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Investigation of pharmacognostical and preliminary phytochemical characters of *sida cordifolia*

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Abstract

Objective: To study detailed pharmacognostic profile and preliminary phytochemical investigation of leaf of *Sida cordifolia (Malvaceae).* In Ayurvedic system of medicine it is used as anti-rheumatic, analgesic, antipyretic, anti-asthmatic, nasal decongestant, antiviral, laxative, diuretic, aphrodisiac, hypoglycemic, hepatoprotective and in the treatment of parkinson disease.

Methods: Leaf, of *Sida cordifolia was* studied by Macroscopical, Microscopical, Physiochemical, Phytochemical analysis of powder of the plant and other methods for standardization recommended by WHO.

Results: Macroscopically, the leaves are simple. 2.5-7 cm long and 2.5-5 cm broad, with 7-9 veins, heart shaped, serrate and truncate, acute apex, toothed margin, reticulate venation, soft, dark green colour, characteristic odour and bitter taste. Microscopically, the leaf showed. thin cuticle on both upper and lower epidermis with stellate trichomes. Upper epidermis single cell-layered, thick, and is composed of oval to oblong cells. Mesophyll tissue is consisting of compactly arranged, rectangular, elongated palisade cells followed by rounded to oval shaped, loosely arranged spongy cells. In the midrib region, the upper epidermis is very thinly cuticularised with different types of trichomes. Vascular bundle sheath is distinct and composed of sclerenchymatous cells. Xylem elements are radially elongated and followed by phloem elements. A few calcium oxalate crystals are present in this layer. Stomata is anisocytic type and some places occur paracytic stomata. The investigations also included leaf surface data; quantitative leaf microscopy. Preliminary phytochemical screening revealed the presence of reducing sugar, alkaloids, saponin and steroids.

Conclusions: The results of the study can serve as a valuable source of information and provide suitable standards for identification of this plant material in future investigations.

Keywords: *Sida cordifolia*, Microscopy, Macroscopy, Phytochemical evaluation

1. Introduction

Medicinal plants research continues to be faithful approach for the search of new drugs. The endurance of herbal medicines may be explained often without side effects both on the illness and its symptoms. An impressive number of thousands of plants have been utilizing for treatment of diseases since thousands of years. Many of them are fairly introduced in our Indian traditional medicines "Ayurveda "(corell et al., 2000). According to the world health organization, herbal medicines are being used by about 80% of the world population primarily in the developing countries for primary health care. This plant-based traditional medicinal system continues to play an essential role in health care [1-2].

Sida cordifolia (Linn) syn. Country Mallow of Malvaceae family is widely distributed along with other species are common throughout the tropical and sub- tropical plains all over India and Srilanka up to an altitude of 1050 m., growing wild along the roadside. It grows as wasteland weed. It is also known as the "Bala" in Hindi and Sanskrit. (Narayan et al., 1956) The plant name Bala is coined on the name of 'Parvati' (goddess of strength and beauty). The quantities are low, with less than 2% of ephedrine and pseudoephedrine found in the leaves of *Sida cordifolia*.. Ephedrine is known to stimulate the central nervous system (CNS), and as such can enhance weight loss. Traditionally nutrition companies used plants such as Ma-Huang (Ephedra plant), because it contained relatively large amounts of ephedrine, in their weight loss products. However, since this product was banned in many countries including the USA and UK, they are now looking for alternatives. *Sida cordifolia*, with its ephedrine and pseudoephedrine has gained a lot of interest and is now sold by many of these companies.

Sida cordifolia is a small, erect, downy shrub. The leaves of the plant are chordate-oblong or ovate- oblong and fruits with a pair of awns on each carpel. Roots of the plant which constitute a drug are 5-15 cm long with few lateral roots of smaller size. The tap roots are generally branched at the tip. The outer surface of the root is off to grayish yellow. It is almost odourless with slightly bitter taste (Rangari et al., 1995). *Sida cordifolia* (Malvaceae) is a highly reputable medicinal herb in the Ayurveda and other traditional systems of medicine in India and various other countries. In the Ayurvedic system of medicine it is used as antirheumatic, analgesic, antipyretic, antiasthmatic, nasal decongestant, antiviral, laxative, diuretic, aphrodisiac, hypoglycaemic, hepatoprotective and in the treatment of Parkinson disease. The chemical composition of this herb comprises of alkaloids, flavonoids, phytoecdysteroids, sterols and fatty acids. Leaves are demulcent and febrifuge, used in dysentery [3-13].

The present study was carried out the Macroscopic, Histological and physiochemical and quantitative microscopical studies and preliminary phytochemical investigation of leaf of *Sida cordifolia.*

2. Materials and Methods

Collection and Authentication

Sida cordifolia was collected, in and around Palakkad, Kerala, India and authenticated by taxonomist and the plant authenticated specimen is deposited in the Department of Pharmacognosy, Sanjo College of pharmaceutical studies, Palakkad, the authentication specimen number is SCPS/P.COG/004/2019. The fresh leaves were kept for shade drying. Dried specimen was powdered using mechanical grinder and passed through 60 mesh sieve to get the powder of desired coarseness. Powdered material was preserved in an air tight container.

Pharmacognostic Standardization

Organoleptic characters such as shape, size, colour, odour, taste of stem were determined. Microscopic studies were carried out by preparing thin hand section of leaf and stem with Chloral hydrate solution, stained with Phloroglucinol-hydrochloric acid (1:1) and mounted in glycerine. Histochemical studies and powder microscopy were carried out to know about the inclusions and detailed anatomical characters of the material [14].

Quantitative microscopy

The quantitative microscopy such as vein- islet number, vein- terminal number, stomatal number and stomatal index were determined as per standard procedure [15].

Physio-chemical Evaluations

The parameters were done to evaluate the proceedings of total ash; water soluble ash; acid insoluble ash and sulphated ash were calculated as per Indian Pharmacopoeia. Extracts of the powdered stem was prepared with different solvents for the study of extractive value. Fluorescence analysis was also carried out for the powder and for extract as per standard procedure [16].

Preliminary Phytochemical Screening

The ethanol, petroleum ether, benzene, chloroform and aqueous extract of S.cordifolia Linn. was subjected to tests for the presence or absence of the major class of compounds by standard methods [17].

Extraction of Plant material

For preliminary phytochemical analysis, extract was prepared by weighing 1kg of the dried powdered aerial parts were subjected to hot successive continuous extraction with different solvents as per the polarity, petroleum ether, benzene, chloroform, methanol, ethanol and finally with aqueous. The extracts were filtered in each step using Whatman filters paper. The filtrate was concentrated using a rotary evaporator at low temperature (40-45^{o}C) and pressure. The presence or absence of the primary and secondary phytoconstituents was detected by usual prescribed methods [18]

Fluorescence analysis

Powder drug was treated with different reagent and was observed for Fluorescence under UV light

Results

Macroscopy of the leaf

Leaves 2.5-6.5 x 1.5-3.5 cm, orbicular, ovate to oblong, cordate at base, obtuse or acute, occasionally rounded or truncate at apex, crenate-serrate along margin, 5-7 nerved at base, densely velutinous with stellate hairs on both the surfaces; petioles 2-3cm long; stipules free-lateral, filiform, densely stellate-hairy mixed with few simple hairs.Dark green in colour, characteristic odour, slightly bitter taste, acute apex, soft texture,

Fig 1: Habitat profile of entire

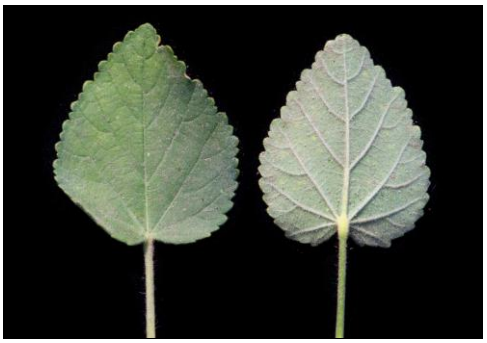

Fig 2: Macroscopy of the plant

Histological characters

The detail and systemic Pharmacognostical evaluation would give valuable information for the future studies.

T.S of Leaf

Transverse section of leaf-blade shows thin cuticle on both upper and lower epidermis with stellate trichomes. Upper epidermis single cell-layered, thick, and is composed of oval to oblong cells. Mesophyll tissue is consisting of compactly arranged, rectangular, elongated palisade cells followed by rounded to oval shaped, loosely arranged spongy cells. In the midrib region, the upper epidermis is very thinly cuticularised with different types of trichomes. The cells are tangentially elongated on upper and radially elongated on lower epidermis. Next to the upper epidermis 4-5 rows of rounded to oval cells followed by parenchymatoua cells surrounding the vascular bundles. The vascular bundles are collateral, with higher amount of xylem and scanty phloem tissues. Vascular bundle sheath is distinct and composed of sclerenchymatous cells. Xylem elements are radially

elongated and followed by phloem elements. A few calcium oxalate crystals are present in this layer. Stomata is anisocytic type and some places occur paracytic stomata.

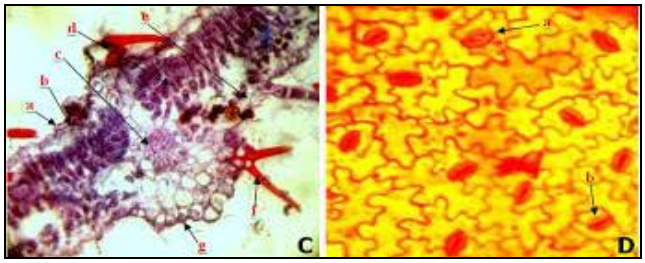

Fig 3: T.S of Leaf of *Sida Cordifolia*

T.S.of leaf, a-upper epidermis, b-cuticle, c-vascular bundles, d-palisade parenchyma, e-spongy parenchyma, f- trichome, g- lower epidermis. D-Surface view of leaf epidermis showing a-anisocytic and b-paracytic stomata.

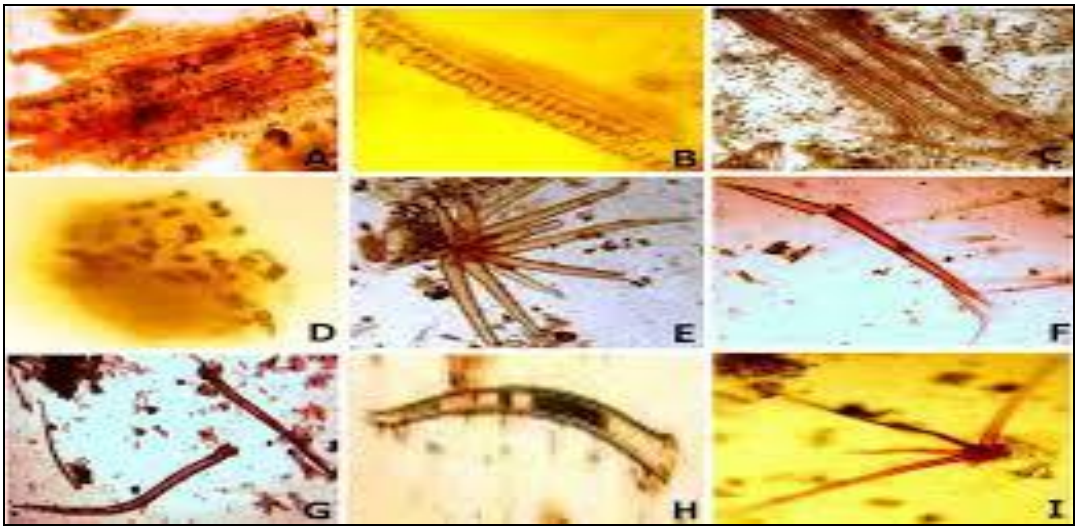

Fig 4: Powder microscopy of leaf of *Sida cordifolia*

A- Epidermal cells, B-Annular to spiral Vascular Bundle, C-Vessels, D- starch grains, E- Multiseriate trichome, F-Unicellular conical trichomes, G-Warty trichome, H-Uniseriate trichome, I- Stellate trichome

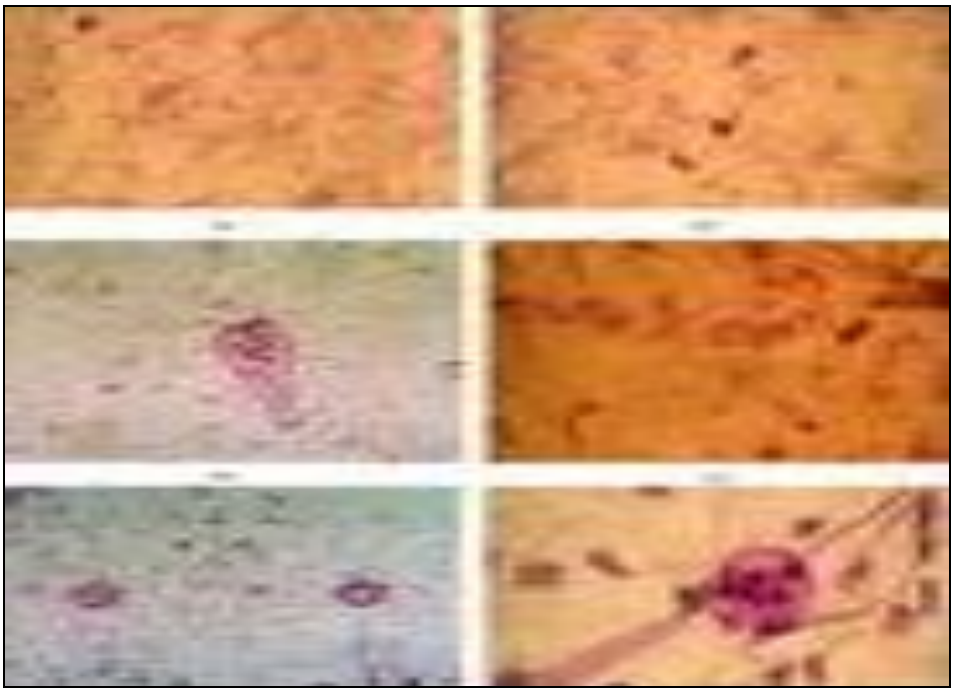

Fig 5: Effect of air pollution on micro morphological structures on leaves of Sida cordifolia L. in the summer (left side: healthy site; right side: polluted site)

(a) upper foliar surface showing stomata; (b) lower foliar surface showing stomata with striations at the trichome base; (c) lower foliar surface showing distribution of stomata with developing trichome base; (d) upper foliar surface showing slit-like aperture of stomata; (e) lower foliar surface showing distribution of stomata; (f) lower foliar surface with degenerating trichome).

Powder microscopy

Powder characteristics revealed the presence of Epidermal cells, annular to spiral Vascular Bundle, vessels, starch grains, multiseriate trichome, unicellular conical trichomes, Warty trichome, uniseriate trichome, Stellate trichome

Quantitative microscopy

The quantitative microscopy such as vein- islet number, vein- terminal number, stomatal number and stomatal index were determined and the results were tabulated. (Table 1)

Table 1: Quantitative evaluation of the crude drug of leaf of *Sida cordifolia*

Standardization parameters	
Vein islet no	38.59/sqmm
Vein termination no	31.49/sqmm
Stomatal number (upper) (Lower)	21.58 26.57
Stomatal index (upper) (Lower)	145.80 190.99
Palisade ratio	1.32

Physiochemical parameters

The powdered drug was evaluated for its physico-chemical parameters like total ash values, acid insoluble ash, water soluble ash and loss on drying, and the results were tabulated (Table 2). The ash contents showed the amount of inorganic matter present in the sample and the acid insoluble ash almost within 2.2% which expresses low siliceous matter present in the sample.

Table 2: Physico chemical evaluation of *Sida cordifolia*

Standardization parameters	Leaves(%w/w)
Total ash	15.62±0.03
Acid insoluble ash	7.57±0.02
Acid soluble ash	3.80±0.019
Water soluble ash	6.02 ±0.023
Loss on drying	7.32

Extractive values

The extracts were prepared according to the polarity and they were concentrated and their values were calculated with reference to air dried drug and the results were tabulated (Table 3).

Table 3: Extractive values of leaf extracts of *Sida cordifolia* with different solvents

Extracts	Percentage of extractive value
Aqueous	4.50
Ethanol	12.02

Preliminary phytochemical analysis

Table 4: Phytochemical analysis of *Sida cordifolia*

Secondary metabolite	Name of the test	Observation	Result
Reducing sugar	Benedict's test	Red precipitate	++
Alkaloids	Mayer's test	Yellow color precipitate	++
	Hager's test	Orange brown precipitate	++
Flavonoids	General test	No red coloration	- -
Tannins	$FeCl_3$ test	No brownish green color	- -
Saponins	Frothing test	Change was observed	++
Gums & Carbohydrates	Molisch Test	No red-violet layer at the interface between the acid (bottom) and aqueous (upper) layers	- -
Steroids	Sulphuric	Red color was observed	++

Fluorescence analysis: The powdered drug and they were treated with solvents and the colour changes were observed under Ultra violet light and the results were tabulated (Table 5)

Table 5: Fluorescence analysis of *S.cordifolia*

Solvents used	Day Light	UV Light (254nm)
Powder as such	Light green	Light green
Powder + Picric acid	Yellowish green	Light green
Powder + HNO_3	Faint Brown	Yellowish green
Powder + HCl	Dark green	Dark green
Powder + H_2SO_4	Light green	Light yellow
Powder+$FeCl_3$	Dark brown	Dark brown
Powder + NaOH	Light green	Dark green
Powder + Glacial acetic acid	Light green	Light green
Extract+ Iodine solution	Faint black	Black
Extract+Water	Light green	Dark green
Powder + Aqueous Mercuric chloride	Light green	Dark green
Powder+HNO_3 +NH_3Solution	Light brown	Light brown

Discussion

The morphological and anatomical features both are the important characters for the identity of 'Bala' plant. The cultivation with proper method can provide good as well as suitable drug which help in identification of adulterants and substitutes. Natural cultivation is more fruitful than tissue culture method. The unscientific and skill-less uprooting during harvesting of the whole plant seems to trend deterioration of the natural habitat in the near future. The only solution is to use the required portion of the plant scientifically and its ex-situ or in-situ cultivation.

Conclusion

In present investigation, various standardized parameters such as macroscopic, microscopic, pharmacognostic and phytochemical screening was carried out and which could be helpful in authentification of *Sida cordifolia L.* The results of present study will also serve as reference material in the preparation of monograph. It is present need to conserve the plant for medicinal usage.

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Competing interests

Authors have declared that no competing interests exist

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