PHYTOCHEMICAL SCREENING BY QUALITATIVE AND FTIR SPECTROSCOPIC ANALYSIS OF LEAF AND STEM OF *CLEMATIS TERNIFLORA* DC (RANUNCULACEAE)

Rajeswari S. and Sumitha V. R.
Post Graduate Department and Research Centre of Botany, M.G College, Thiruvananthapuram, H. H. M. S. P. B. N. S. S. College,Neeramankara,Thiruvananthapuram. Kerala

Email: rajeswaribalachandra@gmail.com

Resubmission - December 2020 ; Accepted for Publication 01 August 2021

ABSTRACT

The current study is pointed to analyse the leaf and stem powder of *Clematis terniflora* through qualitative and FTIR spectroscopy method. The crude extracts were tested for the presence of active compound by using standard procedures. The presence of various phytochemicals such as phenols, alkaloid, tannin, saponin, flavonoids steroids, glycosides and terpenoids in different solvent extracts of stem and leaf. The FTIR spectroscopic studies exposed diverse characteristic peak values with different functional compounds in the leaf and stem powder. The FTIR analysis of leaf and stem powder confirmed the presence of amide, alcohols, phenols, alkanes, carboxylic acids, aldehydes, nitro, alkenes, primary amines, aromatics, esters, ethers, alkyl halides and aliphatic amines compounds. The major peaks are showed. The characteristics peak values and their functional groups are detected by spectrophotometer system in FTIR method. The results of the current study produced the qualitative analysis and FTIR spectrum profile for *C. terniflora*.

Keywords: *Clematis terniflora*; FTIR; Spectroscopy; Functional groups; Qualitative.

INTRODUCTION

Medicinal plants are used as substitute medicine for men as well as animals since the utmost of them are without side effects when compared with synthetic drugs. The plants included phytocompounds are recognizing the chemical nature and it is provided, various functional groups. It will help to analyse their medicinal properties. Ragavendran *et al.* [1] studied in various extracts of *Aerva lanata* detected functional groups by using the spectroscopic method. The crude dry powder of 11 medicinal plants used to detect saponins by using FTIR spectroscopy, which was mentioned by Kareru *et al.* [2]. FTIR methods were used for phytochemical screening in a wide variety of plants. The compounds have types of functional groups, that are identifying by powerful tool Fourier Transform Infrared Spectrophotometer (FTIR). The function of the tool was the wavelength of light absorbed and marked characteristic of the chemical bond in the spectrum. The chemical bond in a molecule was interpreting by the infrared absorption spectrum. It was reported by Ashokkumar and Ramaswamy [3].

Subramaniyan S., Sandhia G. S., Preetha T. S. & Sudha Bai R. (Eds.)
 ISBN : 978-93-5620-800-1

Ramamoorthi and Kannan [4] reported the detection of bioactive group of chemicals in dry leaf powder of *Calotropis gigantea* to by using the FTIR method. The powder sample of leaf, stem, and root of *Eclipta alba* and *Eclipta prostrate* were used by Muruganantham *et al.* [5] for FTIR spectroscopic analysis.

The present study was carried out in *Clematis terniflora*, an ornamental plant of family Ranunculaceae. *Clematis* has its origin in China as well as Japan and is used in tribal medicine of those countries. Medicinally important compounds present in this plant are used for various ailments such as nervous disorders, syphilis, gout, malaria, dysentery, rheumatism, asthma. In India, *Clematis terniflora* is accepted as an ornamental plant. A survey of literature revealed that the FTIR analysis of functional groups was not done so far with the *C. terniflora*. Therefore, try to detect the functional groups of Phytoactive compounds in the leaf and stem powder by using qualitative and FTIR spectroscopic methods.

MATERIALS AND METHODS

Collection of plant

Leaf and stem samples of *C. terniflora* were collected from the Department of Botany Karyavattom, University of Kerala, Thiruvananthapuram, Kerala. The plant was suitably recognized with the help of authentic literature and documented with their characteristic features. The voucher specimens are deposited in the herbarium of the Department of Botany, University of Kerala, Kariyavattom (KUBH 10274).

Preparation of leaf and stem

The shade dried leaves and stem of the plant (at room temperature) were powdered in a mechanical grinder and stored in airtight bottles for further analysis.

Qualitative analysis

The plant extracts were subjected to phytochemical screening for the identification of various classes of active chemical constituents using various standard procedures [6, 7, 8, 9, 10]

Fourier Transform Infrared Spectrophotometer (FTIR)

Dried powder of plant materials was used for FTIR analysis. 10 mg of the dried powders were encapsulated in 100 mg of KBr pellet, to make translucent sample discs. The powdered form of each sample was loaded in FTIR spectroscope (Shimadzu, IR Affinity 1, Japan), with a scan range from 400 to 4000 cm1 with a resolution of 4 cm1.

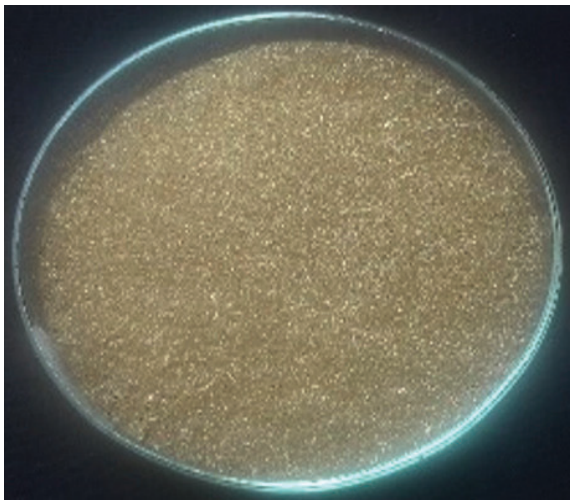
RESULTS

The existence of various phytochemicals such as phenols, alkaloid, tannin, saponin, flavonoids steroids, glycosides and terpenoidsin different solvent extracts of stem and leaf (Table 1). More Phyto constituents are present in distilled water and ethyl acetate extraction of leaf and stem.The FTIR spectrum of leaf and stem powder are given in Fig 1 and 2. The data on the peak values and the possible functional groups (obtained by FTIR analysis) present in the leaf and stem powder of *C. terniflora*. FTIR spectral data interpretation of leaf powder exhibited a characteristic bands at 651.94 (-C (triple bond) C-H: C-H bend, Alkynes), 677.01 (CH'oop', Aromatics), 1001.06 (O-H bend,-Carboxylic acids), 1037.70 (C-Nstretch, Aliphatic amines) ,1072.42 (C-O stretch, Ethers), 1101.35 (C-O stretch, Esters), 1139.93 (C-N stretch, Aliphatic amines), 1203.58 (C-H wag,Alkyl halides), 1737.86(C=O stretch, Saturated aliphatic), 2243.21 [C (triplebond) N stretch, Nitriles] ,2694.56 (H-C=O: C-H stretch, Aldehydes), 3051.39 (= C-Hstretch,Alkenes), 3111.18 (O-H stretch, Carboxylic acids), 3147.83 (O-H stretch, Carboxylic acids), 3597.24 (N-Hstretch, Amide), 3624.25(O-H stretch, Free hydroxyl, Phenols), 3701.40 (O-H stretch, Alcohol), 3726.47 (O-H stretch, Alcohol). The stem powder characteristic absorption band were exhibited at 599.86(C-Br stretch, Alkyl halides), 617.22 (-C(triple bond) C-H:C-H bend, Alkynes), 651.94 (=C-H bend, Alkenes), 1014.56 (C-O stretch, Carboxylic acids), 1319.31(C-N stretch, Aromatic amines),1342.46 (N-Osymmetric-stretch, Nitro compounds), 1367.53 (C-Hroc,Alkanes), 1390.68 (C-Cstretch,Aromatics),1411.89 (C-Cstretch(in-ring), Aromatics), 1452.40 (C-H bend, Alkanes), 1512.19 (N-Oasymmetric stretch, Nitro compounds), 1537.27 (N-O asymmetric stretch, Nitro compounds), 1627.92 (N-H bond,Primary amines), 1643.35 (-C=C-stretch, Alkenes), 3147.83 (O-Hstretch, Carboxylic acids), 3169.04 (O-H stretch, Carboxylic acids), 3184.48 (O-H stretch,Carboxylic acids), 3205.69 (O-H stretch, Carboxylic acids), 3223.05 (O-H stretch Carboxylic acids),3244.27(O-H stretch Carboxylic acids),3263.56(N-H ,Primary, secondary amines),3282.84 (-C(triplebond)C-H:C-H stretch, Alkynes(terminal)),3302.13 (-C(triple bond)C-H:C-H stretch , Alkynes (terminal)),3321.42(-C(triple bond)C-H:C-H stretch, Alkynes(terminal)), 3342.64 (N-H stretch, Primary, secondary amines),3360 (N-H stretch,Primary, secondary amides),

3381.21 (O-H stretch, H-bonded Phenols), 3404.36 (O-Hstretch, H-bonded Phenols), 3539.38 (O-Hstretch-bonded , b Phenols), 3562.52 (O-Hstretch, H-bonded, Phenols), 3591.46 (O-H stretch-bonded, Phenols), 3622.32 (O-H stretch, free hydroxyl, Phenols), 3666.68 (O-H stretch, Alcohol), 3699.47 (O-H stretch, Alcohol), 3728.40O (-H stretch, Alcohol).

Habit

Stem powder



Leaf powder

Table:1 Qualitative analysis of leaf and stem extraction of *C. terniflora*

LEAF						STEM				
Phytochemicals	PE	C	EA	ET	DW	PE	C	EA	ET	DW
Alkaloids	-	-	+	+	+	-	-	+	+	+
Steroids	+	+	+	+	-	+	+	+	+	-
Phenols	-	+	-	-	+	-	+	-	-	+
Flavanoids	-	-	+	+	+	-	-	+	+	+
Terpinoids	+	+	-	-	-	+	+	-	-	-
Tannin	-	-	+	-	+	-	-	+	-	+
Saponin	-	+	-	-	+	-	+	-	-	-
Glycosides	-	-	+	-	+	-	-	+	-	+
Anthraquinone	-	-	-	-	-	-	-	-	-	-
Emodin	-	-	-	-	-	-	-	-	-	-
Phlobatanins	-	-	-	-	-	-	-	-	-	-
Antracene glycosides	-	-	-	-	-	-	-	-	-	-

+ sign indicates the presence of phytochemical; - sign indicates the absence of phytochemical; PE – petroleum ether, C-chloroform, EA-ethyl acetate, E-ethanol, DW-distilled water

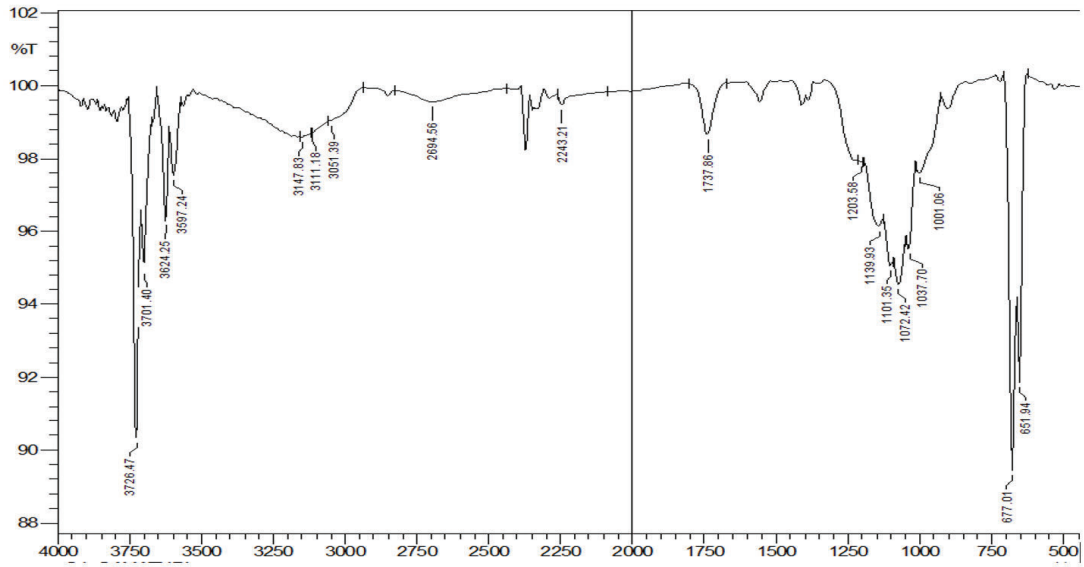


Fig: 1 FTIR spectrum of leaf powder of *C. terniflora*

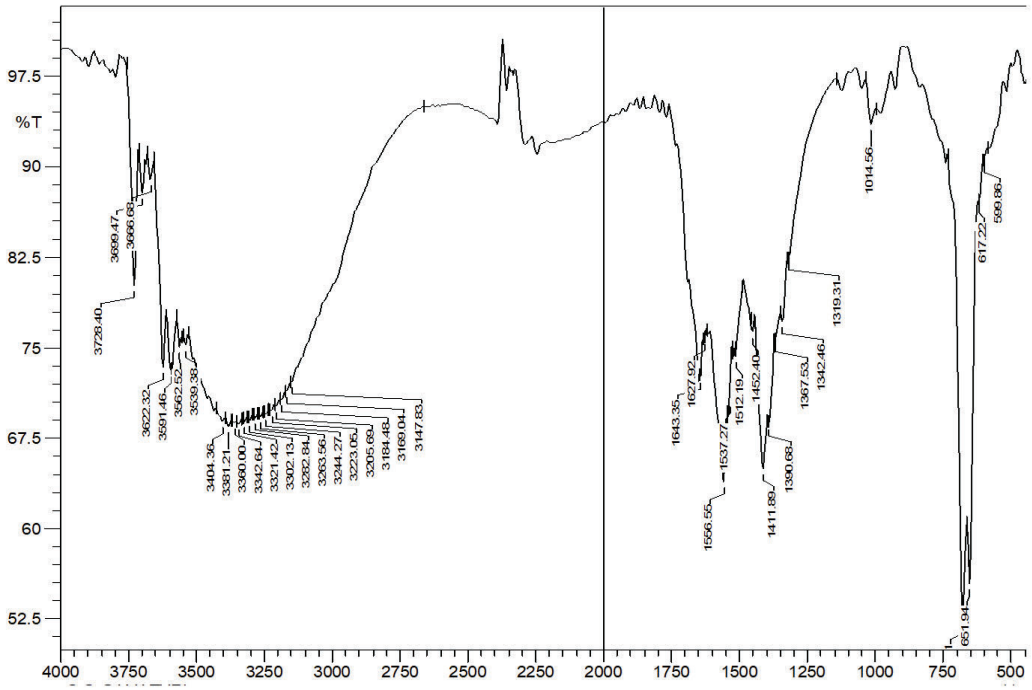


Fig: 2 FTIR spectrum of stem powder of *C. terniflora*

Discussion

The qualitative analysis of leaf and stem extraction of different solvents confirmed many phyto constituents are present. Flavonoids, alkaloids, glycosides, tannin and steroids are present in ethyl acetate extraction of leaf and stem. Alkaloids, phenols, flavonoids, glycosides and tannins are present in distilled water extraction of leaf and stem. Medicinal plants have therapeutic efficiency, so these plants have various phytochemicals such as terpenoids, phenolics, flavonoids, alkaloids etc. [11]. Huge number of studies reveal that many plants have antioxidants, anti-inflammatory, antibacterial and antitumor activities. The activities are contributed by phytocompounds. [11, 12] The FTIR analysis of leaf and stem powder of *C. terniflora* confirmed the presence of amide, alcohols, phenols, alkanes, carboxylic acids, aldehydes, nitro, alkenes, primary amines, aromatics, esters, ethers, alkyl halides and aliphatic amines compounds, that showed major peaks. . Similarities can be observed in the results of study that the, FTIR and EDS spectral analysis of various plant parts of *Eclipta alba* and *Eclipta prostrate*. It was reported by Muruganantham *et al*. [5]. *Eclipta alba* and *Eclipta prostrate* have characteristic functional groups of sulphur derivatives, polysaccharides, nitrates, chlorates, carboxylic acids, amines, amides, and carbohydrate. The functional group are responsible for different medicinal properties of both herbal plants. The FTIR method was used to screen the medicinal properties of functional groups in *Aerva lanata*, reported by Ragavendran *et al*. [1]. Many medicinal plants are used for FTIR analysis and reported functional group.

The spectrum analysis of aqueous and methanolic leaf extracts of *Bauhinia racemosa* showed the occurrence of tannins, carbohydrate protein, phenolic compounds, oil, fats flavonoids and saponins, as major functional groups [13]. The ethanolic extracts of *Ichnocarpus frutescens* was used to analyse FTIR, revealed many functional groups such as carboxylic acid,halogens, carbonyl compounds,amino acids organic hydrocarbons,amides and amines. The transition metal carbonyl compounds and aliphatic fluoro compounds were only present in the methanolic extract of *Ampelocissus latifolia* that result obtained from FTIR analysis, was reported by Pednekar and Raman [14].

Conclusion

The leaf and stem powder and extraction of *C. terniflora* observed the various phyto-constituents and functional groups. Among the functional groups observed in the powder, OH group was found to be more than in stem powder comparable to leaf of plant. The presence of OH group has become the ability of forming hydrogen bonding capacity. The OH group had shown inhibition to microorganisms, so the results revealed that plants have higher anti-microbial activity.

Acknowledgment

The authors are grateful to the University of Kerala and thanks to Head, Post graduate department and research centre of Botany, Mahatma Gandhi College, Thiruvananthapuram

Conflict of interest

Authors are declaring no conflict of interest.

REFERENCES

1. Ragavendran P., Sophia D., Arul Raj C. and Gopalakrishnan V. K. Functional group analysis of various extracts of Aerva lanata (L.,) by FTIR spectrum, Pharmacology Online, 1(2011) 358-364.
2. Kareru PG,Keriko J M, Gachanja A N, Kenji GM, Direct detection of triterpenoid saponins in medicinal plants, African Journal of Traditional, Complementary and Alternative Medicines, 5 (1) (2008) 56 60.
3. Ashokkumar R. and Ramaswamy M., Phytochemical screening by FTIR spectroscopic analysis of leaf extracts of selected Indian Medicinal plants, International journal of current Microbiology and Applied science, (2014) 395-496.
4. Ramamurthy and Kennan S,Fourier transform infrared spectroscopic analysis of a plant (Calotropis gigantea Linn) from an Industrial Village, Cuddalore Dt, Tamilnadu, India. Romanian Journal of Biophysics,17 (4) (2007) 269 276.
5. Muruganantham S., Ambalagan G., Ramamurthy N., FT-IR and SEM-EDS Comparative Analysis of Medicinal Plants, Eclipta alba Hassk andEcliptaprostrata Linn, Romanian Journal of

Biophysics, 19(4) (2009)285 294.

6. Harborne JB,Methods of plant analysis, In: Phytochemical methods. Springer, Netherlands, pp.1 (1973)32

7. Kokate C K, Practical pharmacognosy, Vallabh Prakashan, New Delhi, 4 (1994) 110-111.

8. Karthikeyan A, Shanthi V and Nagasathaya A,Preliminary phytochemical and antibacterial screening of crude extract of the leaf of Adhatoda vasica. L, International Journal of Green Pharmacy, 3 (2009).

9. Aiyegoro O A and Okoh AI, Preliminary phytochemical screening and in vitro antioxidant activities of the aqueous extract of Helichrysum longifolium DC, BMC Complementary and Alternative Medicine, 10(1) (2010).

10. Sivakrishnan S and Muthu K. A., Phytochemical Evaluation of Ethanolic Extract of Aerial Parts of Albizia procera, British Biomedical Bulletin, 2(1)(2014)235-241.

11. Dutta S, Dey P, and Chaudhuri T K, Assessment of bioactive phytochemicals present in the Root of Croton bonplandianum available in the Sub-Himalayan region of West Bengal, International Journal of Pharmacy and Pharmaceutical Sciences, 5 (2013)540-5.

12. Sala A, Recio M D C, Giner R M, Máñez S, Tournier H, Schinella and Ríos J L,Anti inflammatory and antioxidant properties of Helichrysum italicum, Journal of Pharmacy and Pharmacology, 54(3) (2002) 365 -371.

13. Kumar G. Loganathan K. Rao B. Phytochemical composition and in vitro antimicrobial activity of Bauhinia racemosa LAMK (caesalpinaceae) International Journal of Pharmaceutical Sciences and Research 1 (2013) 51-58.

14. Pednekar P. A. Raman B. V. Estimation of variation in the elemental contents of methanolic soxhlet leaf extract of Ampelocissus Latifolia (Roxb.) Planch. by ICP-AES technique. International Journal of Pharmacy and Pharmaceutical Sciences 5(3) (2013) 938-941.