8, 833.05, 864.17, 1012.81, 1099.48, 1338.65, 1378.39, 1433.5, 1453, 1520.92, 1619.21, 1647.1, 1701.12 respectively.

The results of the present study reveals the FTIR spectrum profile of the three different traits of Vilvam plant. Spectral differences are the objective reflection of componential differences. By using FT-IR 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 12. The results of the present study spectrum also revealed the functional constituents present in the crude powder of three traits of Vilvam leaves Many researchers applied the FTIR spectrum as a tool for distinguishing closely associated plants and other organisms The FT-IR spectral analysis reveals that in the trait 1 there are 26 peaks of which 6 functional groups are present in large quantity. In the trait 2 there are 39 peaks of which 10 functional groups are present in large quantity. In the trait 3 there are 27 peaks of which 7 functional groups are present in large quantity. The functional groups present in the Trait 2 and Trait 3 are almost similar of which the trait 2 has more functional groups than trait 3. The trait 1 has less number of functional groups than the other two traits and less number of functional groups. Since the trait 2 has more number of peaks and functional groups it can be used as a effective medicinal plant when compared to other traits.

The results of the present study coincided with the previous observations observed by various plant biologist and taxonomist. The previous report clearly indicated that the compounds like alkaloids, flavonos, terpenoids and saponins are the active principles present in the leaves of vilvam. The results of the present study needs a novel phytochemical marker to identify the difference between the different traits of Vilvam. Further advanced spectroscopic studies are required for the structural elucidation and identification of active principles present in the leaves of Vilvam. Even though various parts of Aelge marmelos are used for the treatment of human ailments, the leaves are predominately used to treat cardiac, neuro and digestive problems. Moreover it is also used as a immunomodulatory drug. Because of the potential use of the leaves, the qualitative phytochemical analysis work was carried out to find out the active principle present in the leaves.

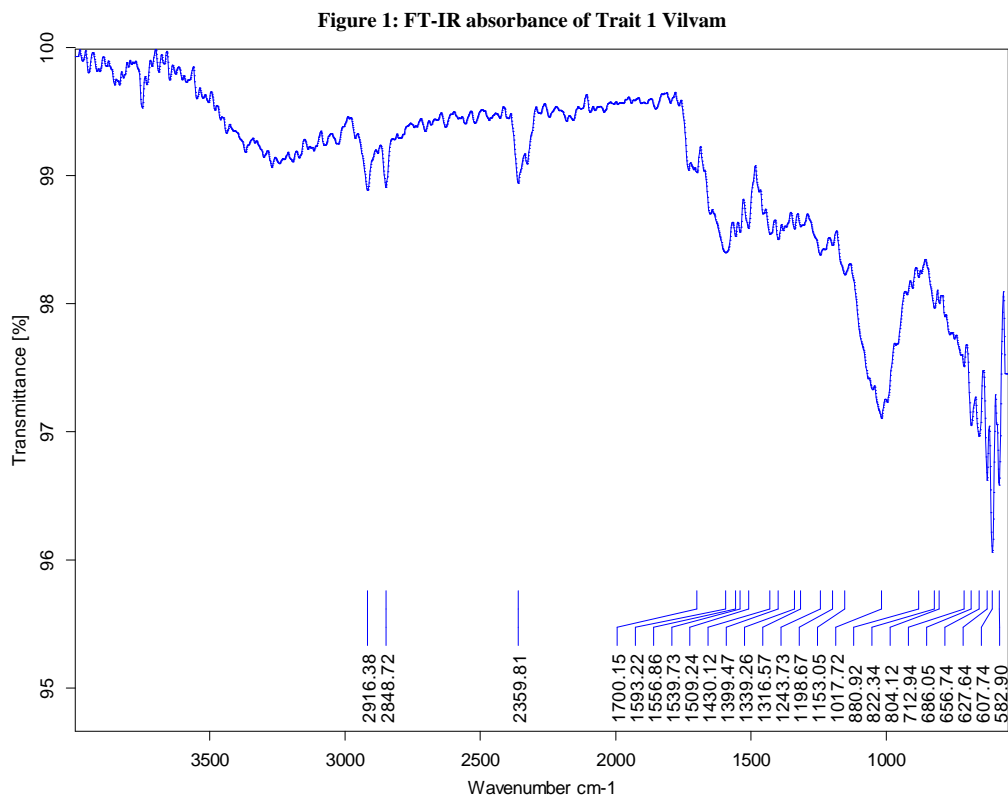


Figure 2: FT-IR absorbance of Trait 2 Vilvam

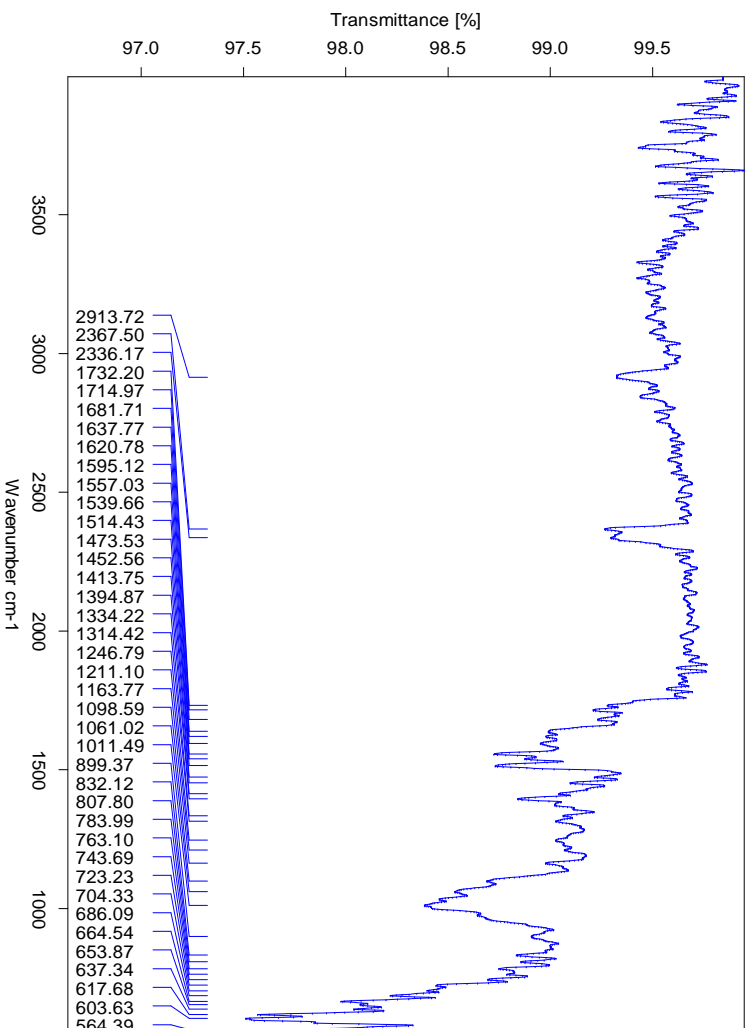


Figure 3: FT-IR absorbance of Trait 2 Vilvam

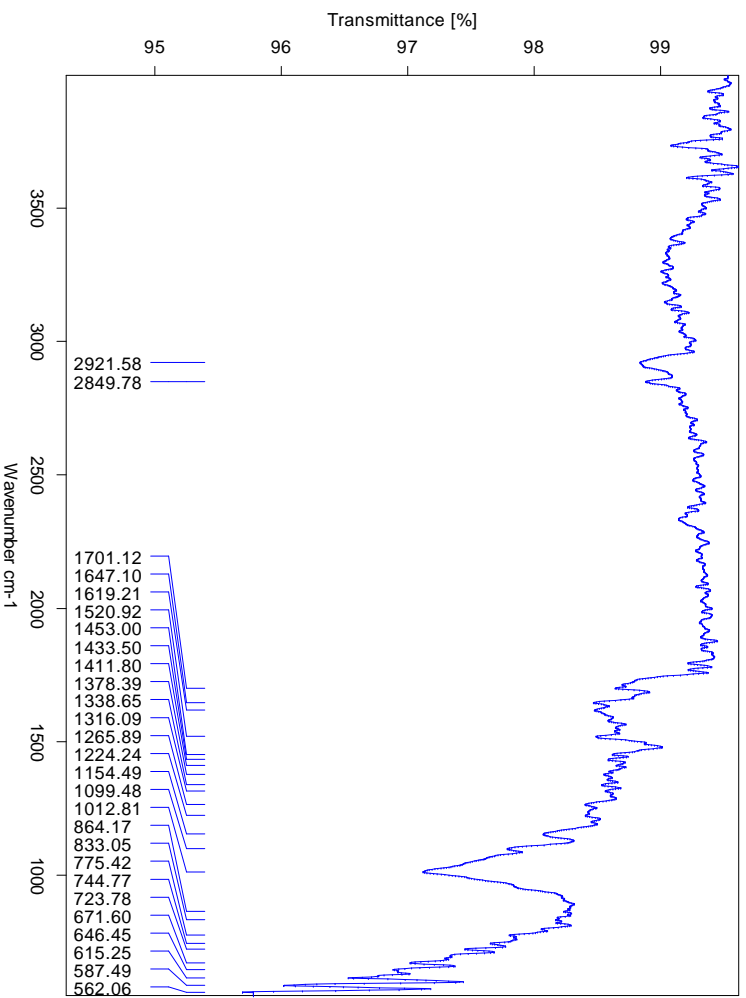


Table 1: Frequency of possible functional group of trait 1 Vilvam

1	Frequency	Possible Functional group
2	656.74	Alkyl Halides
3	686.05	Alkenes
4	1017.72	Alkyl Halides
5	1153.05	Amines
6	1198.67	Phenols
7	1243.73	Carboxylic acid
8	1316.57	Misc. Sulfone
9	1339.26	Misc. Sulfone
10	1430.12	Aromatics
11	1509.24	Misc. Nitro Comp
12	1539.73	Misc. Nitro Comp
13	1593.22	Amines
14	1700.15	Aldehydes
15	2359.81	Misc. Phosphine
16	2916.38	Alkanes

Table 2: Frequency of possible functional group of trait 2 Vilvam

S. No	Frequency	Possible functional group
1	564.39	Alkyl halides
2	686.09	Alkynes
3	723.23	Alkanes
4	807.8	Aromatics
5	832.12	Aromatics
6	899.37	Misc. Esters
7	1011.49	Esters
8	1061.02	Amines
9	1098.59	Amines
10	1211.1	Amines
11	1246.79	Misc. Amine Oxides
12	1314.42	Amines
13	1394.87	Misc. Sulfate
14	1413.75	Aromatics
15	1452.56	Alkanes
16	1473.53	Alkanes
17	1514.43	Misc. Nitro Comp
18	1595.12	Carboxylic acids
19	1714.97	Ketones
20	1732.2	Esther
21	2367.5	Misc. Phosphine
22	2913.72	Alkanes

Table 3: Frequency of possible functional group of trait 3 Vilvam

	Frequency	Possible Functional Group
1	646.45	Alkyl halides
2	671.8	Alkynes
3	775.42	Aromatics
4	833.05	Alkenes
5	864.17	Aromatics
6	1012.81	Misc. Esters
7	1099.48	Alcohols
8	1338.65	Amines
9	1378.39	Alkanes
10	1433.5	Aromatics
11	1453	alkanes
12	1520.92	Misc. Nitro Compounds
13	1619.21	Amides
14	1647.1	alkenes
15	1701.12	amides

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