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Assessment of Physio-Chemical, Phytochemical and Quantitation Profile Achyranthes *Aspera* Leaf Herbaceuticals

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Abstract: There are many remedies for human ailments in nature. For fundamental medical requirements, almost 80% of the world's population depends either fully or partially on traditional medicine. Achyranthes aspera Linn. is a well-known medicinal plant whose roots, leaves, seeds, stems, flowers, and entire plant are used to cure a range of ailments in traditional medical systems. Traditional customs suggest its use in conditions such as diabetes, inflammation, skin conditions, liver problems, infections, digestive problems, and wound healing. As a result, pharmacognostical research appears to be very helpful in identifying adulterants or substituents and assessing the quality of commercial samples available on the market. In addition, lack of standardization, dishonest commercial practice of adulterating and substituting the genuine herbal drugs are posing great obstacle in popularizing the time-tested herbal-based traditional medicines. The present study was focused on preliminary pharmacognostic and phytochemical investigations for determining and establishing the identity, purity and quality of the plants. The preliminary results of the physicochemical characterization and the phytochemical screening of the powdered leaves of *Achyranthes aspera* attest to their safety and confer them a guarantee of phytotherapeutic quality.

Keywords: *Achyranthes aspera*, Physiochemical, Phytochemical investigations.

INTRODUCTION

An essential component of every traditional medical system is a natural medication. Ayurvedic and other traditional medical systems use about 1250 Indian medicinal herbs to make therapeutic medicines. Plants provide a variety of resources that help meet basic needs for clothes, food, and shelter [1]. The medicinal plant *Achyranthes aspera*, also referred to as "Prickly Chaff Flower," has drawn interest from both contemporary scholars and traditional healers because of its many therapeutics uses. This herbaceous perennial plant has been used traditionally for ages in many cultures across the world, and it is an essential component of indigenous medicinal methods [2]. The plant's ethnopharmacological implication is rooted in its multifaceted traditional customs. For generations, it has been employed to report numerous health conditions, such as inflammation, wounds, gastrointestinal disorders, respiratory ailments, and pain management. The broad spectrum of its pharmacological activities, including anti-inflammatory, antioxidant, antimicrobial, and analgesic effects, has prompted researchers to explore its potential applications in modern medicine [3, 4].

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Achyranthes aspera

The ethnopharmacological consequence of Achyranthes aspera lies in its extensive traditional use as a medicinal plant in various cultures worldwide. The present investigation was designed to evaluated phytochemical and physiochemical analysis along with quantitation of Achyranthes aspera leaf extract for presence of various phytopharmaceuticals.

MATERIALS AND METHODS

Collection & Extraction

Freshly collected plant material of Achyranthes aspera consisting of leaves was subjected to shade drying to remove inherent moisture content without affecting thermolabile phytoconstituents. After complete drying, plant material was pulverized using mechanical grinder to obtain coarse powder. The powdered medication underwent sequential solvent extraction via a Soxhlet system, employing solvents in ascending order of polarity: petroleum ether, chloroform, ethanol, and distilled water. Successive extraction method allows systematic separation of phytoconstituents based on polarity differences.

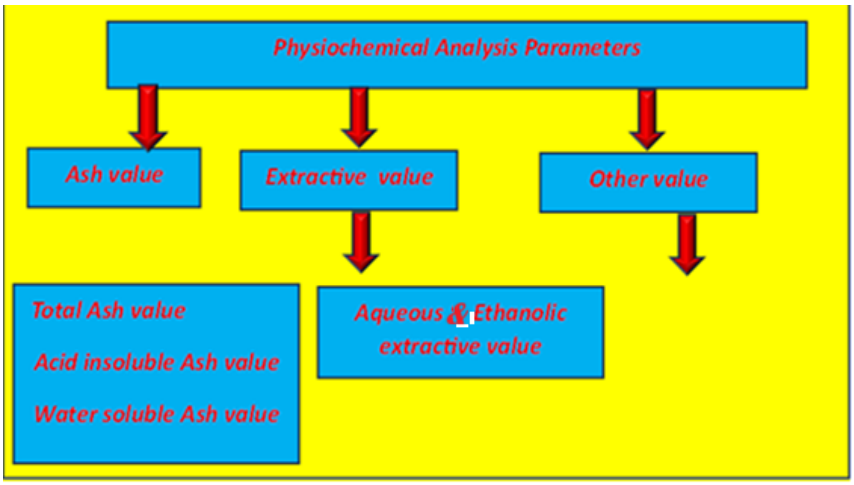
PHARMACOGNOSTICAL STUDIES

Morphological studies

The macroscopical evaluation of medicinal plants is an important step in pharmacognostical standardization and identification of crude drugs. Macroscopic characteristics assist in verifying the authenticity of plant material and identifying adulteration. This study meticulously studied and documented the macroscopic properties of many parts of Achyranthes aspera Linn., particularly the leaves.

Preliminary Physiochemical Screening of Plant Extracts [5-8]

The parameters which were analysed in the present studied was graphically presented as:



Phytochemical analysis

The various extract of *Achyranthes aspera* was subjected to preliminary qualitative phytochemical investigation. Preliminary phytochemical screening was carried out to identify the presence of various classes of bioactive constituents in different extracts of Achyranthes aspera Linn. Linn., including petroleum ether, chloroform, ethanolic and aqueous extracts of both leaf (PEEASL, CEASL, EEASL, AEASL). The qualitative analysis was performed using standard chemical tests as described in the methodology [9].

Quantitative Estimation of Phytoconstituents

A quantitative analysis of phytoconstituents was conducted to ascertain the concentration of principal bioactive compounds in various extracts of Achyranthes aspera Linn., specifically petroleum ether extract (PEEASL), chloroform extract (CEASL), ethanolic extract (EEASL), and aqueous extract (AEASL). The assessment of total phenolic, total flavonoid and total alkaloid content was conducted utilizing standard spectrophotometric and gravimetric techniques [10-11].

Assessment of Total Flavonoid Content

The total flavonoid content was determined as quercetin equivalent (mg/100mg) utilizing the equation derived from the calibration curve: Y=0.032X + 0.018, R2=0.998, where X is the quercetin equivalent (QE) and Y is the absorbance.

Assessment of Total Phenolic Content

Total phenolic compounds (TPC) were quantified as mg/100mg of gallic acid equivalent in the dry extract sample, utilizing the equation derived from the calibration curve.: Y = 0.011X+0.011, R2= 0.998, where X is the gallic acid equivalent (GAE) and Y is the absorbance.

Estimation of Total Alkaloidal content

Achyranthens aspera Linn leaf and stem extracts were tested for total alkaloid concentration [12].

RESULT & DISCUSSION

Achyranthes aspera (Amaranthaceae) is a significant medicinal herb that grows almost exclusively

in rural India as a weed. Nearly every component is utilized in the conventional medical system. These are the most significant portions that are utilized medicinally, along with seeds, roots, leaves, and shoots. Cancer, leprosy, asthma, fistula, piles, arthritis, wounds, insect and snake bites, dandruff, hepatitis, renal disorders, dermatological disorders, gynecological disorders, gonorrhea, malaria, fever, cough, diabetes, pyorrhea, dysentery, ophthalmia, rabies, hysteria, toothache, etc. have all been treated with achyranthes asper L. Antimicrobial, larvicide, immunostimulant, hypoglycemic, hypolipidemic, antioxidant, diuretic, anti-inflammatory, cardiac stimulant, antihypertensive, anti-anasarca, analgesic, antipyretic, antinociceptive, prothyroidic, antispasmodic, and hepatoprotective properties have all been attributed to the plant. This work aimed to objectively assess the phytochemical, physiochemical and quantitative estimation of active phytopharmaceuticals several leaf extracts of Achyranthes aspera Linn. The investigation commenced with a Pharmacognostical assessment of the chosen plant materials to verify their authenticity, purity, and quality. Morphological and physicochemical analyses established standard parameters that are beneficial for the authentication of the crude medicine and the avoidance of adulteration. Macroscopic evaluation is crucial in the quality control of herbal medications as it offers essential information regarding plant identity and purity. Proper identification of plant material ensures reproducibility and reliability of phytochemical and pharmacological studies. The detailed observations of macroscopical characteristics of leaf and stem are presented in Table 1& fig.1. Physicochemical characteristics are crucial for assessing the identity, purity, and quality of crude drugs. These criteria facilitate the identification of adulteration, incorrect handling, contamination, and the presence of inorganic contaminants. The assessment of foreign organic matter, moisture content, ash values, swelling index, and extractive values establishes a scientific foundation for the standardization of herbal pharmaceuticals. The result was tabulated in table 2 & fig 1. Defining these criteria was crucial prior to advancing to phytochemical and pharmacological studies. Sequential solvent extraction of leaf powders utilizing petroleum ether, chloroform, ethanol, and aqueous solvents yielded extracts with differing percentage yields. The outcome of investigation showed in table 3. The variations in extractive yield may be ascribed to the polarity of solvents and the chemical composition of chemicals found in various plant sections. Ethanolic and aqueous extracts exhibited somewhat larger yields, likely attributable to elevated quantities of polar chemicals, including flavonoids, phenols, glycosides, and tannins. Conversely, petroleum ether extracts exhibited reduced yields as they mostly extract non-polar components, including lipids, waxes, and sterols. Initial phytochemical analysis [table 4-5] verified the existence of numerous significant secondary metabolites, including alkaloids, flavonoids, phenolic compounds, tannins, glycosides, steroids, terpenoids, and saponins. These findings align well with previously documented investigations on Achyranthes aspera, reinforcing its therapeutic significance. The quantitative assessment of total phenolic and flavonoid contents revealed elevated amounts in specific extracts, potentially influencing their observed biological activities. The result of quantitative profiling of phytochemical was tabulated in table 5 &fig.3. The outcome of investigation showed that aqueous leaf extracts showed highest flavonoid, phenolic and alkaloid content as compared to ethanolic extract however alkaloid was only found in chloroform leaf extract.

Table 1: Morphological studies of *Achyranthens aspera Linn*

S.No.	Descriptions	Observations
		Leaves
1.	Color	Green
2.	Odor	Characteristics
3.	Taste	Sweet
4.	Shape	Obovate
5.	Size	1.5-5.5 cm(L); 0.4-4 cm (B)
6.	Surface Characters	Smooth
7.	Fracture	Absent

Table 2: Physicochemical parameters of *Achyranthens aspera* L

S. No.	Parameter	% Content
1.	Foaming index	1.1143
2.	Ethanol soluble extractive	26.4326
3.	Water soluble extractive	24.3218
4.	Swelling index	3.1189
5.	Total ash	13.3816
6.	Acid-insoluble ash	1.6514
7.	Water soluble ash	2.4419
8.	Loss on drying	4.2438

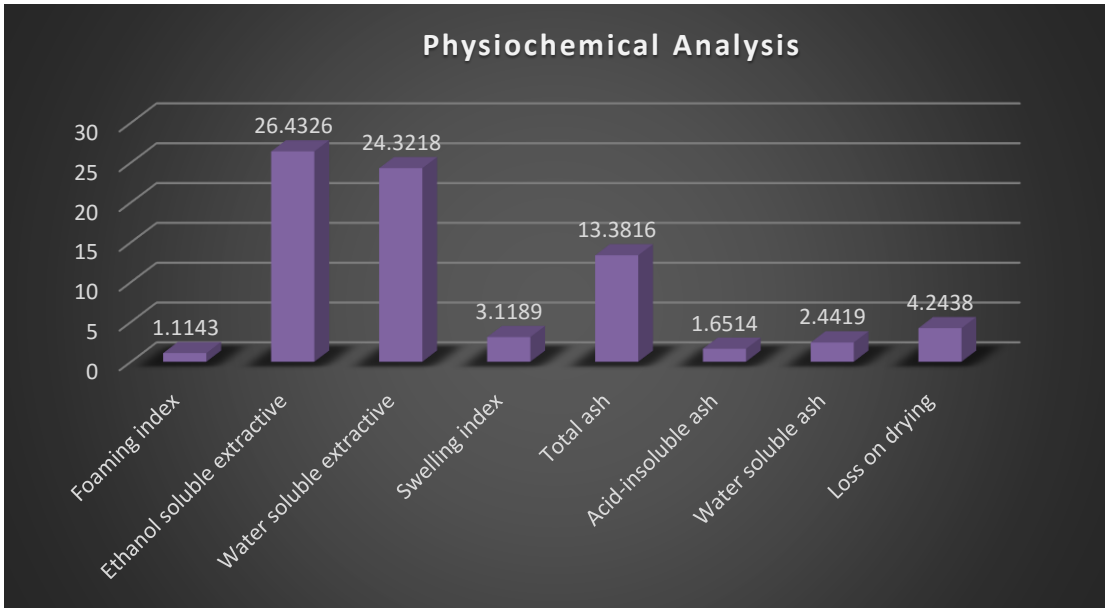


Fig. 1: Physiochemical analysis

Table 3: Percentage yield of different extracts of ASL

Extract	Colour	Nature	Yield (% w/w)
PEEASL	Dark green	semi solid	3.42
CEASL	Greenish black	semi solid	4.11
EEASL	Light green	solid powder	18.27
AEASL	Green	solid powder	16.29

Table 4: Phytochemical Screening of *Achyranthens aspera* Linn. Extract

Constituents	PEEASL	CEASL	EEASL	AEASL
Carbohydrates	-	-	+	+
Glycosides	-	+	+	+
Alkaloids	+	+	+	+
Protein & Amino acid	-	-	-	+
Tannins & Phenolic compounds	-	-	+	+
Flavonoids	-	+	+	+
Fixed oil and Fats	-	-	-	-
Steroids & Triterpenoids	-	+	+	+
Waxes	-	-	-	-
Mucilage & Gums	-	-	-	-

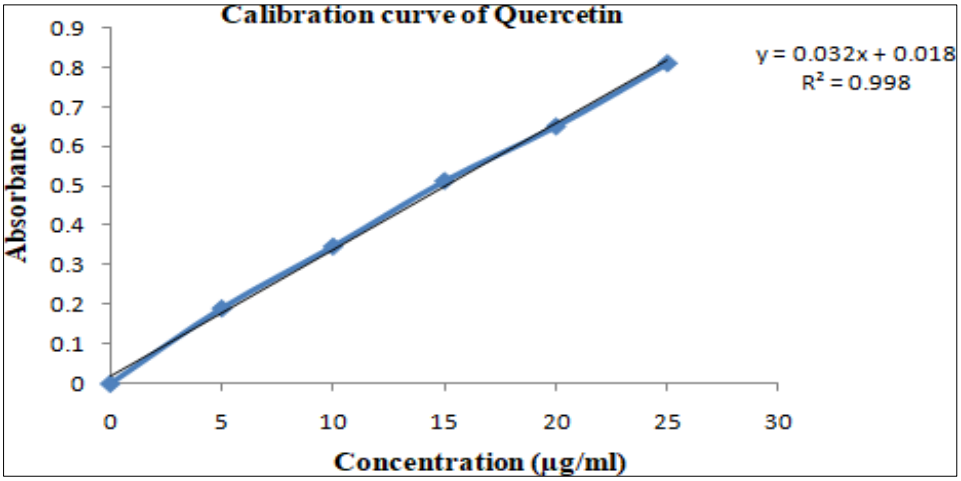


Fig. 2: Calibration of Quercetin

Table 5: Qualitative Profiling of Phytoconstituents

Sl. No.	Extract	TFC (%)	TPC (%)	TAC (%)
1.	PEASL	-	-	1.39±0.24
2.	CEASL	1.13±0.29		1.33±0.11
3.	EEASL	3.46±0.08	2.14±0.19	2.18 ±0.21
4.	AEASL	4.19±0.03	3.23±0.11	3.42±00.18

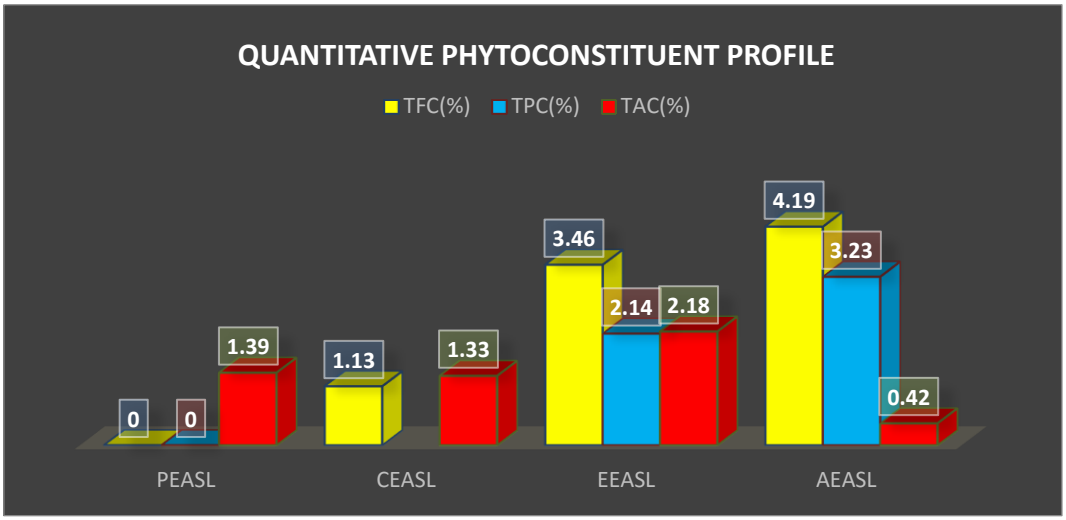


Fig. 3: Quantitative Phytoconstituent Profile

CONCLUSION

The current investigation confirmed the authenticity and quality of the plant materials, while successive solvent extraction enabled efficient isolation of phytoconstituents based on polarity. Phytochemical screening, quantitative estimation. The presence of active Herbaceuticals in leaf extracts showed the efficacy and medicinal value of the *Achyranthens aspera* plant.

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