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Assessment of phytochemical and pharmacognostic properties of flowers of *Achyranthens Aspera*

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Abstract: The current work reveals pharmacognostic and phytochemical analyses on the flowers of *Achyranthens Aspera*, a member of the Amaranthaceae family. The Americas, Asia, and Africa are where you can find *Achyranthens Aspera* most frequently. *Achyranthens Aspera* is a perennial herb that stands tall, quadrangular, and has several branches. The entire plant has been utilized for medicinal purposes, including the roots, seeds, leaves, roots, flowers, and fruits. Despite its significance, there hasn't yet been any pharmacognostic research on its components, like flowers. Several organoleptic traits were visible upon microscopical evaluation. A microscopic study of the flowers revealed the presence of calcium oxalate crystals, fibers, and trichomes, as well as fluorescence analysis. The current work also comprises a Fourier transform infrared spectroscopy analysis of *Achyranthens Aspera*. FTIR spectra showed the existence of aldehyde, alkene, alkyl, amine and aromatic groups. By offering trustworthy evidence of the plant's quality, these pharmacognostic and phytochemical investigations can be beneficial to medical experts and companies who produce herbal medicines.

Keywords: *Achyranthens Aspera*, FT-IR spectra, standardization, microscopy.

INTRODUCTION

A large component of the worldwide pharmaceutical market is made up of plants. For judging their quality in this regard, internationally recognized rules are essential. According to estimates, 80% of people in developing nations only use conventional herbal remedies. Documenting the standardization of these plant elements that will be employed as future pharmaceuticals is therefore crucial (Khan et al., 2015). Foods that include phytochemicals, also known as phytoconstituents, which are bioactive compounds, include fruits, whole grains, leaves, seeds, roots, nuts, vegetables, and legumes. Phytochemicals come in hundreds, yet only few have been isolated from plants (Cao et al., 2017). Polyphenols, lignans, phenolic acids, ginsenosides, carotenoids, flavonoids, procyanidins, coumarins, indoles, isoflavones, catechins, phenylpropanoids, anthraquinones, and other phytochemicals are the most common ones found in food (Zhao et al., 2018; Xiao, 2017). Herbal treatments are safer than synthetic ones because phytochemicals in plant extracts target the metabolic pathway (Nisar et al., 2018). *Achyranthens Aspera* is a perennial herb that stands tall, quadrangular, and has several branches. The plant, also known as chaff flower, prickly chaff flower, or devil's horsewhip, can reach heights of up to 6 to 7 feet. The entire plant has been utilized for medicinal purposes, including the roots, seeds, leaves, roots, flowers, and fruits. The genus Cordia contains plant species used as ornaments. *Achyranthens Aspera* has straightforward, hairy, and short-stemmed leaves. The leaves are opposite one other on a woody stalk with a sharp end and are two hues, yellowish below and green above. The leaves have a broad base with an egg-shaped base, a pointed tip that is 8 to 10 cm long, and a pointy tip that is 7 to 8 cm wide. The 60 cm tall, long, slender spikes of *Achyranthens Aspera* have few green or yellowish-white blooms. By the time the blooms are in the fruiting stage, the bracts around them have sharp, pointed points, giving the heads a spiky appearance. Orange to straw-brown capsules are fruits. Plants in the Amaranthaceae family are found in tropical, subtropical, and hotter climates all over the world. In June and July, a perennial shrub known as *Achyranthens Aspera* blooms profusely (Adeosun et al., 2015; Prakash et al., 2020). Flowers are showy and orangish red, blooming in clusters mostly in spring and summer (Hanani et al., 2019). The ethyl acetate extract of *Achyranthens Aspera* fractions were subjected to bioassays, which led to the separation of sebestinoids with aspartic protease inhibitory potential (Dai et al., 2010). *Achyranthens aspera*'s seed oil contains palmitic and oleic acids (Agunbiade et al., 2013). AgCuO biometallic nanomaterial made from *Achyranthens aspera* leaf extract through a green manufacturing procedure. Moreover, it has been claimed that the flowers of *Achyranthens aspera* can be used to colour (Ravi et al., 2020; Kumaresan et al., 2012). Fresh *Achyranthens Aspera* leaves and blooming spikes' pulp, when applied externally, is a potent home cure for scorpion bites that is thought to paralyze. The seeds are helpful for treating corneal infections and other ocular problems in cases of snake or reptile bites. When a furious dog bites someone, flowering, long spikes are coupled with a modest amount of sugar to treat hydrophobia. *Achyranthens Aspera* ash, which is high in potash, has been used to wash garments (Hegde et al., 2014; Sharma et al., 1987). Menorrhagia can be treated with the flowers and fruits of *Achyranthens Aspera*. We outline the full chemical make-up of the hexane extract together with the pharmacognostic characteristics of the flowers of *Achyranthens Aspera*.

METHODS AND MATERIALS

On August 2022, flowers from the Quaid-i-Azam University were collected. The plant specimen was recognized by a taxonomist at the Institute for Plant Conservation (Fig. 1).

Preparation of *Achyranthens Aspera* flower extract

One liter of hexane was added to 500g of *Achyranthens Aspera* flowers in an extraction flask, and the mixture was shaken three times each day while it was maintained at room temperature for three days. Using No. 1 Whatman filter paper, the extract was filtered. On a rotating evaporator, the filtered extract was vacuum-pressure dried at 40 °C. The resulting extract was stored in a dark amber glass bottle at room temperature (Upadhya et al., 2014).

Fig. 1: *Achyranthens Aspera* flowers.

Pharmacognostic research

Macroscopic analysis

We evaluated the macroscopical features of the flowers from *Achyranthens aspera* (Ahmed and Hasan, 2015). A light microscope was used to perform powdered microscopy on the blooms of *Achyranthens aspera*. The mechanically powdered dried flowers were filtered via sieve number 40. (Bharthi et al., 2017). On a glass slide, a small layer of powder was applied, and several reagents including water, glycerine, chloral hydrate, and iodine were used in different treatments. We performed microscopic observations and took photomicrographs using 4, 40, and 10 objective lenses (Evans, 2009; WHO, 2011).

Fluorescence examination

The fluorescent chemical components were observed under visible and UV light of short (254nm) and long (365nm) wave lengths, fluorescence analysis of *Achyranthens Aspera* flower powder with various chemicals was also conducted (Tang et al., 2018; Kadam et al., 2012).

Fourier transform infrared spectroscopy (FTIR)

The distinct functional groups present in phytochemicals were identified using FTIR. The functional groups were identified using the fine powder of *Achyranthens Aspera* flowers. The powder was then investigated using an FTIR spectroscope with a 500–4000 cm1 wave number range. Data from FT-IR spectra were interpreted using the correlation chart (Pavia et al., 2008; Bigoniya et al., 2012).

RESULTS

Macroscopic and Microscopical analysis

The fresh flowers of *Achyranthens aspera* were orange in colour, grouped together, and made up of epipetalous stamen with a salve-like neck. Flowers have a long tube that widens into a polypetalous flower that is actinomorphic, gamosepalous, have a 1.5–2.5 cm calyx, a crenulate corolla, and an involucre bract that is 3–5 cm in size, has a bland flavor, has a silky texture, and breaks softly when broken (Ankad et al., 2013). As can be seen in fig. 2, the orangish brown powder of *Achyranthens Aspera* flowers displayed some notable microscopic characteristics.

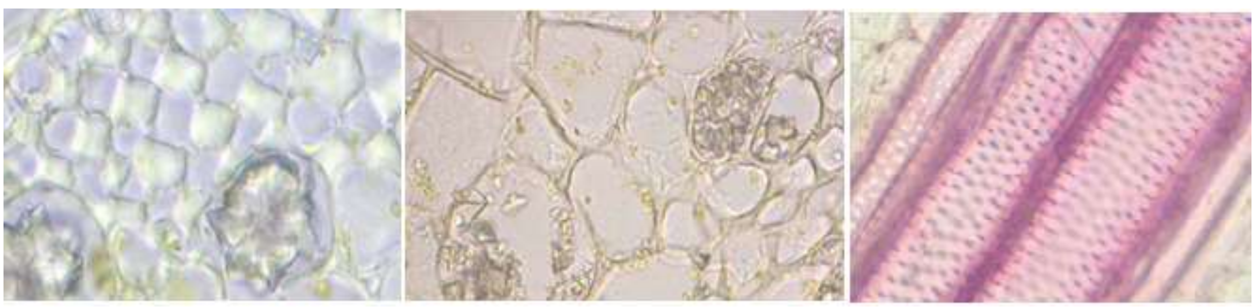

Fig. 2: Microscopical analysis of flowers of *Achyranthens aspera*.

Fluorescence examination

The findings of the fluorescence investigation of *Achyranthens Aspera* flowers are shown in Table 1.

Table 1: Fluorescence characters of the flowers *Achyranthens Aspera*.

Reagent	**Day light**	**Ultra Violet light (254nm)**	**Ultra Violet light (365nm)**
Chloroform	Orange brown	Brownish	Grey
Ethanol	Orange brown	Reddish brown	Bluish grey
Methanol	Brown	Light Brown	Yellowish

Sulphuric acid	Orange brown	Orange brown	Brownish
Glacial Acetic acid	Yellow	Pinkish white	Blue and green
Hydrochloric acid	Brownish	Brownish	Brownish
Ferric chloride	Blackish black	Blackish brown	Blackish brown

FOURIER TRANSFORM INFRARED SPECTROSCOPY (FTIR)

The outcomes of an FTIR analysis of *Achyranthens Aspera* flowers are displayed in Table 2 and Figure 2.

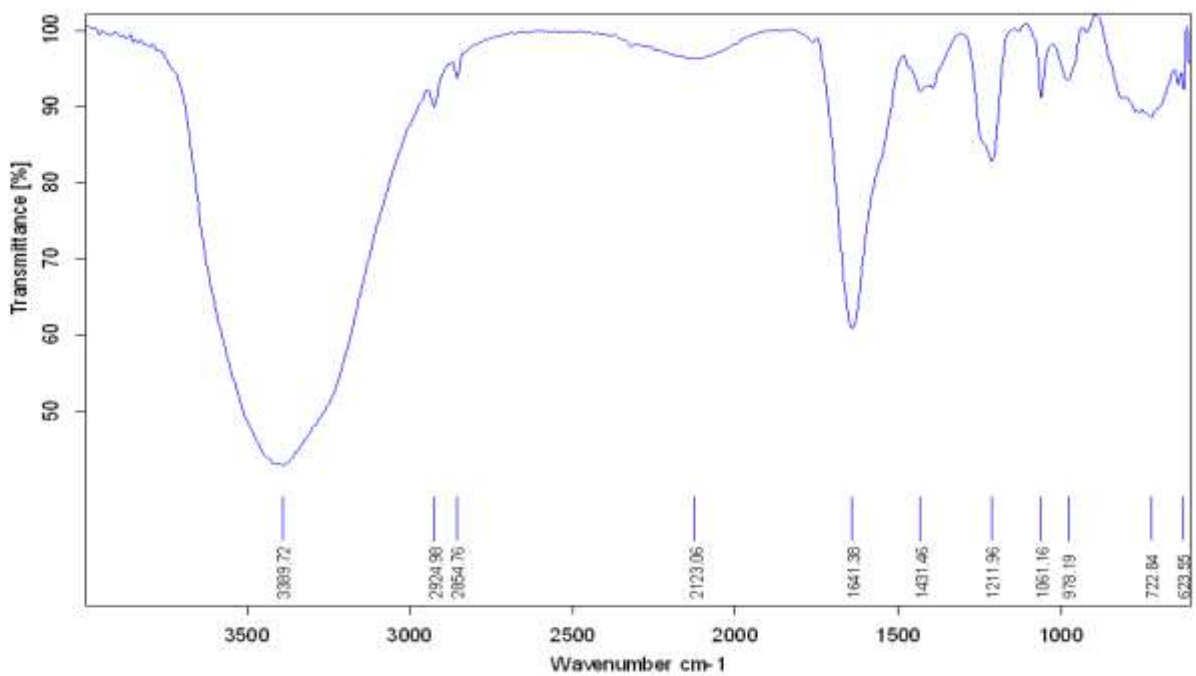

Fig. 2: FTIR spectrum of *Achyranthens Aspera* flowers.

Table 2: FT-IR analysis of flowers *Achyranthens Aspera*

Type of Vibration Assigned	**Absorption Frequency (cm^{-1})**
C-H	2800-3000
C=C	1600-1800

C-O Alcohols, carboxylic acids, ethers, anhydride, esters	1000-1200
Aromatic	1400-1600
C-N Amines	1200-1400

DISCUSSION

It is believed that plants with therapeutic characteristics provide a source of novel chemical compounds that, with further study, can be turned into medicines. Modern medications are frequently directly or indirectly derived from medicinal plants (Gurudeva et al., 2001; Pai et al., 2011). Due to the frequent finding of inferior or false herbal suppliers, standardization of herbal treatments is essential to proving their validity and understanding their structure, science, botanical value, and therapeutic usefulness (Zhang et al., 2021). The most important tests for standardization are histological analysis and macroscopic appraisal. The authors have devised a project to identify histological features and macroscopic studies that can be used for the identification and standardization of this plant because there are currently no known standard standards for standardization. As depicted in fig. 2, fibres, calcium oxalate crystals, and different kinds of trichomes project the microscopic properties of *Achyranthens aspera* flowers (Bijeshmon and George, 2014; Bharthi et al., 2017) found fibers of slightly related types in the blooms of Vitex negundo L. and Tabernaemontana divaricata R. Similar multicellular trichomes were found in the flowers of Justicia (Reddy et al., 2015; Bijeshmon and George, 2014; Baravalia et al., 2011). Comparable xylem pieces with spiral thickening were examined in the flowers of *Tabernaemontana divarcata R.* and *Woodfordia fruticosa Kurz*. Fluorescence analysis is a crucial component that shows the drug's chromophore symbol and is necessary for standardization (Prasanth et al., 2017). While they may frequently be transformed into fluorescent subsidiary by applying various chemicals, as stated in table 1, which is helpful for identifying them, few constituents showed luminous in ultraviolet or visible light. For a complete understanding of the numerous functional groups contained in plant material, Fourier-transform infrared spectroscopy is a useful tool (Selvaraju et al., 2021; Pai et al., 2011). There are also significant details on the organic and inorganic components. The presence of alcohol, anhydride, confirmed by the strong peak of C-H group, which confirmed the existence of many aliphatic, aldehyde-containing compounds, the alkene and alkyl group, the presence of carboxylic acids, ethers, esters, and alcohol, as well as the C-N group, which indicates the presence of aliphatic amines, are just a few vibrations that were found by (Tandon, 2011). Each functional group in a plant has unique therapeutic properties, and these functional groups produce the phytochemicals found in natural goods. It is crucial to define the chemical elements of plants since they are fundamental to the pharmacological and biological processes of plants (Duan et al., 2011). A methyl ester known as hexadecanoic acid has hemolytic, anti-inflammatory, hypocholesterolemia, anti-androgenic, and alpha reductase inhibitor properties (Pavani and Naika, 2021). Heptacosane's anti-oxidant properties (Dandekar et al., 2015). Nonacosane's bacterial-fighting properties (Ryu et al., 2020). Characteristics of 1,2-benzenedicarboxylic acid diisooctyl ester for antifouling and antioxidants (Parthipan et al., 2015) The presence of different hydrocarbons in the hexane extract affects the chemotaxonomy of *Achyranthens Aspera* (Adeosun et al., 2013).

CONCLUSION

Controlling the quality of herbal medications is a serious problem. For the first time, the pharmacognostic properties of *Achyranthens Aspera* flowers are described, and these results may aid in the identification and authenticity of these plant components in the future for use in further research and application. Research on the phytochemicals in hexane extract has yielded a wide range of findings that can be used to control the standard of plant medicines. Overall, this study may contribute to the development of *Achyranthens Aspera* standardization limits, but additional research is required to develop reference data and compact evidence for precise identification and validation of the natural product, which will aid pharmacopeial documentation in recognizing its distinctiveness, authenticity, and quality.

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