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Research Article

Pharmacognostical over view of species *Abutilon indicum* (l.) Sweet - A tropical weed with great medicinal effect

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Abstract

Background: *Abutilon indicum* (L.) Sweet. (Malvaceae) is wastelands weed plant and best-known medicinal plant used in the Indian Materia Medica. Objectives: In the search for authenticity of this best-known traditional medicine, were investigated in order to obtain characteristic patterns and medicinal potentiality by the way of pharmacognostical analysis. This drug posse's excellent potential in Ayurvedic medicinal system. Materials and methods: The essential parameters studied up for the pharmacognosy of *A. indicum* were macroscopical study, histochemical evaluation, including transverse section, powder microscopy and physicochemical parameters. Result: The pharmacognostical characterization profiles of plant revealed the important identification characters like stellate trichome and presence of rosette type crystals. From the microscopical evaluation, the histochemical evaluation showed the tissue arrangements of petiole, leaf and stem and observed cell storage depositions like starch grains and calcium oxalate crystals. from the powder microscopical observation presence of plenty of calcium oxalate rosette type crystals, prismatic type of calcium oxalate crystals stellate type trichome, glandular trichome, lower epidermis with anomocytic stomata and starch grains, pitted vessels, reticulate vessels, lignified fibres and tracheids are observed. Conclusions: The findings of this research will help in identifying this plant drug and standardization of the single drug or as a powder form, even when added to a formulation this drug as ingredient.

Keywords: *Abutilon indicum (L.) Sweet,* Wasteland plant, Indigenous Medicinal System, Pharmacognosy characterization.

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Introduction

Abutilon indicum (L.) Sweet. (Malvaceae) is one of the best-known drug plants in the Indian Materia Medica (1) and well known for medicinal, industrial use (2)(3) and also known as medicinally important weed[4]. This is a perennial herb distributed in all parts of tropical and subtropical region of India[5]. considered invasive on certain tropical islands (6)(7).

Presence of primary metabolites like proteins and carbohydrates, secondary metabolites like sterols, steroids, terpenes, terpenoids, and flavonoids, phenolic acids, quinones, coumarins, alkaloids, sphingolipids, megastigmanes, iridoids are already reported in various part of this plant species (8)(9)(10)(11). There are many active and inactive phyto chemical compounds like gallic acid, β-sitosterol, β- amyrin, eudesmol, eugenol, geraniol, and caryophyllene, gossyptin-7-glucoside, cyanidin 3-rutinoside, two sesquiterpene lactones, alantolactone and isoalantolactone, in addition to gossypetin 8-glucoside (12)(13). *Abutilon indicum* is an oil yielding plant, seed oil of this plant contains fatty acid and vernoilic acids, sterculic acid and malvalic acid (14).

Sanskrit name of *Abutilon indicum* is Atibala originated from the Sanskrit word "Ati"-very; "Bala"-powerful indicating the strength of biological properties (15). The historical literatures from Vedic period, Samhita period, ancient Nighantu period to current modern texts the evidence of biological property of Atibala is traced (16). Aerial parts of *A. indicum* contains promising antibacterial phyto chemical substances having activity against the bacteria *E. faecalis* (17). The highest antioxidant activities also recorded in the plant source *A. indicum* (18). The various parts of this plant such as roots, leaves, flowers, bark, seeds, and stems have been used as a demulcent in bronchitis, diarrhea, gonorrhea, inflammation of the bladder, arthritis, antipyretic, antioxidant,

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hepatoprotective, antidiarrheal, aphrodisiac, pulmonary, sedative, astringent, laxative, expectorant, tonic, antifungal, anthelmintic, cytotoxic, analgesic, gastroprotective, anti-hyperglycemic, immunostimulant, antiviral, antibacterial, anti-stress, anti-malarial, anti-leishmanial, antidiabetic and diuretic (19) (20)(21).

The current study is aimed to establish the macroscopy, powder microscopy and physicochemical analysis of A. indicum leaf, stem and root. Fruit part of *A. indicum* reported different sizes of lignified stellate hairs with large lumen, thick-walled epidermal cells, round to oval-shaped collenchymatous cells of hypodermis, oil globules, group of scalariform vessels, group of fixed oil globules, brownish matter, thick-walled stone cells, elongated cells of testa and cotyledon parenchymatous cells (10). In Ayurvedic Pharmacopeia of India also reported the root part of *A. indicum*, in this study, an attempt has been made to know about the identification characters of leaf, petiole, stem and root through the pharmacognostical standardization. This study will be useful for the identification of the similarities and differences of the identification key characters and relatable nature with most useful part and other part. Sametime this study will help to identify the flora from its histological characters.

Materials and Methods

Collection, Drying and Preservation.

Fresh whole parts of *Abutilon indicum* species, have been collected from Gangetic plain Region of India. Gangetic plain Regions of India Plants were authenticated by PCIM&H (Pharmacopoeia Commission for Indian Medicine & Homoeopathy) and herbarium were prepared and deposited with the accession number 0087 in the PCIM&H Regional Raw Drug Repositary herbarium (Fig 1). Plant parts were separately cleaned and washed with tap water then left for shade drying and dried sample were powdered with a mixer grinder and sieved through 60 mesh and kept in air tight containers for further analysis.

Macroscopic evaluation

Various macroscopic characters of *A. indicum* were recorded such as duration, type of leaf base, presence or absence of petiole, characters of lamina such as composition, incision, shape, venation, margin, apex, base, surface, texture and colour, odour, taste and morphological nature etc.

Microscopic evaluation

Microscopical evaluation has been conducted by section cutting. Dried samples were soaked in the water for softening their cells after that for thin free Transverse sections with the help of sharp blade. Each section stained with safranine stains, dehydrated with alcohol series of different concentration (10, 20, 30, 40, 50, 60, 70, 80 and 90%) and were mounted with glycerine. Various tissue and cell contents observed through trinocular microscope with 4x, 10x and 40x resolution and documented. Photomicrographs were taken with the Carl Zeiss camera attached Trinocular microscope.

Physicochemical Parameters

Fresh whole parts of *Abutilon indicum* species, have been collected from Gangetic plain Region of India. Gangetic plain Regions of India Plants for the physicochemical studies. The various physicochemical parameters like total ash, acid-insoluble ash, alcohol soluble extractive, water soluble extractive and loss of drying that were determined as per the Ayurvedic Pharmacopeia of India. Three different group of samples collected from different plant individuals and are analysed separately, then average percentage taken as result.

Results

***Abutilon indicum* (L.) Sweet**, Hort.Brit. (Sweet)1:54 (1826); *Sida indica* L., Cent Pl. 2:26 (1756).		
Common characters	:	Erect under shrubs. Leaves ovate to sub-orbicular, acute at apex, dentate, densely pubescent. Flowers yellow, axillary, solitary. Fruit schizocarp, globular, mericarp reniforms. Seeds 2-3 per mericarp.
Distribution	:	Tropics and subtropics of the world.
Habitat and ecology	:	Scrub jungles and wastelands
Flowering and fruiting	:	September-April.
Part used for medicine	:	Root & whole plant

Various name in different languages		
Tamil	:	Thuthi, Panivarattuti, Perunthuthi
Sanskrit	:	Atibalaa
Telugu	:	Duvvena Kayalu.
English	:	Country mallow, Indian mallow
Malayalam	:	Kaluram, Kattooram, Oorpam, Ooram, Thuthi, Velluram, Vennkurunthotti

Macroscopic evaluation

Various sensory parameters of the plant material were studied by macroscopic evaluation (Figure 1).

Description

Sl. No	Plant Part	Observation
1	Leaves	Dimensions: 3-8 x 4-7 cm Colour: As seen in bulk Conditions: dry and whole Lamina: Entire Margin. crenate-dentate Apex: Acute Leaf Base: cordate Petiole: 2-6 cm long, stipules up to 4 mm long Surface: velvety, sparsely stellate-hairy above. Odour: odourless Taste: mucilaginous
2	Stem	Kind: Shrubby. Direction: Upright Shape: Terete (Cylindrical) Colour: Green Surface: Densely clothed with minutely short stellate-pubescent and simple hairs. Odour: odourless Taste: mucilaginous
3	Root:	Kind: Shrubby. Direction: Upright Shape: Terete (Cylindrical) Colour: Creamish white Surface: smooth. Odour: odourless Taste: mucilaginous

4	Flower	Colour: Yellow Flowers: Solitary Pedicel:4-5 cm long, Calyx: 4 mm long with 5 lobes, pubescent with stellate hairs. Corolla:2- 2.5 cm length, 5 number petals, Androecium: staminal column 5-6 mm long Style: 20mm to 1 cm long Stigma: capitate Ovary: globose
5	Fruit	Kind: Dry, Schizocarp Dimensions: 1.2 x 2 cm Shape: globular with a flattened apex, mericarps 15-20, to 12 x 9 mm, reniform, flattened, hairy Colour: Blackish when matured Seeds: Ovoid to reniform
6	Seed	Shape: Ovoid to reniform, 3mm long Warty surface, black colour.

Microscopic evaluation

Leaf

Lamina: T.S shows upper and lower epidermis, rectangular shaped single layered epidermal cells covered with glandular and non-glandular stellate type trichome upto 125µ in length and uneven surface of epidermal layers due to abuntant quantity of trichomes. Mucilage also deposited in few epidermal cells. Anomocytic type of stomata present in lower epidermis region 7-8 celled trichome present, below the epidermis layer the next region was mesophyll which consist of narrow, long elongated palisade cells and calcium oxalate crystals. Spongy parenchyma consists of about 4-5 layers loosely arranged cells. Stomatal Index, 5.4, palisade ratio 5 and vein islet Number 12 (Figure 2).

Midrib: T.S of midrib shows upper and lower epidermis with abundant number of stellate trichome and glandular trichomes, epidermal cells are rectangular shaped followed by closely packed thick collenchyma cells with 2-3 layered in upper region, and 3-4 layered in lower part, large arch shaped vascular bundle arranged in centre with xylem and phloem and it extending upto the lateral margin of midrib. Xylem surrounded by phloem. Lower part arranged homogenous parenchymatous compactly arranged ground tissues (Figure 2).

Petiole: T.S shows circular outline with plenty of unicellular and stellate trichomes, outer most layer of epidermis followed by 4-5 layers of thick-walled collenchymatous cells and parenchymatous cortex followed by vascular bundle arranged radially, xylem surrounded by phloem. Parenchymatous pith arranged in centre and 4-5 vascular bundles. Rosette type calcium oxalate crystals scattered throughout the cortex region and vascular region (Figure 3).

Stem: TS of stem shows circular outline, outer most cuticle, followed by single layered epidermis covered with stellate type of unicellular trichome and glandular trichome, followed by thick-walled round to oval shaped 5-7 layers of collenchymatous layers, thin-walled parenchymatous rectangular shaped cells in cortex, vascular bundles radially arranged in the middle region, phloem fibres arranged as broken strips and transversed phloem rays also present. parenchymatous pith centrally located. Rosette type calcium oxalate crystals scattered throughout the cortex region (Figure 4).

Root: TS of root shows circular outline, outer most brown coloured cork, followed by vascular bundles. Vascular tissue consisting of phloem zone and a very wide zone of xylem extending to phloem fibres arranged as conical shaped patches and a very wide zone of xylem extending to the centre. Cluster type calcium oxalate crystals and starch grains are present in the vascular region. 3-4 rows of tangentially elongated brownish coloured cork cells followed by secondary cortex, Phloem consists of phloem parenchyma, sieve tube, companion cells and successive groups of phloem fibers. Clusters of calcium oxalate are scattered in the phloem parenchyma. The xylem consists of lignified vessels, pitted parenchyma, lignified and non-lignified fibers and tracheids (Figure 5).

Powder microscopy

Leaf veins with plenty of calcium oxalate rosette type crystals, prismatic type of calcium oxalate crystals upto 50µ in length, calcium oxalate rosette type crystals upto 18µ in dia stellate type trichome, glandular trichome, unicellular trichome, lower epidermis with anomocytic tomata, pitted vessels, reticulate vessels, lignified fibres, tracheids, pitted parenchyma, starch grains filled parenchyma, simple and compound starch grains, starch grains filled cell, simple pitted and boarded pitted vessels (Figure 6, 7 & 8).

Table 1: Physico-chemical analysis of the powder of leaf, petiole, stem and root of *A. indicum*

S.no	Parameters	Calculated values	Result	In Ayurvedic Pharmacopeia of India (Root Part)
1	Total Ash	7.45%	Not more than 11%	Not More than 8%
2	Acid-insoluble Ash	0.8%	Not more than 3%	Not more than 3%
3	Alcohol soluble extractive values	6.75%	Not less than 4%	Not more than 3%
4	Water soluble extractive	13.4%	Not less than 12%	Not more than 9%
5	LOD	7.7%	Not more than 10%	-

Discussion

Wrong identity of medicinal plant source has resulted in substitution and adulteration of raw drugs causing many problems in herbal drug trade and industry. It spoiling the identity, purity and efficacy of drugs. The right cure will happen when the right medicine applied for the issue, Adulteration can lead adverse effect also. Quality standardization of medicinal plants drugs is an essential method for verifying their identity purity safety and quality. The bioactivity of *Abutilum* genus has already reported and this plant genus have great potential for human and animal health because of its broad-ranging antioxidant capacity (22). Fresh leaves of *Abutilon indicum* already reported that the presence of anamocytic stomata, cluster and prismatic type of calcium oxalate crystals, unicellular and stellate type covering trichomes (23). The anatomical structures of the root, stem and leaf of the plant *A. theophrastii* Medik reported that the crescent shaped vascular bundle in leaf midrib, presence of mucilaginous content, leaf anatomy showing similarity with the plant *A. indicum* (24), multicellular trichome, long glandular hairs are neither in the leaf of A. indicum nor have these kinds of glandular cells. Clustered crystals and simple and clustered glandular hairs are

reported more in the species *A. theophrastii* (24), similarly clustered crystals and stellate type trichomes are more observed in all of the studied organs of the plant *A. indicum.*

Similarly, In the present study the macroscopic and microscopic physicochemical evaluations are resulted the presence of plenty of calcium oxalate rosette type crystals, stellate type trichome, glandular trichome, unicellular trichome, lower epidermis with anomocytic stomata, simple pitted and boarded pitted vessels, reticulate vessels, lignified fibres, tracheids, pitted parenchyma, starch grains filled parenchyma, simple and compound starch grains were found in leaf, petiole, stem and root.

Conclusion

This study stands determined to perform macro-microscopical protocols on *A. indicum* with the aim of proper identification, the size, shape of calcium oxalate crystals, glandular, unicellular, non-glandular stellate type trichomes, different type of vessels, nature of fibres are important identification key characters of this plant. Morphological and microscopic studies of leaf, petiole, stem and root act as a reliable aid for detecting adulteration, identification of flora and ingredient from the drug formulation.

Acknowledgment

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Conflict of Interest

The authors declare that there is no conflict of interest.

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Figure 1: A. Image showing the habit of plant *A. indicum*

Figure 2: A: TS of leaf Midrib, B; TS of lamina (col; collenchymas, lepi; lower epidermis pal, palisade cells; smes; spongy mesophyl, rcr; rosette crystal, tr; trichome, uepi; upper epidermis, vs, vascular strand; vb; vascular bundle)

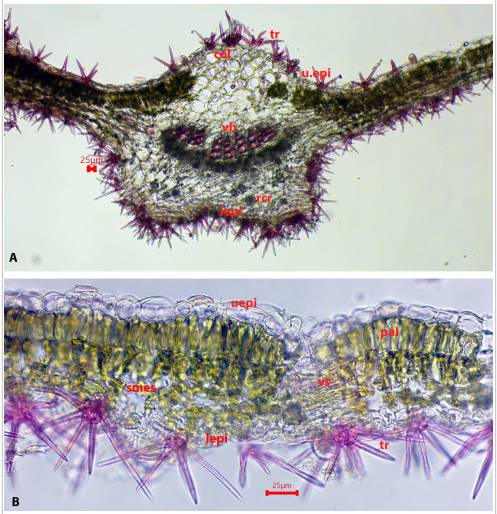


Figure 3: A: TS of petiole, B; TS of petiole outer view enlarged, C; TS of petiole vascular bundle enlarged view (col; collenchyma, cor; cortex, tr; trichome, uepi; upper epidermis, vb; vascular bundle)

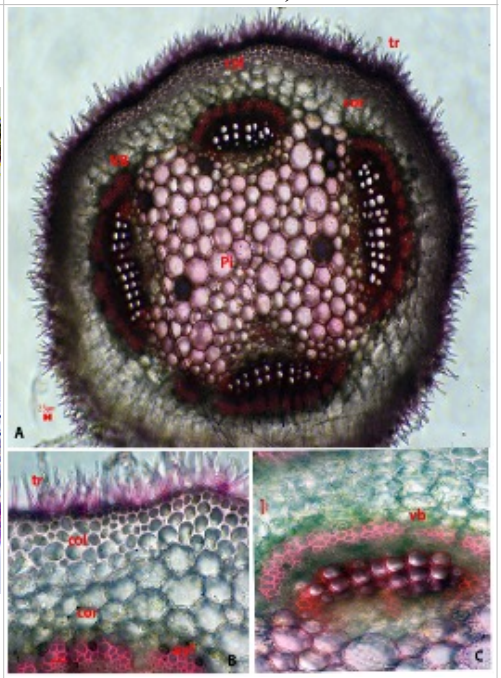


Figure 4: A: TS of stem, B; TS of stem outer view enlarged, C; TS of stem vascular region enlarged view (col; collenchyma, cor; cortex, epi; epidermis, tr; trichome, p;pericycle, phf; phloem fibre, p;pith, scl; sclerenchyma, mr, medullary ray, uepi; upper epidermis, vb; vascular bundle)

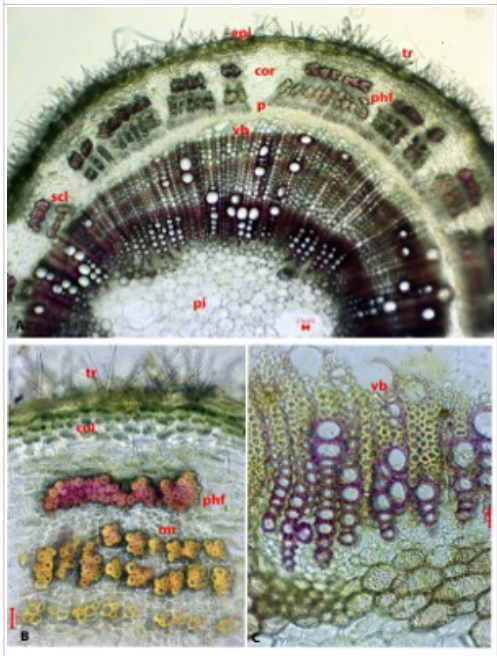


Figure 5: A: TS of root, B; TS of stem outer view enlarged, C; TS of stem central region enlarged view, D; iodine treated root TS for starch grain identification (col; collenchyma, cor; cortex, epi; epidermis, tr; trichome, p;pericycle, phf; phloem fibre, p;pith, scl; sclerenchyma, mr, medullary ray, uepi; upper epidermis, vb; vascular bundle)

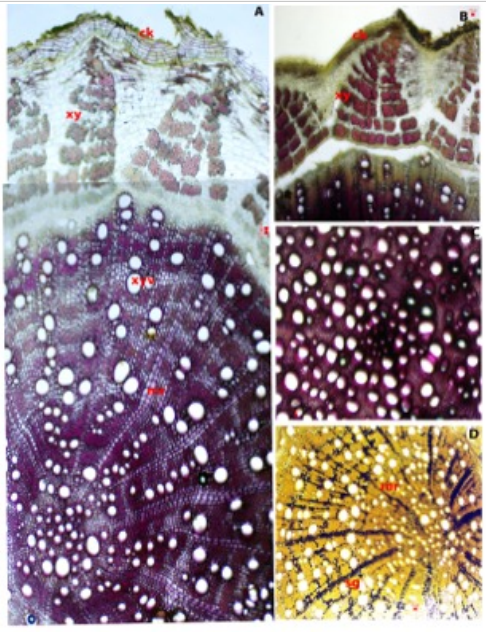


Figure 6: A & F: prismatic crystals, B & C; pitted parenchyma, D; starch grains filled parenchyma, E; rosette crystals, F; prismatic crystals, G; simple and compound starch grains, H; starch grains filled cell, I; stellate trichome from midrib, J&K; epidermal cells and stellate trichome, L; unicellular trichome, M; stellate trichome, N; anomocytic type stomata and epidermal cells from lower epidermis.

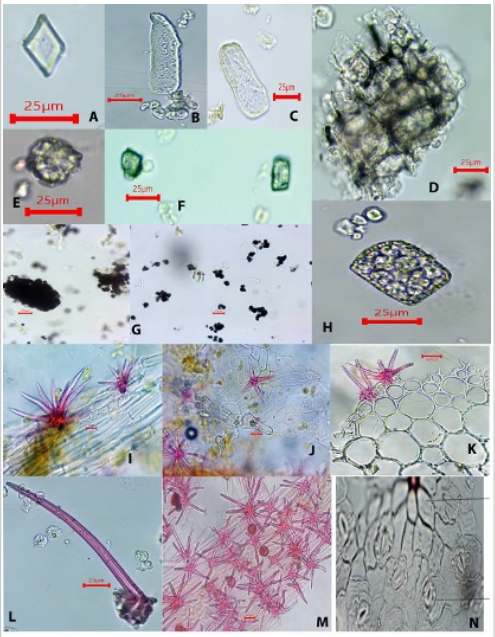
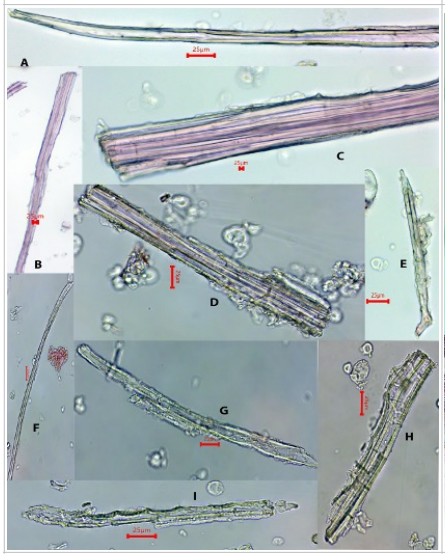
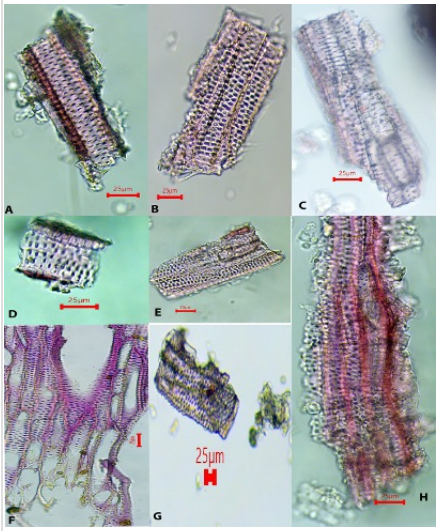


Fig 7. A,B,C&D; lignified fibres, E,F,G,H&I; non lignified fibres	Fig 8. A,C,D,F,G; simple pitted vessels and vessel group, B,E&H; Bordered pitted vessels
	

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