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Research Article

FT-IR Spectroscopic Studies on Synergistic Potential of *Boerhavia diffusa* and *Tridax procumbens*

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Abstract

Medicinal plants are a significant part of natural wealth. They are the source of synthetic and traditional herbal medicine with an attention of greater number of people seeking ecofriendly and biofriendly plant based products free from side effects caused by synthetic chemicals. The present study was aimed to identify the functional groups present in the ethanolic combination of *Tridax procumbens* (leaves) and *Boerhavia diffusa* (root) ethanolic extracts through UV and FT-IR spectroscopy. It is one of the most widely used methods to determine and elucidate the structure of the chemical constituents. The results of FT-IR analysis confirmed the presence of phenols, alkanes, aldehydes, alkynes, alkenes, aromatics, aromatic amines, alkyl halides, and aliphatic amines which showed major peaks at 3363.97, 2975.61, 2542.73, 2256.98, 1657.18, 1407.38, 1333.57, 1253.75, and 1230.63, respectively. The UV Visible spectrum showed different peaks ranging from 200-700 nm. The peaks at 221.85nm, 411.25nm and 664.50nm of the UV-VIS profile indicated the presence of Flavonoids, Terpenoids, and Chlorophyll. Hence the present study creates a platform to monitor various bioactive components to treat many diseases.

Key words: Phytoconstituents, Functional group, Ethanol, FT-IR, UV spectrometry

INTRODUCTION

Medicinal plants serves as a treasure of natural wealth. They supply vital healthful supplements and raw materials for manufacturing numerous conventional and modern medicines (1).Biologically active compounds from plants have the potential to prevent various diseases. Assessment of the phytochemical constituents and discovery of new drugs is considered to be the main step in medicinal plant research (2). With the inception of scientific research in medicinal plants, it is becoming understandable that the medicinal herbs have a potential in today's synthetic epoch. Ancient knowledge together with scientific principles can come to the forefront and provide us with powerful remedies to eradicate the diseases (3). The phytoconstituents present in medicinal plants confer specific characteristics and properties to plants for determining various biological activities of plants. The spectroscopic technique has become a powerful and analytical tool for the qualitative and quantitative analysis of pharmaceutical and biological materials (4).

Characterization of secondary metabolites by spectroscopic analysis provides valuable information about phytochemical formulation of plant species. The UV-Visible spectroscopy offers a simple, technique to identify the main phytochemicals on the basis of polarity. Fourier Transform Infrared Spectroscopy (FT-IR) is a high-resolution analytical and time saving technique that allows the analysis of compositional and structural information in medicinal plants (5).

Boerhavia diffusa (Nyctaginaceae) commonly known as 'Punarnava' in the Indian system of medicine, is a perennial creeping herb found throughout the waste land of India. The *Boerhavia* sp. has ancient medicinal use in different societies from the times of the B.C (6). The whole plant or its specific parts (leaves, stem, and roots) are known to have a long history of important medicinal properties used by indigenous

and tribal people in India. This plant has been traditionally useful in all types of inflammations, strangury, leucorrhoea, ophthalmia, lumbago, scabies, cardiac disorders, jaundice, anemia, dyspepsia, cough, bronchitis and general debility (7).The roots are reputed to be diuretic and laxative and are given for the treatment of anasarca, ascites (8).Pharmacological studies have demonstrated that *Boerhavia diffusa* known to possess diuretic, antifertility, antifibrinolytic, immunomodulatory, anti-inflammatory, antidiabetic, anti-viral, antistress, antimicrobial, hepatoprotective, antimetastatic and antioxidant activities (9).

Tridax procumbens is commonly known as coat button in english, vettukkaaya-thalai, kenathuppoondu or kinatruppasan, thatha poondu in tamil, kansari or ghamra in hindi and belongs to family asteraceae. it is a widespread weed that can be found in fields, meadows, croplands, disturbed areas, lawns, and roadsides (10).it shows a number of pharmacological activities like hypotensive, insecticidal, hair growth promoting, wound healing, anti-inflammatory, hepatoprotective and immunomodulatory due to the presence of phenolics, tannins, saponins, and glycosides(11).the leaf juice possesses antiseptic, insecticidal and parasiticidal properties and is used also to check haemorrhage from cuts, bruises and wounds. its leaves also use for bronchial catarrh, dysentery, diarrhoea (12).

Screening the synergistic combinations from various medicinal herbs is an enduring challenge in research. In the present work ethanolic combination of *Tridax procumbens* and *Boerhavia diffusa* was assessed for characterization and structural analysis.

Methodology

Sample Collection: Freshly grown leaves of *Tridax procumbens* and roots of *Boerhavia diffusa* were collected from the local villages around Tiruchirappalli and got identified from plant taxonomist at the Department of Botany, St.Joseph's College, Tiruchirappalli

Preparation of extractions

The collected plant parts were dried at room temperature for two weeks and were powdered. About 1 g of the powdered material was then subjected to extractions using Soxhlet apparatus using ethanol for 6 hours. The extracts were finally filtered and used for analysis.

Preparation of Herbal Combinations: Herbal combination was prepared by appropriately mixing the ethanolic extracts of *Tridax procumbens* and *Boerhavia diffusa* in the ratio of 1:1.

UV-VISIBLE Spectroscopic analysis

The extracts obtained were scanned in the wavelength ranging from 200-700 nm using Systronic Spectrophotometer and scanned at intervals of 50 nm.The characteristic peaks were detected and recorded.

Spectroscopic analysis by FT-IR

FT-IR Spectra were obtained with the aid of an OMNI-sampler attenuated total reflectance (ATR) accessory on a FTIR spectrophotometer (Perkin Elmer Spectrophotometer system, USA) with some modification (13).A small amount of extract was placed directly on sample holder of the infrared spectrometer with constant pressure applied and the data of infrared absorbance, collected over the wave number ranged from 4000 cm^{-1} to 400 cm^{-1} and computerized for analyses by using the 21 CFR part 11 software. The reference spectra were acquired from the cleaned blank crystal prior to the presentation of each sample replicate. The peak values of FTIR were recorded. Each and every analysis was repeated twice to confirm the spectrum.

Results and Discussion

The UV-Visible profile of ethanolic extract of *Tridax procumbens* and *Boerhavia diffusa* was selected at a wavelength from 200 to 700 nm due to the sharpness of the peaks and proper baseline. The outline showed the peaks at 221.85, 398.75 and 664.50 nm with the absorption of4.000, 1.0458, and 0.5216 respectively (table 1, fig. 1).Characterization of phytochemical constituents by UV-Visible Spectroscopy provide important information about identification of lipophilic and hydrophilic molecules (14).The UV-Visible profile consist of two absorption maxima, the first in the range of 230-290 nm (band I) and the second in the range 400-550 nm for the position of flavonoids and terpenoids.The specific position and virtual intensities give valuable information on the nature of the secondary metabolites (15).

Fig 1: UV VISIBLE SPECTRUM (*Combined*)

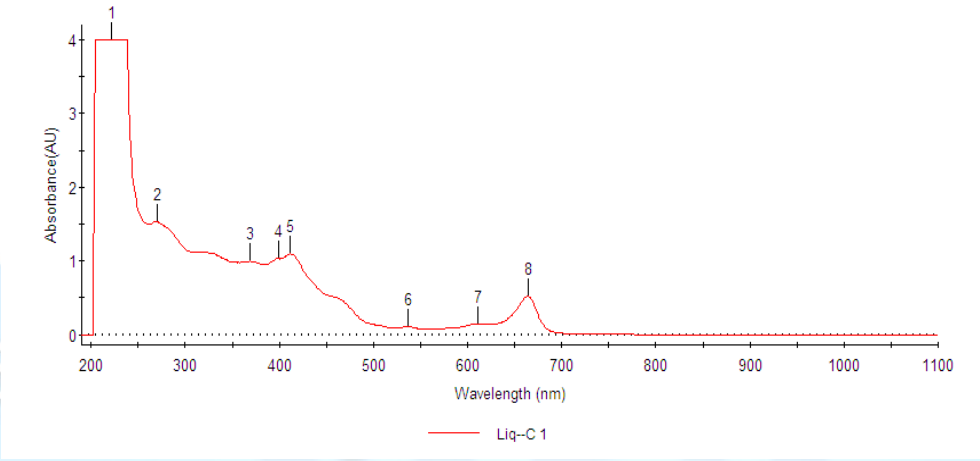

Table 1: UV VISIBLE SPECTRUM PEAK VALUES (Combined)

PEAK NO.	Absorbance (AU)	Wavelength (nm)
1	4.0000	221.85
2	1.5337	269.95
3	0.9952	369.05
4	1.0458	398.75
5	1.0959	411.25
6	0.1065	536.65
7	0.1450	611.20
8	0.5216	664.50

FT-IR spectroscopy provides powerful approach for the structural and functional alterations induced by various factors due to its high sensitivity (16). It can be used to confirm the presence of functional constituents and to evaluate the qualities of medicinal materials (17).

The results of FT-IR peak values and functional groups were presented in table 2. The FT-IR spectrum confirmed the presence of phenols, alkanes, aldehydes, alkynes, alkenes, aromatics, aromatic amines, alkyl halides, and aliphatic amines which showed major peaks at 3363.97, 2975.61, 2542.73, 2256.98, 1657.18, 1407.38, 1333.57, 1253.75, and 1230.63 respectively. The Spectrum revealed the presence of functional constituents which may a member of secondary metabolites that exhibit various medicinal properties (18).

Fig 2: Fourier Transform Infrared spectroscopy (FTIR) (Combined)

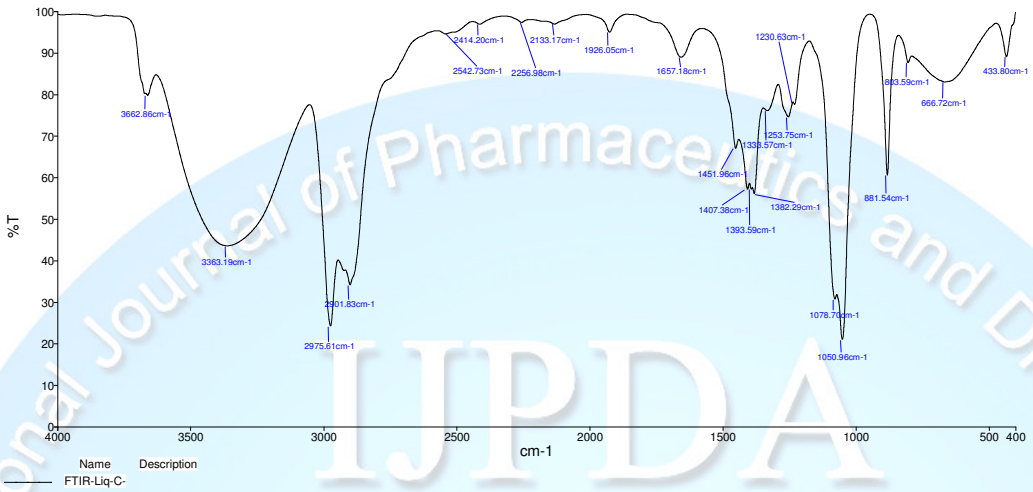

Table 2: Functional group identifications (Combined)

S.NO.	Frequency (Cm^{-1})	Bond	Functional Group
1.	3363.97	O-H	Phenols
2.	2975.61	C–H stretch	Alkanes
3.	2542.73	H–C=O: C–H stretch	Aldehydes
4.	2256.98	–C ≡C– stretch	Alkynes
5.	1657.18	–C=C– stretch	Alkenes
6.	1407.38	C–C stretch (in–ring)	Aromatics
7.	1333.57	C–N stretch	Aromatic amines
8.	1253.75	C–H wag (–CH 2 X)	Alkyl halides
9.	1230.63	C–N stretch	Aliphatic amines
10.	881.54	C–H	Aromatics
11.	666.72	–C ≡C–H: C–H bend	Alkynes

Conclusion

The results of the present study confirmed that ethanolic combination of *Tridax* and *Boerhavia diffusa* proved to be a wealthy resource of phytoconstituents that can be utilized for various pharmaceutical purposes to evaluate the quality and accuracy of formulating curative potential.

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