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Review

Multifaceted Medicinal Potential of *Abutilon Indicum*: Ethnobotany to Evidence-Based Pharmacology

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Abstract

A plant belonging to the Malvaceae family, *Abutilon indicum* (Indian mallow) is widely found in tropical and subtropical areas and has long been used in a variety of traditional treatments. Its taxonomy, phytochemistry, ethnomedical applications, and wide range of pharmacological characteristics are discussed in the article below. Flavonoids (luteolin, quercetin), phytosterols (β-sitosterol, lupeol), essential oils, fatty acids, and phenolic acids are among the plant's many bioactive substances. Its leaves, roots, seeds, and fruits are used ethnomedically to treat conditions like arthritis, wounds, ulcers, and bronchitis. Its anti-inflammatory, antioxidant, antidiabetic, hepatoprotective, antimicrobial, antidiarrheal, antiarthritic, antifungal, wound-healing, larvicidal, antiulcer, anticancer, anxiolytic, antidepressant, and immunomodulatory qualities are all supported by pharmacological research. Additionally, the plant exhibits strong molecular activity in pathways like apoptotic signaling and PI3K-Akt, indicating its potential for managing chronic diseases.

Keywords: Abutilon indicum, Indian mallow, phytochemistry, medicinal plant, pharmacological activity, hepatoprotective, antimicrobial.

INTRODUCTION

The small shrub *Abutilon indicum*, commonly referred to as Indian abutilon as well as Indian mallow, is indigenous to tropical and subtropical areas and comes under the Malvaceae family. Generally, it is a hairy herb or under-shrub 1.0-1.5m high; annual or more often perennial with golden yellow flowers, flowering mostly throughout the year, found abundantly throughout the hotter parts of India, as a common weed on road sides and other waste places in plains and hills, up to an elevation of 600m.[1]

The *Abutilon indicum* has been reported to demonstrate anti-inflammatory, anti-oxidant, hypoglycemic, hepatoprotective, antimicrobial, antidiarrhoeal, antiarthritic, antifungal, wound healing, larvicial, anti-ulcer, anticancer, antidepressant, and immunomodulatory.[2,3]

Vernacular Names: [4]
English: Indian Mallow, Country Mallow, Flowering maples;
Assam: Jayavandha, Jayapateri;
Bengal: Badela;
Gujarat: Kansaki, Khapat;
Hindi: Kanghi, Jhampi;
Malayalam: Katturam, Uram, Tutti, Katuvan, Urubam, Urabam, Oorpam;
Marathi: Akakai, Mudika, Karandi;
Punjab: Kangi, Kangibooti;
Sanskit: Atibala, Bhuribala, Balika;
Tamil: Tutti, Nallatutti;
Telugu: Adavibenda, Peddabenda, Tutti;
Urudu: Kanghi;
Taxonomical Classification: [5]
Kingdom: Plantae
Subkingdom: Tracheobionta
Division: Magnoliophyta
Class: Magnolipsida
Subclass: Dilleniidae
Order: Malvales
Family: Malvaceae
Genus: *Abutilon*
Species: *indicum*

Distribution: [6]
In the Sub-Himalayan region, other hills up to 1200m, and in the hottest parts of India, a weed up to 3mm in height. There are approximately 160 species in both tropical and warm conditions, and they generally occur in both hemispheres' tropics and subtropics. Australia has 48 and India has 18, grown in the Neotropics and China.

Description:
Taxonomic description: [7]
Undershrubs, with ovate-suborbicular leaves and axillary, solitary flowers. Fruits with 15-25 mericarps.
Leaves: Up to 9 by 5 cm in length, the leaves are heart-shaped, ovate, and pointed, with a serrated border that is sometimes sub-trilobate. The length of each of the stipules is about 9 mm, whereas the petioles were between 3.8 and 7.5 cm.
Bark: The outer layer shows a brownish-grey hue, whilst the interior exhibits a smooth, light yellow look; it has a gritty texture and a bitter taste.
Flower: The flower measures 2.5 cm in diameter, which shows a yellow hue, and blooms in the evening.
Seeds: The seeds of this plant are brown-black and exhibit an extremely scrobiculate texture.

Fig 1: *Abutilon indicum* flower

Fig 2: *Abutilon indicum leaves*

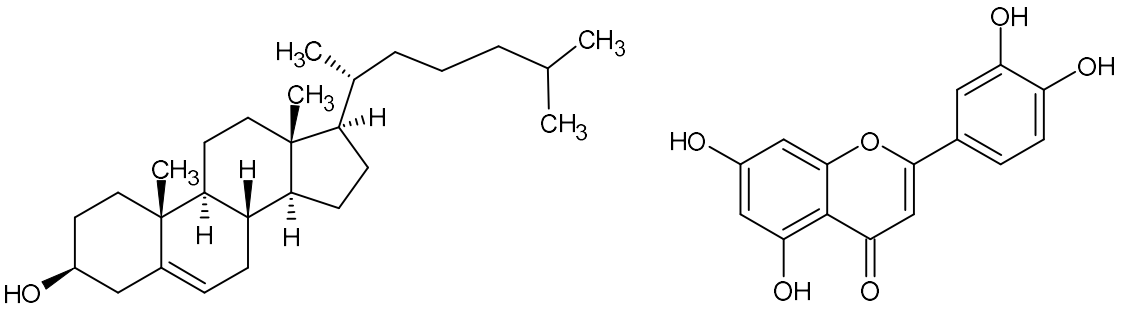
Fig 3: *Abutilon indicum* seed

Ethno-Medicinal uses

Leaves: Boil, Bronchitis, Diarrhoea, Ulcer, Asthma, Spermatorrhoea, Headache, Wound Healing, Toothache, Bleeding Piles, Gonorrhoea, Jaundice, Piles.
Fruits: Stomach complaint.
Roots: Paralysis, Cough, Leprosy, Wound, Leucorrhoea, Fever.
Seeds: Piles, Bronchitis, Arthritis, Gonorrhoea.

Phytochemistry[8-11]

Whole plant: Various phytochemical components were discovered through various studies, such as leucine, alkanol, serine, hexoses, n-alkane mixture, glutamic acid, aspartic acid, histidine, and threonine. It also contains β-sitosterol, glucose-vanilloyl glucose, p-Hydroxybenzoic, vanillic, β-D-Glucosyloxybenzoic acid.
Leaves: Based on reports, flavonoids include luteolin, chrysoeriol, quercetin, gossypetin-7-glucoside, cyanidin-3-rutinoside, and gossypetin-8-glucoside.Two sesquiterpene lactones,
which have been extracted from aerial parts, are alantolactone and isoalantolactone.
There are phytosterols and triterpenes like β-sitosterol, lupeol, β-amyrin, oleanolic acid, and ursolic acid in the aerial parts. Leaf extracts containing steroidal saponin diosgenin levels were approximately 0.11–0.4% w/w. It also contains Essential oils like α-pinene, caryophyllene, caryophyllene oxide, geraniol, borneol, eudesmol, farnesol, and geranyl acetate, α-cineole
Roots: Fatty acids discovered in root or seed oils include palmitic, stearic, oleic, linoleic, lauric, myristic, caprylic, and capric acids, as well as rare vernolic, sterculic, and malvalic acids. It also contains alkanes and sugars like mucilage, amino acids, n-alkanes (C22–C34), hexoses (glucose, fructose), asparagines, which are often an element of primary metabolism, and mucilage contents**.**
Seeds: They comprise fatty acids that consist of oleic, linolenic, stearic, and palmitic acids, along with the unusual sterculic, malvalic, and vernolic acids. Raffinose oligomers and glycerides are produced by seed oil.
Fruits: Significant amounts of carbohydrates, proteins, flavonoids, saponins, phenols, and certain steroids were found.
Flowers: It comprises various flavonoid compounds like Luteolin, chrysoeriol, apigenin etc.,
Root: It contains a variety of fatty acids, including linoleic, palmitic, stearic, myristic, lauric, oleic, caprylic, as well as unique fatty acids such as amyrin and sitosterol.



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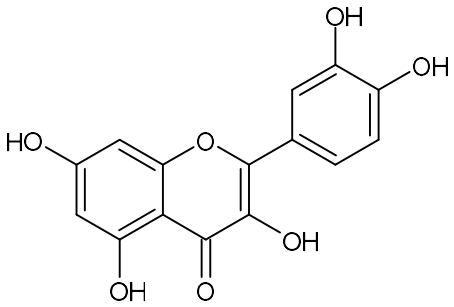

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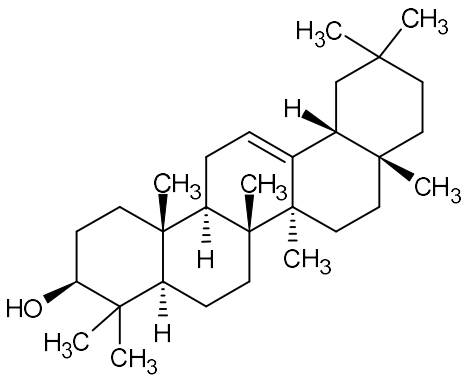

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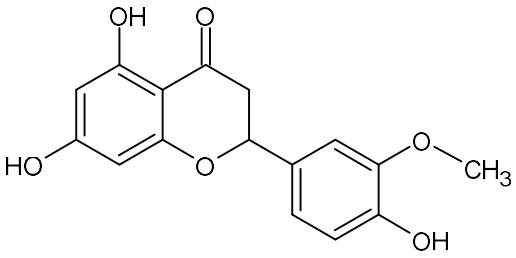

CHRYSOERIOL

Pharmacological studies

Anti-inflammatory

Anti-inflammatory studies were demonstrated from the evaluation of the ethanolic leaf extract of *Abutilon indicum*'s anti-inflammatory and anti-proliferative activity as a potential chemoprotective substance against lung carcinoma was carried out in this study. Along with this research regarding the Apaf1 gene's interactions, studies have been carried out on the lung cancer cell line A549. *A.indicum's* ethanolic leaf extract showed strong anti-inflammatory properties (IC50:8.89µg/mL) based on the assay for 5-Lipoxygenase (5-LOX) inhibition. Based on these studies, the standard chemical curcumin's IC50 is 8.14 µg/mL. The ethanolic leaf extract of *A.indicum* has additionally shown anti-proliferative activities. The Apaf1 gene, an apoptosis-activating factor, interacts with proteins such as CASP9, CASP3, CYCS, BCL2L1, TP53, BCL2, CASP8, HSPA4, DIABLO, and CASP7 to increase the sensitivity of the A549 cell line. By stimulating Apaf-1 through the CASP9, CASP3, CYCS, BCL2L1, TP53, BCL2, CASP8, HSPA4, DIABLO, and CASP7 network, the experimental work shows that the bioactive components discovered in the ethanolic leaf extract of *A.indicum* exhibited good anti-inflammatory and anti-proliferative action. [12]

Antioxidant

Abutilon indicum leaf extracts in aqueous and methanol were investigated for metal ion content, antioxidant activity, and phytochemical presence. The highest yield (18.62%) has been obtained from methanol extract using microwave-assisted extraction techniques. The methanolic extract included Fe, Zn, and Cu, but not Co, Ni, Cd, As, Pb, or Hg, according to atomic absorption spectrophotometry. Both extracts contained amino acids, carbohydrates, alkaloids, flavonoids, sterols, phenols, and saponins, according to phytochemical screening. Gallic acid and quercetin were found by TLC analysis in the methanol extract, but only quercetin was found in the aqueous one. In DPPH and FRAP tests, the methanol extract showed potent antioxidant activity, most likely as a result of its polyphenolic concentration.[13]

Antidiabetic

The antidiabetic effects of *Abutilon indicum* ethanolic (AIE) and aqueous (AIA) extracts were examined in 3T3-L1 adipocytes and L6 muscle cells. AIE enhanced glucose uptake in L6 cells, improved glucose consumption in 3T3-L1 cells (IC50 = 6.25 µg/mL), and significantly inhibited α-glucosidase (IC50 = 74.15 µg/mL) and α-amylase (IC50 = 13.41 µg/mL). The most significant chemical compounds detected by LC-MS-QTOF were riboflavin, gallic acid, and stigmasterol. AIE's significant antidiabetic potential has been shown by

the discovery through molecular docking and network pharmacology that the PI3K–Akt pathway contributes to glucose transport.[14]

Hepatoprotective

In rats, the hepatoprotective effect of *Abutilon indicum* aqueous extract (AE) was evaluated against toxicity induced by lead acetate. Groups were given 300 and 500 mg/kg of saline, lead acetate (0.15%), or AE for 14 days. The 500 mg/kg dose had notable hepatoprotective benefits by lowering lipid peroxidation and enhancing antioxidant enzymes (catalase, glutathione peroxidase, and superoxide dismutase). [15]

Antimicrobial

Extracts from *Abutilon indicum* showed strong antifungal (against *Candida albicans*) and antibacterial (against *Staphylococcus aureus & E. coli)* properties against both bacterial and fungal species. The extracts showed dose-dependent growth inhibitory action. The study also reveals that *Abutilon indicum* exhibits strong antifungal and antimicrobial properties.[16]

Antidiarrhoeal

The antidiarrheal properties of *A. indicum* ether, methanol, and aqueous leaf extracts were examined in albino rats using gastrointestinal motility, castor oil-induced diarrhea, and prostaglandin E2-induced enteropooling. The standard drug used was loperamide. When compared to loperamide, the methanolic and aqueous extracts demonstrated notable antidiarrheal effects in cases of castor-induced and prostaglandin E2-induced diarrhea.[17]

Antiarthritic

Using Freund's adjuvant model, a methanolic extract of *Abutilon indicum* revealed significant anti-arthritic efficacy in male albino rats. Comparable to methotrexate (0.75 mg/kg), it significantly reduced paw volume ($P<0.01$) on days 7 and 14 at 400 mg/kg. Doses of 100 and 200 mg/kg show no effectiveness.[18]

Antifungal

The disc diffusion method shows that the ethanolic extract of *Abutilon indicum* is effective against various kinds of fungi, namely *Microsporum canis* and *Trichophyton rubrum*. At the lowest concentration, the *Abutilon indicum* ethanolic extract exhibited the maximum activity. Our studies thus led to the conclusion that the extracts' bioactive components might be in charge of treating ringworm infections.[19]

Wound healing

By examining tensile strength, epithelialization, and wound contraction, the wound healing activity of ethanolic and ethyl acetate extracts of *Abutilon indicum* has been evaluated using incision and burn models. Both extracts demonstrated antibacterial activity against strains of fungi, bacteria, and Gram-positive and Gram-negative bacteria. Comparing ethyl acetate root extract to ethanolic extract, both showed stronger antibacterial activity and wound healing.[20]

Larvicida

Abutilon indicum crude leaf extracts showed larvicidal and adult emergence inhibitory action against *Culex quinquefasciatus*, *Aedes aegypti*, and *Anopheles stephensi*. The most potent extract against *A. aegypti* was hexane, which had an LC50 of 261.31 ppm after 24 hours. The extract delayed hatching, inhibited adult emergence, and interfered with larval and pupal development. Disrupted egg shells and dechitinized body walls showed anti-juvenile actions. The overall growth index decreased, indicating that it might be used as a repellent for mosquitoes in small aquatic environments.[21]

Antiulcer

In ethanol-induced ulcer models in rats, the ethanolic flower extract of *Abutilon indicum* showed strong antiulcer action at 250 and 500 mg/kg, with results similar to those of ranitidine (20 mg/kg). The ulcer index, pH, and acidity levels were significantly improved by the 500 mg/kg dosage. Its activity through interaction with human carbonic anhydrase I and II was supported by ADMET and *in silico* docking investigations. Bioactive substances with drug-like potential were found by GC-MS, including squalene, phytol, and several fatty acid esters that followed Lipinski's rule. By inhibiting the release of gastric acid and shielding the stomach mucosa, the extract shows great results.[22]

Anticancer

FeO nanoparticles (Ai-FeO NPs) have been generated using leaf extract from *A. indicum* as a stabilizing and reducing agent. In addition to FTIR confirming bioactive functional groups as stabilizers, UV-Vis revealed a surface resonance at 415 nm. According to XRD examination, the Nano particles were spherical and ranged in size from 10 to 95 nm. Potential applications for these stable AI-FeO Nanoparticles as therapeutic agents which includes the treatment of breast cancer.[23]

Anxiolytic and Antidepressant

Mice were used to investigate the anxiolytic and antidepressive effects of a methanolic leaf and bark extract of *Abutilon indicum* (Ai.Cr). Diazepam and fluoxetine have been studied with doses of 30, 50, and 100 mg/kg. Ai. Cr enhanced mobility in the forced swim and tail suspension tests and increased the duration of time spent in light, open arms, and head poking in the LDE, EPM, and HB tests. With a peak activity at 100 mg/kg, the effects were dose-dependent and showed potential antidepressant and anxiety-reducing activities.[24]

Immunomodulatory

The immunomodulatory and antioxidant properties of *Abutilon indicum* (*AI*E) ethanolic extract were evaluated on chicken lymphocytes. Immunopotentiating effects were demonstrated by a lymphocyte proliferation study. RT-PCR revealed that pro-inflammatory, APAF-1, and CASPASE-3 genes had been reduced, whereas anti-inflammatory and NRF-2 genes were increased. The findings show that AIE has potent anti-inflammatory, immunostimulatory, and antioxidant properties.[25]

CONCLUSION

Both historic use and contemporary scientific research support the considerable pharmacological potential of *Abutilon indicum*, a significant medicinal herb. Packed with phytochemicals such as fatty acids, flavonoids, sterols, and essential oils, it has important medicinal benefits for a range of biological systems. Its proven benefits, which range from antioxidant and anti-inflammatory to antidiabetic, anticancer, and immunomodulatory, point to a promising future for the creation of innovative plant-based medicines. To verify its effectiveness, safety, and mechanisms of action in people, further thorough research is advised, including clinical trials and extract standardization.

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