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Functional Group Identification of *Mimosa pudica* (Shameplant) by UV-Visible and FT-IR spectroscopy

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ABSTRACT
Medicinal plant research involves much more than drug discovery. This area has been expanded to include various topics, such as power negotiations based on medicinal plant lore. A wide range of modern medicines is derived directly or indirectly from plants. Some of these drugs are no longer synthesized in significant quantities by competitors because they have been toxic to humans and other animals. Therefore, this study focuses on scientific research to confirm the knowledge of the phytocompounds of Mimosa pudica by UV-Visible and FT-IR spectroscopy. It also provides clues for evaluating its performance in various fields.

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1. Introduction

India contains more herbal and spice cultures including about 2000 species, and used with high potential for Ayurvedic, Unani, and Siddha traditional medicine, of which chemical and pharmacological research has been conducted for their potential medicinal properties [1]. For many years, people have habitually used plants to treat various ailments. According to the World Health Organization, most people still depend on traditional medicine for their mental and physical health needs because they cannot afford Western pharmaceutical industry products with side effects and lack health benefits [2]. Rural areas of many developing countries still depend on traditional medicine for their principal healthcare needs and daily lives. These drugs are safer and cheaper than synthetic or modern drugs [3]. People who live in rural areas know from experience that these folk remedies are an esteemed source of natural products for maintaining human health [4].

As a source of primary healthcare, medicinal plants are in prodigious demand in both developed and developing countries due to their wide range of biological and medicinal activities, high safety, and low-cost attributes [5]. Plant molecules are harmless and can overcome pathogen resistance because they bind to the protoplasm of plant cells or bind to one or more molecules. Despite the advent of modern or homeopathic medicine, Balik and Cox

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(1996) note that many important modern medicines are derived from plants used by indigenous peoples.

The use of traditional medicine is seen as a way to learn about impending medication in the future. Researchers have acknowledged many compounds used in traditional medicine from "ethnomedical" plant sources. This plant is used medicinally in several countries and is the source of many potent drugs [6].

Mimosa pudica is a small evergreen plant native to Brazil, Asia, Africa, and India. This plant has several nicknames: shy plant and sensitive plant. *Mimosa pudica* is so named because of its interesting reactions. Its leaves will close when it gets touched. *Mimosa pudica* (Figure 1) is a widespread weed that grows wild in warm and humid regions of India, Africa, and tropical America. It is a spreading shrub, 45-90 cm tall, with a stem and branches covered with long weak setae and small spines. Sensitive leaves are palmate compounds, with small leaves consisting of 12-20 pairs, narrow and oblong in shape. The flowers are small, lilac-pink, and round, with small cups. The pods with small setae are 2.5 to 3.5 cm long and consist of 3 to 5 one-seed segments. The root is reddish brown, cylindrical, slightly tapered, and branched in all directions.

Figure 1. *Mimosa pudica*

In Ayurvedic medicine, *Mimosa pudica* is known as Lajjalu and is included in the system not because of its dancing leaves but because of the therapeutic benefits of the compounds found in the plant. Many hemorrhoid sufferers have experienced relief from this particular plant's pharmacological profile and antioxidant activity. *Mimosa pudica* has attracted the attention of researchers worldwide for its pharmacological properties, such as anti-diabetic, anti-toxin, anti-hepatoxic, antioxidant, and wound-healing effects. It has been reported to contain alkaloids, glycosides, flavonoids, and tannins. It is used to inhibit *kapha* and *pitta*, wound healing, blood clotting, and sexual weakness. All parts of the tree are believed to have medicinal properties and are used to treat jaundice, leprosy, dysentery, vaginal and uterine ailments, inflammation, burning, fatigue, asthma, and blood disorders.

The history of ancient civilizations records the use of medicinal herbs to treat disease. Until the discovery of modern synthetic medicine, people relied entirely on herbal medicine for the prevention and treatment of disease. Touch-me-not, a common plant scientifically known as *Mimosa pudica* Linn, is the subject of this study. *M.pudica* is used medicinally in Siddha, Unani, and Ayurveda. We hope that this study will provide information for further exploration of shy mimosa as an alternative medicine. Humans were completely dependent on medicinal herbs for the prevention and treatment of diseases.

2. Materials and methods

2.1. Collection of samples

The leaves of *Mimosa pudica* were collected from several locations in Badakara, Calicut region, Kerala state, India. Then, wash the fresh leaves 2-3 times with running tap water and dry them in the shade for 7-10 days. This is because some compounds are denatured in the sun. Dried leaves are ground into powder using an electric mixer. This powdered sample is further analyzed for FTIR study.

2.2. Extraction method

A powder sample of about 20 g was immersed in 100 ml of methanol (100%). It was left for 48 hours to dissolve the ingredients in Shy Mimosa. The methanol extract was then filtered using Whitman1 filter paper. This solution is used for UV-VIS spectral analysis.

3. Results and discussion

FTIR spectroscopic studies revealed the presence of various chemical constituents in the leaves of *Mimosa pudica* (Figure 2). The absorption band and wave numbers (cm^{-1}) of the main peak obtained from the absorption spectrum were 634.50, 860.08, 954.00, 1068.97, 1589.56, and 3340.92 cm^{-1}. Despite the interference of plant fibers inherent in medicinal materials, we can still see that the IR spectrum of medicinal plants shows a lot of structural information about the main and minor constituents. It should be noted that we did not find a peak at 1635 cm^{-1} due to the lack of water content in the sample examined, as shown in Figure 2. A weak peak at 3400 cm^{-1} is due to O-H stretching vibrations, and a stronger peak appears in the range 1130-997 $cm^{-1,}$ mainly due to C-O stretching vibrations [7].

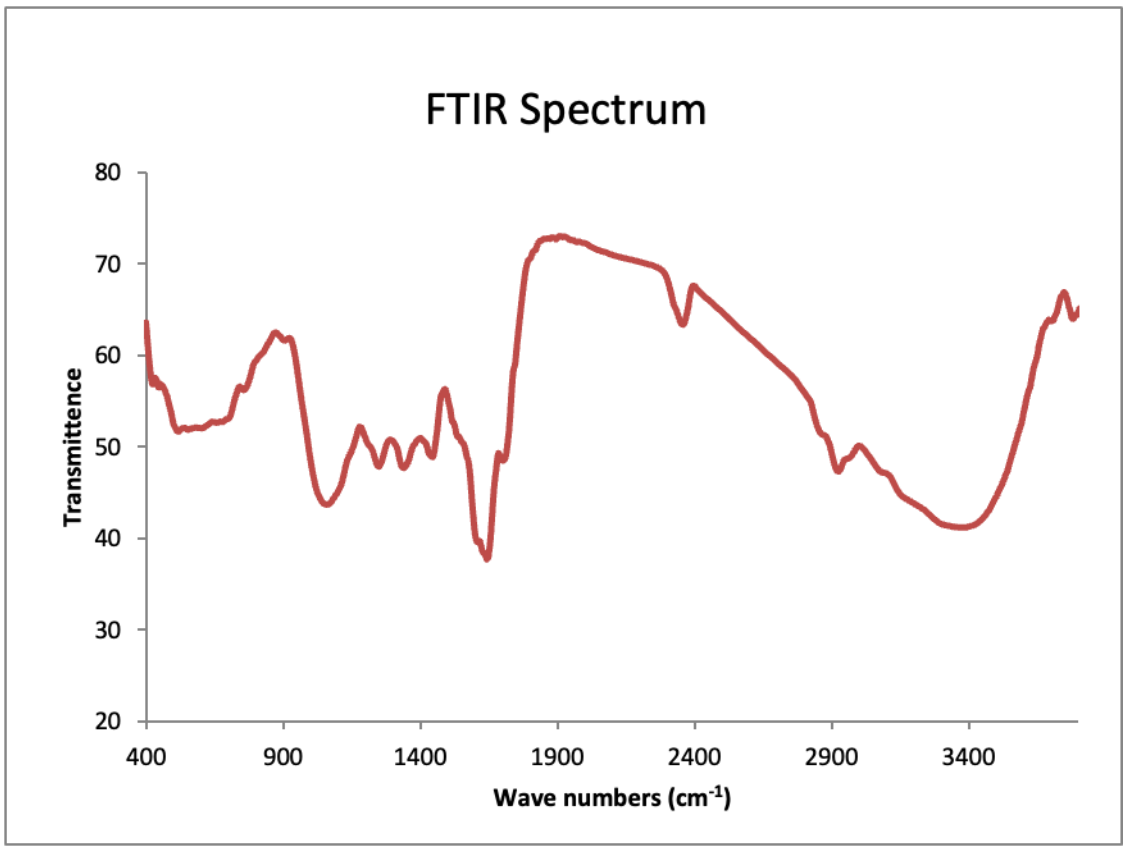

Figure 2. FTIR spectrum of *Mimosa pudica*

The peak at 634.50 cm^{-1} is the characteristic of C–H stretching vibrations of sulphoxides, sulphides, and disulphides and C–Br stretching in acyclic, aromatic, and aliphatic axial compounds. The peak at 954.00 cm^{-1} corresponded to the C–H in-plane bending in the phenyl ring and density-populated phenanthrenes, many weak bands of 1,2- Benzanthracenes and N–O stretching in quinine monoximes. The peak at 860.08 cm^{-1} indicated the C–H out-of-plane bending vibration with a lone H atom. It also shows the same vibrations in 1,2,4-Trisubstituted benzene and β-substituted naphthalene. C–H vibrations are also present in aromatic hydrocarbons such as biphenyl, polyphenols, anthracenes, phenanthrenes, naphthacenes, 1,2-benzanthracenes, and pyrene. In the case of esters, it shows C–O–C asymmetric stretching vibrations similar to those in aldehydes. Aliphatic and aromatic nitro groups can also be there with C–N stretching, and some nitrate compounds show O–N stretching.

The peak 1068.97 cm^{-1} included many weak bands, such as 1,2-benzathracenes. Also, C–CHO skeletal vibrations are present in aldehyde groups. Similarly, some halogen derivatives, such as mono-fluorinated compounds, show C- F stretching vibrations. The peak 1589.56 cm^{-1} shows C=C stretching vibrations in alkenes and NH_4 asymmetric bending vibrations in primary amine salts. Peak 3340.92 cm^{-1} shows C–H stretching in alkynes and OH stretching in some hydroxyl compounds. It also performed N–H stretching in both amides and amines II [8].

The UV-Visible study of leaf extract of *Mimosa pudica* green color solvent shows prominent absorptions in 664 nm, 537 nm, 468 nm, 435 nm, 414 nm, 338 nm, 279 nm, and 233 nm. The UV spectrum (Figure 3) results show that maximum absorption occurs in 380-450 nm

regions. So the most absorbed color is violet, and the transmitted color is yellow-green (Akhter et al. 2019).

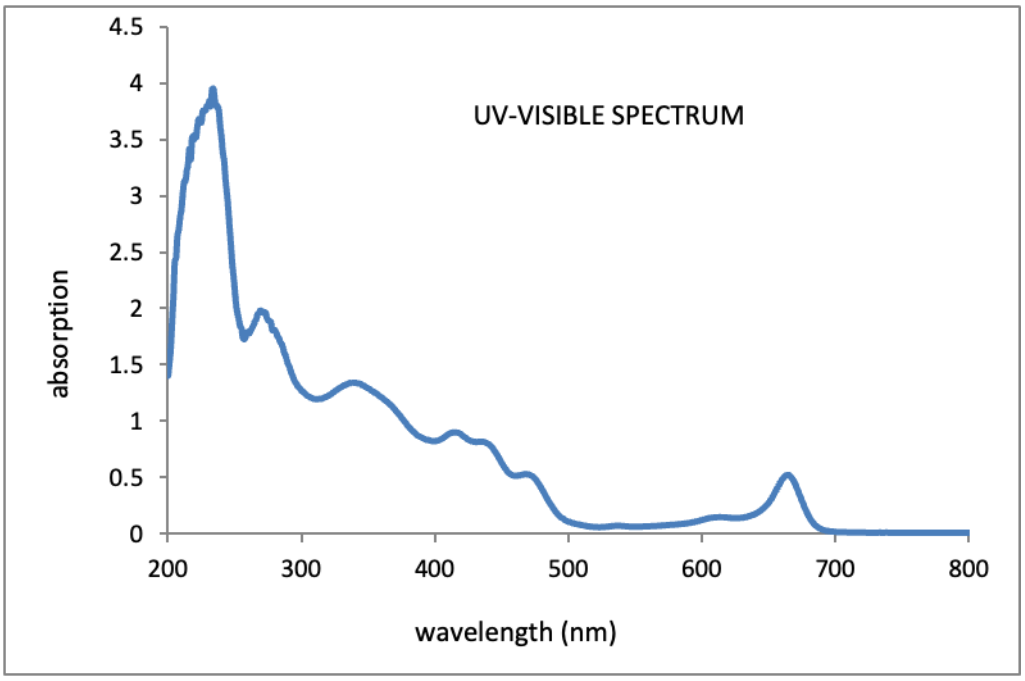

Figure 2. UV-visible spectrum of *Mimosa pudica*

These absorption ranges show that the chromophores and auxophores contain C_6H_5, N=N, C=S, and NO_2 groups since the absorption ranges are <260 nm, 338 nm, 468 nm, and 277 nm respectively. Electronic transitions in the UV region corresponding to the wavelength are given in Table 1.

The UV absorption at 233 nm, 269 nm, and 338 nm correspond to the functional groups of nitrite, ketone, and naphthalene. It can be seen that phenol and thiophenol are present since they have absorption wavelengths of 270 nm and 233 nm respectively. Previously our group discussed the importance of functional group roles for the synthesis of nanoparticles-mediated plant extracts, and we suggested that carboxylic acid, aliphatic amines, and alkaloids were identified as major functional groups in as-prepared nanocomposites by the aiding of WSLE, which are may be responsible for the reduction of Ag and NiO NPs from the precursor material. In another study, we discussed the major role of saponins, nimbin, nimbidin, and azadirachtin in Neem nanoparticles confirmation and stimulated its performance in electrochemical analysis for energy storage material. Previously, our group conformed alkaloids in *Datura metel* L and *Withania somnifera* leaf extract in the UV spectra. Moreover, we calculated the inflammatory activity and correlated it with experimental results of antimicrobial activity [5, 9, 10]. Therefore, in this study, we find the clue of compounds nitrite, ketone, and naphthalene and will evaluate their performance in the future.

Table 1. Assignment of UV absorption lines

Wavelength (nm)	Functional Group	Transition
177	–C=C–	Pi -----> pi*
280	–C=O–	n ----->sigma *, n-----> pi *
204	–COOH–	n -----> pi *
233	$–C_6H_5SH–$ (Thiophenol)	n -----> pi *
338	–N=N–	n -----> pi *
277	$–NO_2–$	n -----> pi *
270	$–NO_3–$	n -----> pi *

4. Conclusions

This study shows the presence of functional groups such as carbohydrates, glycogen, amino acid, amide, starch, phosphate, lipid, glycogen, and cellulose. Therefore, FT-IR and UV-Visible spectra, which objectively reflect the panorama of chemical composition in complex systems, are the most reliable methods for identifying and identifying mixed-substance systems such as traditional medicine and herbal medicine. Further research may help identify new bioactive compounds from this medicinal plant, such as mimocapsin (US Patent 6071507 A).

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Not Available

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