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Original Article

SPECTROSCOPIC STUDIES ON *POUZOLZIA WIGHTII* BENN

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ABSTRACT

Objective: The present study was aimed to reveal the spectroscopic profile (UV-Vis and FT-IR) of *Pouzolzia wightii* Benn.

Methods: To detect the UV-Vis spectroscopic profile of *P. wightii* crude extracts were examined under UV-Vis Shimadzu spectrophotometer with the wavelength ranged from 100 to 1100 nm. About 1 mg of different extracts of petroleum ether, chloroform, ethyl acetate and acetone, ethanolic extracts of *P. wightii* were separately made into thin discs with 10-100 mg of potassium bromide using a mould and pressed under anhydrous conditions. The pellets were measured in an automatic recording FT-IR Spectrophotometer (Shimadzu 8400S) in the range of 400 to 4000 cm^{-1}

Results: In UV-Vis analysis, *P. wightii* petroleum ether extracts showed more number of peaks in roots (15) than other studied parts. Chloroform and ethyl acetate extracts of *P. wightii* leaves observed 9 peaks and acetone extracts of *P. wightii* stem showed 10 peaks. Medicinal property of plant extracts are confirmed by the presence of secondary metabolites. FT-IR analysis of ethyl acetate extracts of *P. wightii* leaves, stem and root observed the highest number of (16, 12 and 16) functional compounds.

Conclusion: These UV-Vis and FT-IR spectroscopic results may be used as a pharmacognostic marker in the pharmaceutical industries and can be used as a chemometric tool to distinguish the studied *P. wightii* leaves, stem and root. The present study used to find out the bioactive compounds which may be subjected to subsequent target isolation. Further research will be needed for the structural characterization of the isolated compound by the use of different analytical methods such as NMR and mass spectrophotometer.

Keywords: *Pouzolzia wightii,* FT-IR-Fourier Transform-Infra Red, UV-Vis-Ultra Violet–Visible, Pharmacognosy

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INTRODUCTION

Medicinal plants are abundantly available all over the world and are gaining a lot of attention due to their specific role in various health care of human immune system in different nations. They serve as therapeutic agents as well as important raw materials for the manufacture of traditional and modern medicine [1]. Plant-based drugs are highly effective, low cost, easily available, evidently minor toxicity as side effects and proving to be a good substitute for allopathic medicines [2]. Phytochemicals are biologically active chemical compounds naturally present in a plant which acts as a natural defence system for plants and provide aroma, colour and flavour. They have a significant role in treating human diseases such as cancer, coronary heart diseases, diabetes and infectious diseases [3]. The therapeutic properties of medicinal plants are due to some phytochemical compounds. Various secondary metabolites with different Biopotency were present in medicinal plants which include flavonoids, carotenoids, alkaloids, anthocyanidins, phenolics, tannins, carboxylic acids, terpenoids, amino acids and inorganic acids [4]. Presence of these phytoconstituents provides specific distinctiveness and properties to the plants [5]. Therefore, the phytochemical analysis of these constituents would help in determining various biological activities of plants. A variety of techniques can be used to determine the presence of such phytoconstituents in medicinal plants. Spectroscopic (FT-IR-Fourier Transform-Infra Red; UV-Vis-Ultra Violet-Visible) methods together or separate can be used in this sense as well as conventional methods [6]. In many applications other techniques are available but UV-Visible spectrometry is specifically used for its simplicity, versatility, speed, accuracy and cost-effectiveness; it is used to determine the chemical compounds of the plants.

UV-Vis spectrophotometry related to the spectroscopy of photons in the UV-visible region. UV-Visible spectroscopy uses light in the visible ranges or its adjacent ranges. FT-IR is a measurement technique to identify the functional constituents and concrete structure of certain plant secondary metabolites [7, 8]. In chemotaxonomy and pharmacognosy, the UV-Vis and FT-IR spectroscopic profiles are used as a biochemical and pharmacognostical marker to identify the medicinal source. But there is no report on the spectroscopic studies of *Pouzolzia wightii* Benn. With this background, the present study was aimed to reveal the spectroscopic profile (UV-Vis and FT-IR) of *Pouzolzia wightii* Benn.

MATERIALS AND METHODS

Preparation of extracts

Pouzolzia wightii Benn was collected from their natural habitats and thoroughly washed by using tap water and then followed by distilled water to remove the unwanted debris. To remove the excess water, plant samples were blotted on the blotting paper and shade dried at room temperature for 20 d. The shade dried samples were grounded to a fine powder using a mechanical grinder. The powdered samples were stored in airtight container. The powdered materials (30 g) of *P. wightii* were successively extracted with 400 ml of petroleum ether, chloroform, ethyl acetate, acetone and ethanol (Hi-Media, Mumbai) using Soxhlet extractor for 8-12 h at a temperature not exceeding the boiling point of the solvents. The residues of the plant samples were obtained and stored in a refrigerator at 4°C for further studies.

Chemicals and reagents

The solvents used in this study are purchased from Hi-Media, Mumbai, India.

UV–Vis analysis

UV–Vis spectrophotometer analysis, the extracts were centrifuged at 3000 rpm for 10 min and filtered through Whatmann No. 1 filter paper and the filtrate was used for spectroscopic analysis. To detect the UV-Vis spectroscopic profile of *P. wightii* crude extracts were examined under UV–Vis shimazdu spectrophotometer with the wavelength ranged from 100 to 1100 nm.

FT-IR spectroscopic analysis

FT-IR analysis was performed using Perkin Elmer Spectro-photometer system, which was used to detect the characteristic peaks and their functional groups. About 1 mg of different extracts of petroleum ether, chloroform, ethyl acetate and acetone, ethanolic extracts of *P. wightii* were separately made into thin discs with 10-100 mg of potassium bromide using a mould and pressed under anhydrous conditions.

The pellets were measured in an automatic recording FT-IR Spectrophotometer (Shimadzu 8400S) in the range of 400 to 4000 cm^{-1}. The percentage of transmissions was recorded against the wave number. The peak values of FT-IR were recorded and the functional groups were predicted [9]. Each and every analysis was repeated twice for the spectrum confirmation.

RESULTS

UV–Vis analysis

The UV–Vis spectroscopic profile of different extracts of *P. wightii* were taken from wavelength ranged from 200 to 800 nm due to the sharpness of the peak values and proper baseline. The presence of an absorbance band at a particular wavelength is a good indicator for the presence of a chromophore. The absorbance of the extracts revealed the concentrations of compounds present in the crude extracts. These spectrum profiles are useful to identify the specific bioactive classes of compounds found in various extracts of *P. wightii*.

The results of UV–Vis spectroscopic analysis of petroleum ether, chloroform, ethyl acetate, acetone and ethanol extracts of *P. wightii* leaves, stem and roots were illustrated in table 1. UV–Vis spectroscopic profile of ethanol, chloroform, ethyl acetate extracts of *P. wightii* leaves displayed more number of peaks (5) followed by acetone (3 peaks) and petroleum ether extracts (2 peaks). In *P. wightii* leaves, UV region showed only one peak with 0.325 absorbances at 319 nm. The invisible region, ethyl acetate extracts of *P. wightii* leaves represented the maximum absorbance 4.000 at 403 nm and petroleum ether extracts of *P. wightii* leaves were illustrated minimum absorbance 0.062 at 668 nm in table 1.

In *P. wightii* stem, acetone and ethyl acetate extracts expressed more number of peaks (6) followed by ethanol and chloroform (4), petroleum ether (3) extracts. Acetone extracts of *P. wightii* stem showed the highest absorbance 3.457 at 339 nm and the lowest absorbance 1.931 at 305 nm in UV region. The invisible region, chloroform extracts showed the maximum absorbance 2.436 at 665 nm and petroleum ether extracts illustrated minimum absorbance at 666 nm (table 1).

Among the five different extracts of *P. wightii* root, chloroform and petroleum ether extracts expressed more number of peaks (7) followed by ethanol and ethyl acetate (6 peaks), acetone (1 peaks) extracts. An ethyl acetate extracts of *P. wightii* root exhibited highest absorbance 1.702 at 307 nm and the lowest absorbance 0.317 at 319 nm in petroleum ether extracts. Invisible region, acetone extract represented the maximum absorbance 1.011 at 661 nm and petroleum ether extracts exhibited minimum absorbance 0.118 at 533 nm (table 1).

Table 1: UV-Vis peak values of *Pouzolzia wightii*

Plant extracts	Leaves		Stems		Roots	
	λ max	ABS	λ max	ABS	λ max	ABS
Petroleum ether	668	0.062	751	0.03	791	0.082
	319	0.325	666	0.063	667	0.145
			310	2.962	607	0.111
					533	0.118
					505	0.124
					409	0.263
					319	0.317
Ethanol	666	0.462	665	0.15	664	0.237
	608	0.122	497	0.182	606	0.169
	531	0.178	402	0.512	538	0.189
	502	0.219	305	1.931	504	0.202
	402	2.128			407	0.547
					307	1.557
Ethyl acetate	664	1.311	664	0.381	665	0.236
	606	0.399	604	0.201	605	0.128
	540	0.559	534	0.268	536	0.153
	504	0.614	502	0.308	504	0.167
	403	4	409	1.216	409	0.671
			307	2.991	307	1.702
Chloroform	697	0.889	953	1.26	699	0.189
	667	1.487	665	2.436	666	0.261
	609	0.719	606	1.959	608	0.208
	544	0.899	540	2.157	542	0.242
	507	0.891	508	2.214	515	0.234
					413	0.559
					305	1.173
Acetone	664	0.825	663	0.533	661	1.011
	606	0.213	605	0.157		
	540	0.328	534	0.224		
			504	0.27		
			409	1.945		
			339	3.457		

Note: λ max–Wavelength of maximum absorption; ABS–Absorbance

FT–IR spectroscopic analysis

The FT-IR spectrum was used to identify the functional group of the active components with reference to the peak values in the region of infrared radiation. The analytical evaluation of the FT-IR spectrum in terms of functional groups corresponding to absorption of certain frequencies of *P. wightii* exhibited the spectral features. It also revealed significant differences in band position and absorbance intensities.

The comparative FT-IR spectrum showed an apparent change in relative intensity of the bands. FT-IR peak values for the three different parts of *P. wightii* were displayed with varied frequency

ranged and the functional groups were obtained from absorption spectra in table 2.

FT-IR analysis of *Pouzolzia wightii* leaves

The FT–IR peak values for five different extracts of *P. wightii* leaves were displayed in table 2; fig. 1-5. The strong and medium band with C–O stretch, C-C-stretch (in ring) and-C=C-stretching vibration band corresponding to alcohols, carboxylic acids, esters, ethers, aromatics and alkenes showed their occurrence in all the five extracts viz., petroleum ether (1166.29 $_{(s)}$ cm^{-1}, 1410.84 $_{(m)}$ $cm^{-1}$and 1658.15 $_{(m)}$ cm^{-1}), acetone (1036.43 $_{(s)}$ cm^{-1}, 1443.66 $_{(m)}$ cm^{-1}, 1448.37 $_{(m)}$ cm^{-1} and 1659.57 $_{(m)}$ cm^{-1}), chloroform (1037.36$_{(s)}$ cm^{-1}, 1443.27$_{(m)}$ cm^{-1} and 1659.17 $_{(m)}$ cm^{-1}), ethanol (1055.80 $_{(s)}$ cm^{-1}, 1443.66 $_{(m)}$ cm^{-1}, 1659.26 $_{(m)}$ cm^{-1}) and ethyl acetate (1074.23 $_{(s)}$ cm^{-1}, 1448.63 $_{(m)}$ $cm^{-1}$and 1659.13$_{(m)}$ cm^{-1}) of *P. wightii* leaves respectively. The peak values at 1629.41, 1628.88, 1628.73 and 1628.09 $_{(m)}$ cm^{-1}respectively) matching to N–H bend which represents the presence of 1˚amines in four different extracts of *P. wightii* leaves *viz.,* petroleum ether, acetone, ethyl acetate and ethanol. Nitro compounds of medium intensity with N–O symmetrical stretching was observed in acetone (1513.88 $_{(m)}$ cm^{-1}), chloroform (1530.99 $_{(m)}$ cm^{-1}), ethanol (1548.87 $_{(m)}$ cm^{-1}) and ethyl acetate (1530.86 $_{(m)}$ cm^{-1}) extracts *P. wightii* leaves. Two strong and two medium peaks obtained with =C-H bend, C=O stretch, C-H stretch showed the presence of alkenes, α, β unsaturated aldehydes, ketones and alkanes in petroleum ether (974.1$_{(s)}$ cm^{-1}8, 1677.23 $_{(s)}$ $cm^{-1}$and 2918.58$_{(m)}$ cm^{-1}), ethyl acetate (974.55$_{(s)}$ cm^{-1}, 1709.64 $_{(s)}$ $cm^{-1}$and 2918.19$_{(m)}$ cm^{-1}) and ethanolic (975.6$_{(s)}$ cm^{-1}5,1708.89 $_{(s)}$ $cm^{-1}$and 2853.74$_{(m)}$ cm^{-1}) extracts of *P. wightii*. The frequency 720.27 and 719.90 $_{(m)}$ $cm^{-1}$with strong and broad vibrations observed in petroleum ether and acetone extracts of *P. wightii* depicted the presence of alkanes. The band at 2850.83 and 2850.82 $_{(m)}$ cm^{-1}which was attributed to O-H stretch revealed the presence of carboxylic acids in acetone and chloroform extracts of *P. wightii*. The functional group's alkyl halides and 1˚2˚ amines with the medium, strong and broad band corresponding to C-Br stretch and N-H wag at 690-515 $_{(m)}$ $cm^{-1}$and 910-665 $_{(s,b)}$ cm^{-1}peak values were present only in ethanolic extracts (669.32 and 900.07) of *P. wightii*.

Acetone extracts of *P. wightii* leaves showed the presence of functional groups *viz.,* aromatics, 1˚,2˚ amines, amides corresponding to C-H "oop" and N-H stretch at peak values 833.48 $_{(s)}$ $cm^{-1}$and 3357.61 $_{(m)}$ $cm^{-1}$with strong and medium intensity band. The medium and strong intensity band occur at 836.07 $_{(m)}$ $cm^{-1}$and 1722.54 $_{(s)}$ cm^{-1}peak values were corresponding to C-Cl and C=O stretching indicated the presence of alkyl halides, esters and saturated aliphatics only in ethyl acetate extract of *P. wightii*. The functional group's alkyl halides, aldehydes, saturated aliphatics were located at 1162.05 $_{(m)}$ $cm^{-1}$and 1722.87 $_{(s)}$ cm^{-1}peak values corresponding to C-H wag (-CH_2X) and C=O stretch which were present only in chloroform extracts of *P. wightii* leaves. In petroleum ether extracts of *P. wightii* the medium band at 1168.45 $_{(m)}$ cm^{-1}corresponding to C-N stretch indicated the presence of aliphatic amines.

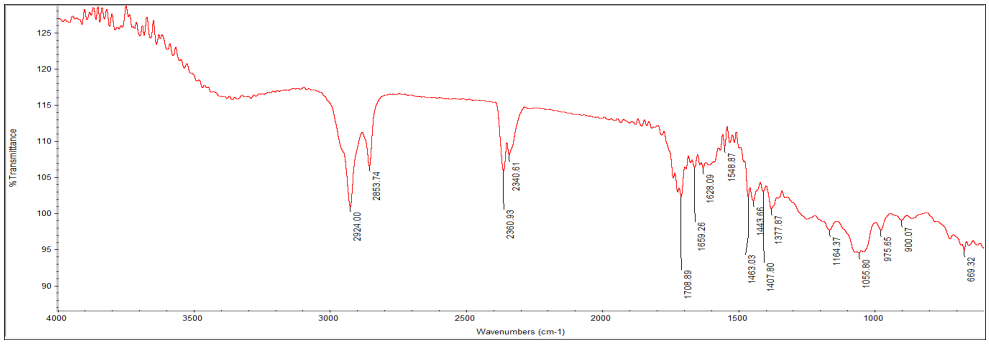

Fig. 1: FT-IR analysis of *P. wightii* leaves ethanolic extract

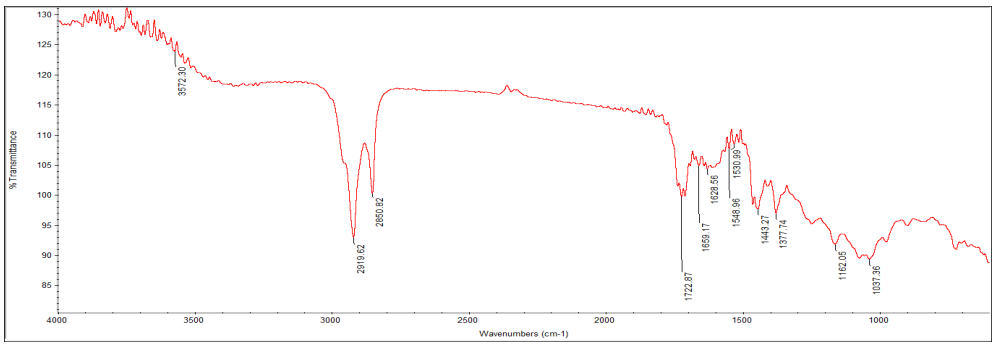

Fig. 2: FT-IR analysis of *P. wightii* leaves chloroform

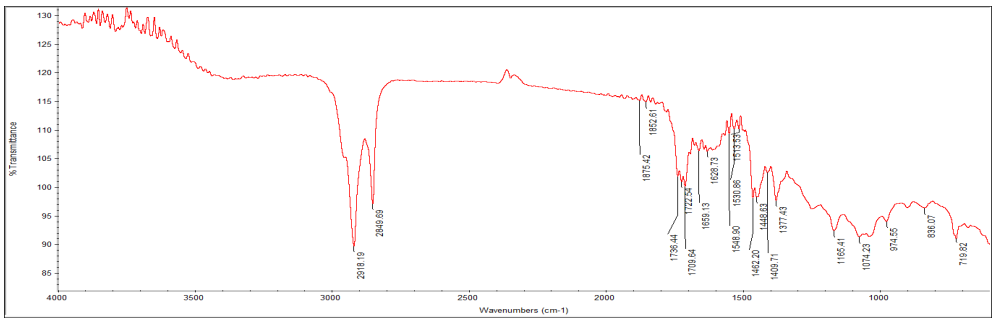

Fig. 3: FT-IR analysis of *P. wightii* leaves ethyl acetate extract

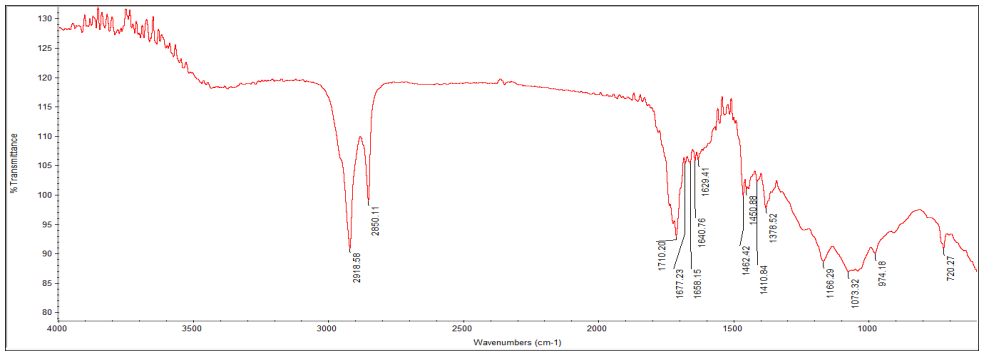

Fig. 4: FT-IR analysis of *P. wightii* leaves petroleum ether extract

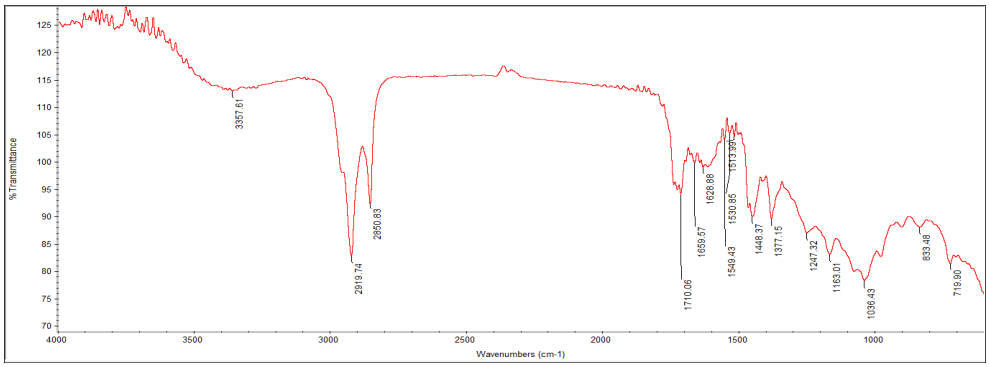

Fig. 5: FT-IR analysis of *P. wightii* leaves acetone

FT-IR analysis of *Pouzolzia wightii* stem

The medium intensity regions which were assigned due to C-N stretch and N-H bend vibration of aliphatic amines and 1° amines were observed in all the five different extracts viz., petroleum ether (1168.45 and 1640.51 $_{(m)}$ cm^{-1}), acetone 1029.34 and 1601.21 $_{(m)}$ cm^{-1}), chloroform (1029.74 and 1630.00 $_{(m)}$ cm^{-1}), ethanol (1028.58 and 1600.58 $_{(m)}$ cm^{-1}) and ethyl acetate (1031.02 and 1601.00 $_{(m)}$ cm^{-1}) extracts of *P. wightii* (table 2; fig. 6-10). The functional groups alkanes with C-H bend and carboxylic acid corresponding to O-H stretch with medium intensity bands were found in four different extracts *viz.,* petroleum ether (1462.48 and 2848.50 $_{(m)}$ cm^{-1}), acetone (1463.17 and 2849.02 $_{(m)}$ cm^{-1}), chloroform (1462.68 and 2848.58 $_{(m)}$ cm^{-1}) and ethyl acetate (1463.21 and 2848.61 $_{(m)}$ cm^{-1}) extracts of *P. wightii* (table 2; fig. 6-10). Nitro compounds corresponding to N-O symmetric stretching with medium intensity band which showed the presence in acetone (1513.88$_{(m)}$ cm^{-1}), chloroform (1513.28$_{(m)}$ cm^{-1}), ethyl acetate (1513.86$_{(m)}$ cm^{-1}) and ethanolic (1514.53$_{(m)}$ cm^{-1}) extracts of *P. wightii* (table 2; fig. 6-10). Petroleum ether, acetone, ethanol and ethyl acetate extracts of *P. wightii* showed the presence of α, β unsaturated aldehydes, ketones matching to C-O stretch with the strong band at 1709.61, 1709.12, 1708.89 and 1709.64 $_{(s)}$ cm^{-1}respectively (table 2; fig. 6-10). Alkyl halides were found to be present with C-Cl stretch at 719.67, 719.40 and 719.67 $_{(m)}$ cm^{-1}respectively with medium intensity band represents its presence in petroleum ether, chloroform and ethyl acetate extracts *P. wightii*. The strong peak values intensity with C-O stretching were determined the presence of alcohols, carboxylic acids, esters and ethers in acetone (1158.72 $_{(s)}$ cm^{-1}), chloroform (1162.67 $_{(s)}$ cm^{-1}) and ethyl acetate (1161.34 $_{(s)}$ cm^{-1}) extracts of *P. wightii* stem. The peak values at 1443.26, 1443.66 and 1448.63 $_{(m)}$ cm^{-1}respectively present in acetone, ethanol and ethyl acetate extracts of the stem with medium intensity band corresponding to C-C stretch (in the ring) showed the presence of aromatics. The functional group's esters and saturated aliphatic with strong intensity band corresponding to C=O stretch were present in petroleum ether (1736.04 $_{(s)}$ cm^{-1}) and ethyl acetate (1722.54 $_{(s)}$ cm^{-1}) extracts of *P. wightii* stem. Alkenes at 1659.13 $_{(m)}$ cm^{-1} with medium intensity band corresponding to–C=C-stretch were found only in ethyl acetate extracts of *P. wightii* stem.

The functional group alkane corresponding to C-H stretch with the medium band at 2853.74 $_{(m)}$ cm^{-1}peak value represents its occurrence only in ethanolic extracts *P. wightii* stem (table 2; fig. 6-10).

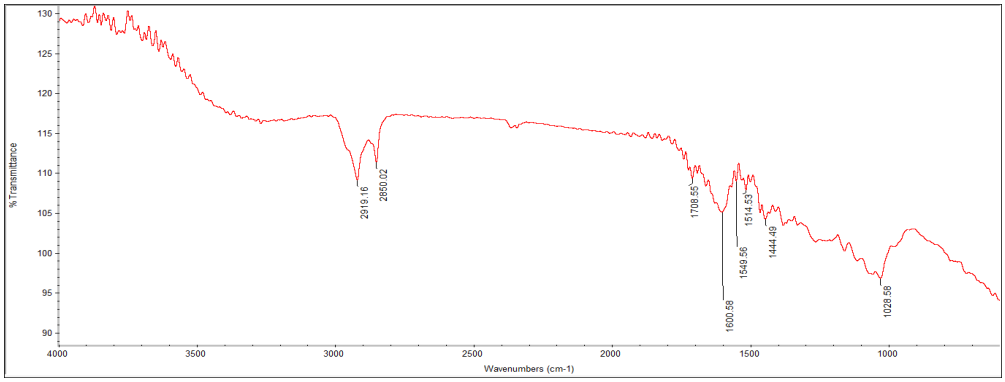

Fig. 6: FT-IR analysis of *P. wightii* stems ethanolic extract

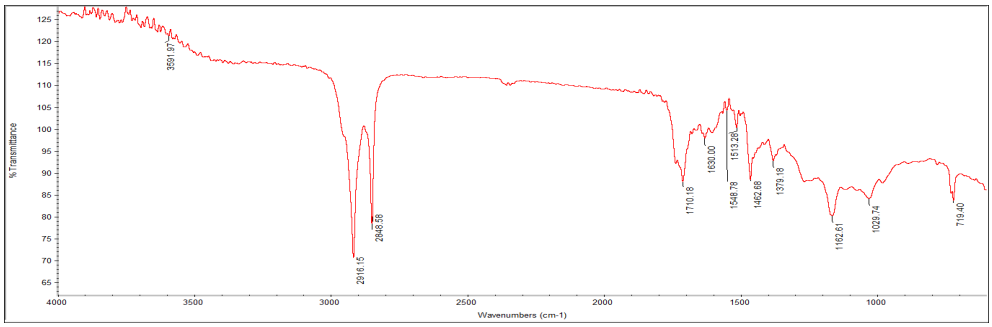

Fig. 7: FT-IR analysis of *P. wightii* stem chloroform extract

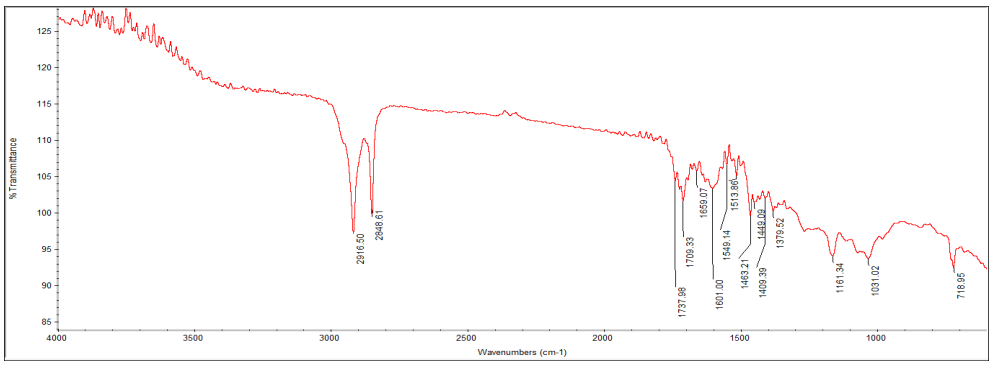

Fig. 8: FT-IR analysis of *P. wightii* stem ethyl acetate extract

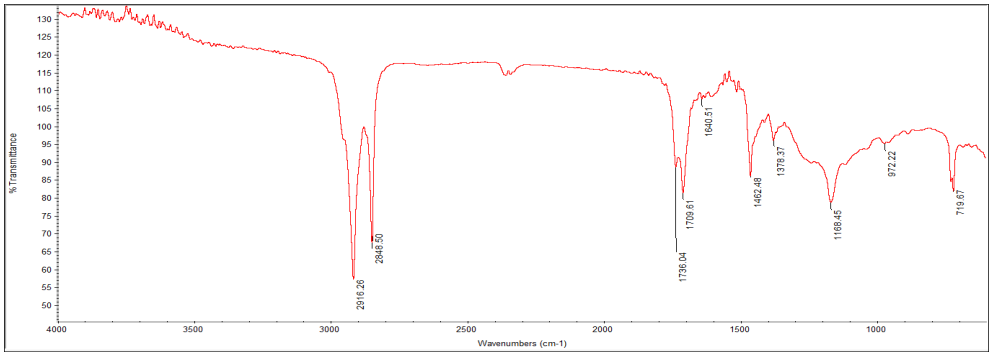

Fig. 9: FT-IR analysis of *P. wightii* stem petroleum ether extract

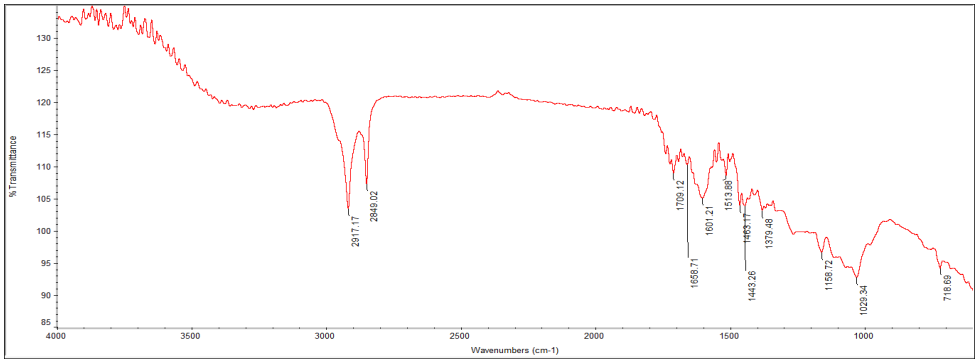

Fig. 10: FT-IR analysis of *P. wightii* stem acetone extract

FT-IR analysis of *Pouzolzia wightii* root

The presence of aliphatic amines with C-N stretch, nitro compounds with N-O symmetric stretch, Ɪamines with N-H bend and carboxylic acids with O-H stretch respectively in all the five different extracts *viz*., petroleum ether (1034.91, 1513.55, 1630.67 and 2848.65), acetone (1032.04, 1514.25, 1601.82 and 2849.45), chloroform (1029.16, 1513.85, 1630.32 and 2848.70), ethanol (1056.54,

1515.98, 1608.11 and 2851.98) and ethyl acetate (1029.93, 1513.51, 1658.06 and 2848.62) extracts of *P. wightii* root (table 3; fig. 11-15). Alkyl halides with C-Cl stretch at 827.77, 775.81 and 834.46 $_{(m)}$ cm^{-1}respectively with a band of medium intensity occurs in petroleum ether, ethanol and ethyl acetate extract *P. wightii* root (table 3, fig. 11-15). The functional group aromatic amines with the strong band at the peak values of 1266.88, 1266.11 and 1265.11 $_{(s)}$ cm^{-1}respectively due to C-N stretch showed their existence in petroleum ether, chloroform and ethyl acetate extract *P. wightii* root (table 3, fig. 11-15). The medium band intensity at 1462.52, 1462.75 and 1462.47 $_{(m)}$ $cm^{-1}$with C-H-bend determined the presence of alkanes in petroleum ether, chloroform and ethyl acetate extracts of *P. wightii* (table 3, fig. 11-15). The strong band related to C=O stretching vibration indicated the existence of α, β–unsaturated aldehydes, ketones in petroleum ether (1709.67 $_{(s)}$ cm^{-1}), acetone (1708.99 $_{(s)}$ cm^{-1}) and ethanolic (1768.35 $_{(s)}$ cm^{-1}) extracts of *P. wightii* root (table 3; fig. 11-15). The vibration of C-Br stretch, CH 'oop' and =C-H bend showed the existence of alkyl halides, aromatics and alkenes in petroleum ether (668.30 $_{(m)}$ cm^{-1}, 719.21 $_{(s)}$ $cm^{-1}$and 981.68 $_{(s)}$ cm^{-1}) and ethyl acetate (668.79 $_{(m)}$ cm^{-1}, 719.09 $_{(s)}$ $cm^{-1}$and 981.21$_{(s)}$ cm^{-1}) extracts of *P. wightii*. An aromatics absorbed at the region 1442.59 and 1442.52 $_{(m)}$ cm^{-1}corresponding to C-C stretch (in the ring) revealed the presence in acetone and ethanolic extracts of *P. wightii* root. The strong intensity band occurring at 1739.91 and 1736.41 $_{(s)}$ cm^{-1} determined the presence of esters, saturated, aliphatic corresponding to C=O stretching in ethanolic and ethyl acetate extracts of *P. wightii* root. The functional group 1, 2amines, amides with medium intensity band due to N-H stretch at 3284.12 and 3268.46 $_{(m)}$ cm^{-1} was present in chloroform and ethanolic extracts of *P. wightii* root. Alkanes with strong and broad intensity band due to C-H rock, alkane with medium intensity band correspond to C-H stretch and alcohol, phenols with strong and sharp intensity band related to O-H stretch free hydroxyl at peak values 718.71 $_{(m)}$ cm^{-1}, 2916.26 $_{(m)}$ cm^{-1} and 3633.45 $_{(s,sh)}$ cm^{-1} were found only in chloroform extracts of *P. wightii* root.

The medium intensity band at 1658.06 $_{(m)}$ which was the representative for the presence of alkenes corresponding to–C=C- stretch occurred in ethyl acetate extracts of *P. wightii* root. The peak value 3485.86 $_{(s,b)}$ cm^{-1} with strong and broadband intensity corresponding to O-H stretch bonded represents the presence of alcohol, phenols in ethanolic extracts of *P. wightii* (table 3, fig. 11-15).

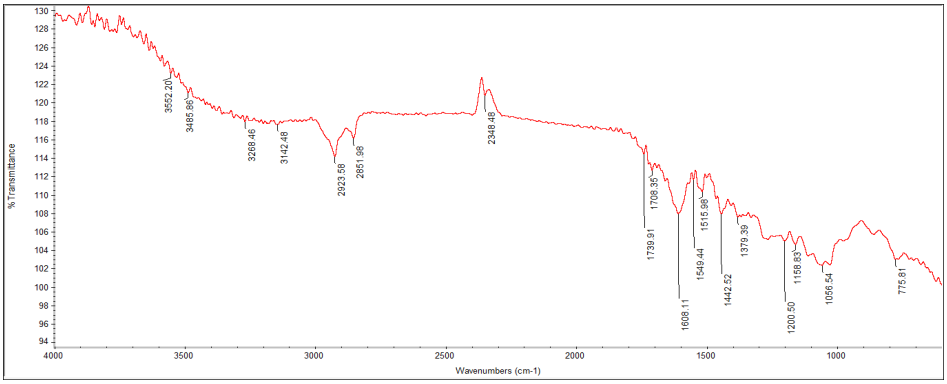

Fig. 11: FT-IR analysis of *P. wightii* root ethanol extract

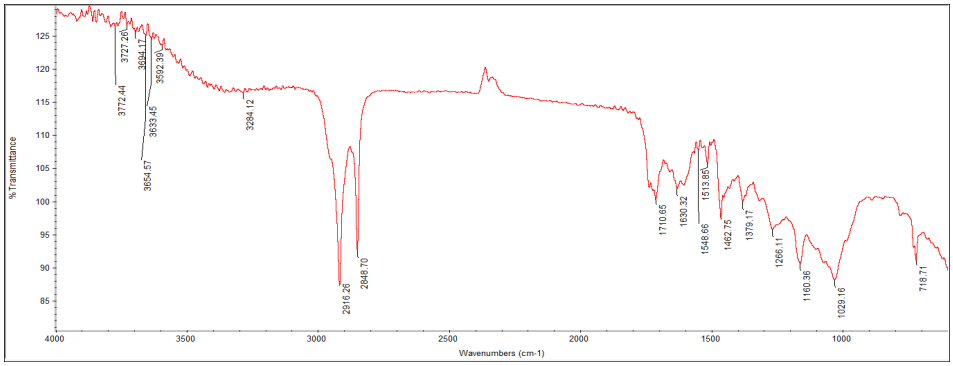

Fig. 12: FT-IR analysis of *P. wightii* root chloroform extract

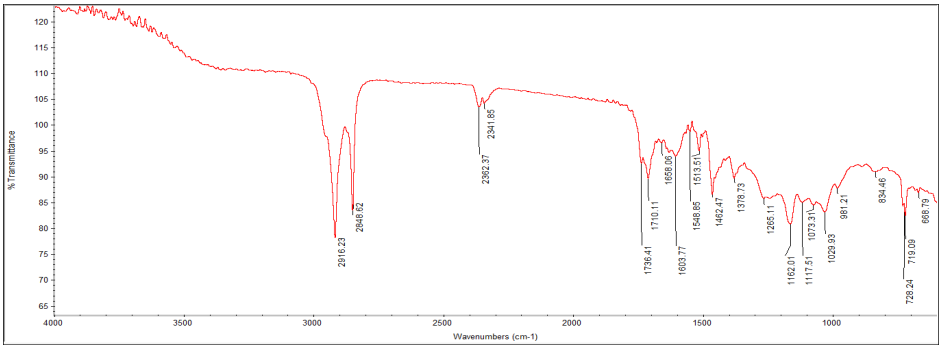

Fig. 13: FT-IR analysis of *P. wightii* root ethyl acetate extract

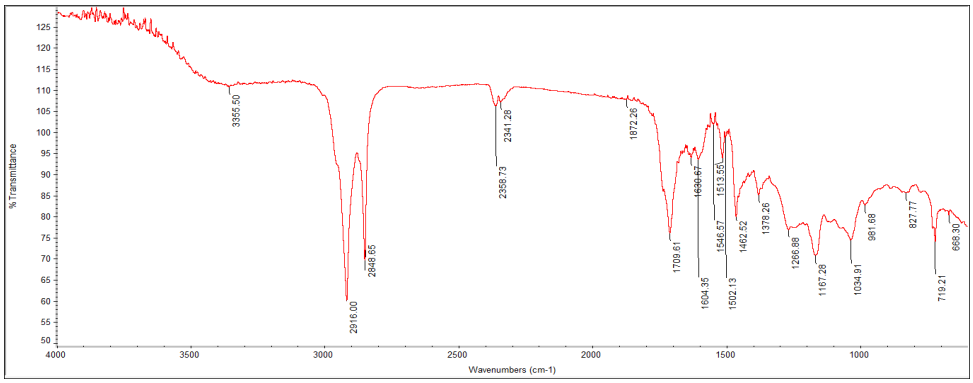

Fig. 14: FT-IR analysis of *P. wightii* root petroleum ether extract

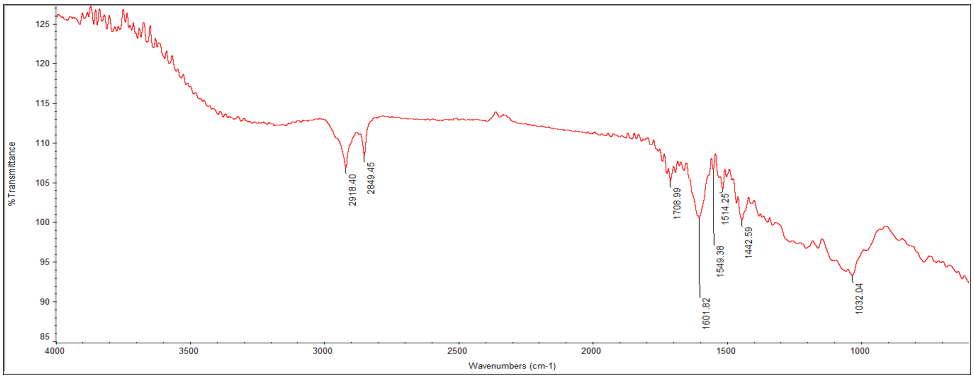

Fig. 15: FT-IR analysis of *P. wightii* root acetone extract

DISCUSSION

UV-Vis and FT-IR spectroscopic methods are proved to be a reliable and sensitive method for detection of biomolecular composition [10]. Plants contain a variety of chemical components which were used to prepare natural medicines [11].

Proper investigation of medicinal plants composition and their activity is very important to promote the therapeutic compounds [12]. The functional groups present in these chemical compounds of plants are usually identified by FT-IR. This technique is beneficial to elucidate the structure and gained importance to identify medicines in pharmacopoeia of many countries [13]. Thus, FT-IR spectroscopy technique has become one of the avenues for the identification of compounds.

The UV-Visible spectra results obtained in the methanolic extract of *Meisotropis pellita* leaves showed the absorption 0.085, 1.250, 2.605, 4.455 and 3.639 at 660, 340, 270, 235 and 210 nm [14]. They also reported the presence of phytochemicals flavonoids and alkaloids during qualitative analysis of the methanolic extract of *M. pellita* leaves supported by the spectroscopic studies showed the characteristic peaks obtained in UV–Visible region. In the present study also phytochemical flavonoids and alkaloids were found to be present during qualitative analysis of *P. wightii* leaves. The presence of these phytochemicals was also supported by the spectroscopic studies showing the characteristic peaks obtained in UV–Visible region. By using UV-Vis spectrum profile of methanolic extract of *Drynaria quercifolia* rhizome showed the peaks at 214 and 279 nm with the absorption of 2.60 and 0.92 [15].

The UV-Vis profile of acetone extract of *Vitex altissima* showed the peaks at 455, 533and 664 nm with the absorption of 2.571, 0.659 and 2.590 respectively. The ethanolic extract of *V. altissima* leaves showed the peaks at 422 and 664 nm with the absorption of 2.485 and 1.862 respectively. Petroleum ether extract of *V altissima* leaves was observed the peaks at 410 and 669 nm with the absorption of 1.659 and 0.972 respectively. Chloroform extract of *V. altissima* leaves showed the peaks at 537, 609 and 668 nm with the absorption 1.180, 0.912 and 3.147 respectively [16]. In the present study acetone extract of *P. wightii* leaves showed the peaks at 644 nm with the absorption of 0.825.

According to Sahu and Saxena [17] methanolic extract of *Curcuma caesia* rhizome showed three peaks at the wavelength 200 to 800 nm. In *P. wightii* leaves (acetone, chloroform and ethyl acetate), stem (acetone) and root (petroleum ether) revealed the more number of peaks (9, 10 and 15). Among the three parts, leaves were observed the highest absorbance 4.000 at 403 nm in the visible region. Hence, the extracts were subjected to UV-Vis analysis is used for the identification of chemical constituents present in *P. wightii* leaves, stem and root.

UV-Vis spectrum with absorption bands at 230-290 nm, 400-550 nm and 600-700 nm nm indicate the occurrence of flavonoids and its derivatives, terpenoids and chlorophyll in the crude extracts [18-20]. The occurrence of UV-Vis spectroscopic around 280-330 nm indicates the existence of phenolic derivatives, at 330 nm confirms the presence of flavonoids in the crude extracts [20, 21]. In the present study, the chlorophyll occurrence was confirmed in all the studied extracts of *P. wightii*. The terpenoids existence also substantiated in the studied extracts of *P. wightii* except petroleum ether and ethanolic extracts of *P. wightii* stem and acetone extracts of *P. wightii* root.

The presence of phenols, alkanes, alcohol, alkyl halides, carboxyl acid and aromatic compounds in ethanolic extracts of *Hybanthus enneaspermus* was identified by FT-IR spectroscopy method [22]. FT-IR studies on the ethanolic extract of *Albizia lebbeck* leaves showed the presence of amide, alkynes, alkanes, carboxylic acids, alkenes, aromatics, aliphatic amines and alkyl halides compounds [23]. FT-IR analysis of *Aerva lanata* showed the presence of amino acids, organic hydrocarbons, halogens and amines [24]. IR spectrum of *Caralluma nilagiriana* extract showed the presence of OH group, phenol, alcohol, carboxylic acids, nitro compounds, esters and ethers group of compounds [20]. The FT-IR spectroscopic of *Aerva lanata* leaves validated the presence of alcohols, phenols, alkanes, carboxylic acids, aldehydes, alkenes, nitro compounds, alcohols, carboxylic acid, esters, ethers, aliphatic amines and alkyl halides

compounds. The stem of *Aerva lanata* showed the presence of amide, alcohols, phenols, amines, alkanes, ketones, primary amines, nitro compounds, alcohols, carboxylic acids, esters, ethers, alkyl halides aliphatic amines. Roots of *Aerva lanata* also proved the presence of amines, amides, alkanes, aldehydes, ketones, esters, carboxylic acids, carbonyls, alkenes, primary amines, nitro compounds, aromatics, alcohols, esters, ethers, alkyl halides compounds [13].

The results of the present study also confirmed the occurrence of amide, alcohols, phenols, alkanes, carboxylic acids, aldehydes, ketones, alkenes, primary amines, aromatics, esters, ethers, alkyl halides and aliphatic amines compounds in *P. wightii*.

Many researchers used FT-IR analysis for identification, classification and identify the functional groups of closely related plants and other organisms [25-29].

Table 2: FT-IR peak values with functional groups of *Pouzolzia wightii*

Peak values	Bond	Functional group	Leaves					Stem					Root				
			P	A	C	ET	EA	P	A	C	ET	EA	P	A	C	ET	EA
690-515(m)	C-Br strectch	Alkyl halides	-	-	-	+	-	-	-	-	-	-	+	-	-	-	+
900-675(s)	C-H "oop"	Aromatics	-	+	-	-	-	-	-	-	-	-	+	-	-	-	+
850-550(m)	C-Cl stretch	Alkyl halides	-	-	-	-	+	+	-	+	-	+	+	-	-	+	+
725-720(s,b)	C-H rock	Alkanes	+	+	-	-	-	-	-	-	-	-	-	-	+	-	-
910-665(s,b)	N-H wag	1˚,2˚ amines	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
1000-650(s)	=C-H bend	Alkenes	+	-	-	+	+	-	-	-	-	-	+	-	-	-	+
1320-1000(s)	C-O stretch	Alcohols, carboxylic acids, esters, ethers	+	+	+	+	+	-	+	+	-	+	-	-	-	-	+
1250-1020(m)	C-N stretch	Aliphatic amines	+	-	-	-	-	+	+	+	+	+	+	+	+	+	+
1300-1150(m)	C-H wag (-CH_2X)	Alkyl halides	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
1335-1250(s)	C-N stretch	Aromatic amines	-	-	-	-	-	-	-	-	-	-	+	-	+	-	+
1360-1290(m)	N-O symmetric stretch	Nitro compounds	-	+	+	+	+	-	+	+	+	+	+	+	+	+	+
1500-1400(m)	C-C stretch (in-ring)	Aromatics	+	+	+	+	+	-	+	-	+	+	-	+	-	+	-
1650-1580(m)	N-H bend	1˚ amines	+	+		+	+	+	+	+	+	+	+	+	+	+	+
1680-1640(m)	-C=C-stretch	Alkenes	+	+	+	+	+	-	-	-	-	+	-	-	-		+
1710-1665(s)	C =O stretch	α, β-unsaturated aldehydes,ketones	+	-	-	+	+	+	+	-	+	+	+	+	-	+	-
1740-1720(s)	C =O stretch	Aldehydes, saturated aliphatic	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
1750-1735(s)	C =O stretch	Esters, saturated aliphatic	-	-	-	-	+	+	-	-	-	+	-	-	-	+	+
3300-2500(m)	O-H stretch	Carboxylic acids	-	+	+	-	-	+	+	+	-	+	+	+	+	+	+
3000-2850(m)	C-H stretch	Alkanes	+	-	-	+	+	-	-	-	+	-	-	-	+	-	-
3500-3200(s,b)	O-H stretch,H-bonded	alcohols, phenols	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
3400-3250 (m)	N-H stretch	1˚,2˚ amines, amides	-	+	-	-	-	-	-	-	-	-	-	-	+	+	-
3640-3610(s,sh)	O-H stretch,free hydroxyl	alcohols, phenols	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-

Note: P-Petroleum ether; A-Acetone; C-Chloroform; ET-Ethanol; EA-Ethyl acetate+Presence; -Absence

In the present study also FT-IR analysis is used to reveal the functional groups of P. wightii and results of the analysis confirmed the existence of various functional groups. The similarity and variation in functional groups at different parts such as leaves, stem and root of P. wightii alos identified. In the present study, FT-IR spectrum was used to confirm the functional group's presence in five different extracts of studied *P. wightii* leaves, stem and roots.

The FT-IR spectrum confirmed the presence of alcohols, phenols, alkanes, alkynes, alkyl halides, aldehydes, carboxylic acids, aromatics, nitro compounds and amines in different extracts of *Vitex altisssima* leaves. Aromatics were absorbed at the region of 900-675 cm^{-1}in acetone and ethanolic extracts of *P. wightii* leaves. Aromatics were also observed in acetone and ethyl acetate leaf extracts and also in acetone stem extracts. An ethanolic and chloroform extracts of *P. wightii* stem and root showed the presence of functional group alkane. In the crude extracts of *O. stamineus*, a sharp absorption peak at 1600-1760 $cm^{-1}$was observed and it indicated the C=O stretching vibration in carbonyl compounds [30].

The FT-IR spectrum of *Cleome gynandra* showed the presence of phenol ring and nitrosamine by the strong absorption bands at 1458 cm^{-1}. The peak at 3419 cm^{-1}assigned to O-H stretching vibrations was observed in *Eichhornia crassipes*. Ethanolic extracts of *P. wightii* root confirmed the presence of O-H stretch. FT-IR analysis of dry methanolic extract of *Punica granatum* peel proved the presence of alkenes, aliphatic fluoro compounds, alcohols, ethers, carboxylic acids, esters, nitro compounds, alkanes, H-bonded H-X group, Hydrogen-bonded alcohols and phenols which shows major peaks values were found to be 671.23, 688.59, 707.88, 754.17, 802.39, 875.68, 921.97, 1016.49, 145.72, 1226.73, 1317.38, 1338.60, 2860.43, 2929.87, 3082.25, 3176.76, 3219.19, 3246.20, 3265.49 and 3334.92. Similarly, *P. wightii* leaves extracts viz., petroleum ether, acetone, chloroform, ethanol and ethyl acetate contains alcohols, carboxylic acids, esters and ethers. Nitro compounds were observed in all the extracts of *P. wightii* root and stem, except petroleum ether and also occurred in acetone, ethanol and ethyl acetate extracts of *P. wightii* leaves extracts. In addition to the previous observation, the current study exposed and supplemented the functional groups of *P. wightii* leaves, stem and root.

The present study used to find out the bioactive compounds which may be subjected to subsequent target isolation. The results of the present study revealed the spectroscopic profile for the medicinally important plant *P. wightii*. These profiles will be used as a pharmacognostic marker in the pharmaceutical industries. Further research will be needed for the isolation of active principles and structural characterization of isolated compound.

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the reviews and summarized the results. She also contributed in the writing of the manuscript.

AUTHORS CONTRIBUTIONS

All the author have contributed equally

CONFLICT OF INTERESTS

Declared none

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