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Review

The Therapeutic Prospects of *Abutilon indicum* (L.) Sweet: An Integrative Review of Pharmacology and Physicochemical Properties

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Abstract

Abutilon indicum (L.) Sweet, also known as Indian Mallow, is a key component of traditional medicine systems such as Ayurveda, Siddha and Unani. This integrative review combines current pharmacological evidence and physicochemical data to assess therapeutic potential and set quality control standards. Preclinical research reveals a diverse pharmacological profile, including significant hepatoprotective, anti-inflammatory, analgesic, and antidiabetic properties. notably, the plant has specialized properties such as wound healing through collagen synthesis, anti-asthmatic effects through mast cell stabilization, and strong larvicidal action against major mosquito vectors. flavonoids, alkaloids, and beta-sitosterol are among the bioactive secondary metabolites that contribute to these activities. furthermore, this review compiles key physicochemical parameters such as extractive values and ash content from various plant parts to aid in the standardization of herbal formulations. While A. indicum remains a promising candidate for evidence-based phytopharmaceuticals, the transition from bench to bedside necessitates extensive clinical trials to ensure human safety and efficacy.

Keywords: *Abutilon indicum,*Indian mallow, beta-sitosterol, Phytopharmaceutical.

INTRODUCTION

Abutilon indicum (L.) Sweet, also known as "Indian Mallow," is a medicinal plant widely used in traditional medical systems such as Ayurveda, Siddha, and Unani. This plant has been studied for a variety of therapeutic applications due to its high concentration of bioactive phytochemicals such as flavonoids, alkaloids, tannins, glycosides, and sterols. In vitro and in vivo studies have shown that it has potential in hepatoprotection, wound healing, analgesia, immunomodulation,

antimicrobial action, anti-inflammatory, anti-ulcer, anti-hyperglycaemic, and anticonvulsant properties.

In addition to its pharmacological worth, *Abutilon indicum* exhibits encouraging physicochemical traits that help ensure its quality control and standardization as a natural drug source. This review attempts to integrate the pharmacological and physicochemical evidence currently available on *Abutilon indicum*, highlighting its therapeutic prospects and research gaps for future clinical translation, in light of the growing interest in plant-based therapeutics.

Fig,1; *Abutilon indicum* (L.) Sweet (Indian mallow) plant.

Pharmacological insights into *Abutilon indicum*

Hepatoprotective Activity of *Abutilon indicum*

Abutilon indicum exhibits significant hepatoprotective effects against chemically induced liver damage in experimental rat models, notably against carbon tetrachloride (ccl_4) and paracetamol toxicity. Aqueous and hydroalcoholic leaf extracts normalize elevated liver enzymes (AST, ALT, ALP), serum bilirubin, and total protein levels, indicating hepatocyte membrane stabilization and liver function restoration. The protective mechanism is attributed to antioxidant phytoconstituents like flavonoids, tannins, and ß-sitosterol, which inhibit free radical formation and lipid peroxidation. Histopathological studies support these findings by showing improved liver tissue architecture. The efficacy of A. indicum is comparable to silymarin, validating its traditional use for liver disorders and highlighting its potential as a natural hepatoprotective agent.

***Abutilon indicum's* Anti-Diarrhoeal Action**

In albino rats, extracts from the leaves of *Abutilon indicum* show notable anti-diarrhoeal properties. Similar to the common antidiarrheal medication loperamide, methanolic and aqueous extracts significantly decreased gastrointestinal motility, hence reducing the transit of charcoal meals. Additionally, these extracts dramatically lowered intestinal fluid accumulation in prostaglandin E2-induced enterpooling models and both the frequency and severity of diarrhoea in castor oil-induced diarrhoea. There was no

discernible action in the petroleum ether extract. The direct suppression of intestinal peristalsis and inhibition of prostaglandin synthesis are credited with the anti-diarrheal action. The extracts' flavonoids, which have spasmolytic and prostaglandin-inhibitory qualities, probably play a part in these actions. These results justify more research for therapeutic development and support the traditional applications of A. indicum in the treatment of diarrhoea.

The Ability of *Abutilon indicum* to Heal Wounds

Excision, incision, and dead space wound models in albino rats all corroborate *Abutilon indicum*'s notable wound healing effectiveness. At 400 mg/kg, the ethanolic leaf extract significantly improved granulation tissue weight, boosted skin breaking strength, and accelerated wound contraction and epithelization. Compared to the control and silver sulfadiazine-treated groups, histological analyses showed well-organized collagen fibers, full re-epithelialization, and almost repaired hair follicles. In order to heal tissue and increase tensile strength, the extract encourages the synthesis and maturation of collagen. The plant's traditional usage in treating wounds and inflammation is probably due to these effects. All things considered, A. indicum exhibits potential as a natural wound-healing agent that merits more phytochemical and clinical investigation.

The Pain-Relieving Properties of *Abutilon indicum*

Significant analgesic effects of *Abutilon indicum* have been demonstrated by experimental research employing mouse models. The tail flick and hot plate methods were used to assess the analgesic activity of many extracts of the entire plant, including petroleum ether, chloroform, ethanol, and aqueous extracts, at a dose of 400 mg/kg body weight [Saraswathi et al., 2011].

With notable increases in pain latency times, the methanol and aqueous extracts outperformed petroleum ether and chloroform extracts in terms of analgesic efficacy. These effects were similar to those of pentazocin, a common painkiller. The presence of bioactive phytoconstituents such flavonoids, glycosides, and phenolic compounds—which may have both central and peripheral analgesic effects—is probably connected to the analgesic process.

The ability of *Abutilon indicum* to prevent asthma

Because of its anti-inflammatory and mast cell stabilizing qualities rather than its bronchodilatory or antispasmodic activities, *Abutilon indicum* has shown promise as an anti-asthmatic. Research employing methanolic extracts of aerial portions revealed no discernible suppression of smooth muscle contractions or bronchodilation against histamine or acetylcholine-induced bronchospasm in guinea pigs [Paranjape and Mehta, 2008].

Notably, in rat peritoneal mast cells, the extract significantly inhibited the degranulation of mast cells generated by compound 48/80 and egg albumin. This stability stops the production of mediators that are important to the pathogenesis of asthma, such as histamine and cytokines. Furthermore, A. indicum demonstrated significant anti-inflammatory efficacy by successfully reducing carrageenan-induced paw edema in rats.

Anti-Larvicidal Action of *Abutilon indicum*

Abutilon indicum has shown encouraging anti-larvicidal properties against the main mosquito vectors that spread diseases like filariasis, dengue, and malaria. The toxicity of many solvent extracts, such as hexane, ethyl acetate, petroleum ether, acetone, and methanol, against early fourth-instar larvae of Anopheles stephensi, Aedes aegypti, and Culex quinquefasciatus was assessed [Rahuman et al., 2008].

With 100% mortality at 1,000 ppm concentration, the petroleum ether extract had the strongest larvicidal action among all. ß-sitosterol was isolated and identified as the main larvicidal ingredient using bioassay-guided fractionation. Its potent lethal concentration (LC_{50}) against Aedes aegypti, Anopheles stephensi, and Culex quinquefasciatus were 11.49 ppm, 3.58 ppm, and 26.67 ppm, respectively. The isolation of ß-sitosterol from *Abutilon indicum* has never been reported before.

Abutilon indicum's Anti-Inflammatory Properties

Carrageenan-induced paw edema experiments in animal models show that *Abutilon indicum* has strong anti-inflammatory properties. Paw swelling was considerably decreased by 400 mg/kg of methanol and aqueous extracts, which was equivalent to diclofenac sodium. Inhibiting mediators generated throughout different stages of inflammation, such as histamine, serotonin, kinins, and prostaglandins, is probably the anti-inflammatory process. Flavonoids, saponins, glycosides, phenolic compounds, and sterols were identified by phytochemical research; these substances may work together to produce the effect. Furthermore, ethanolic leaf extracts have strong anti-inflammatory and immunomodulatory qualities because they increase the expression of IκB while modulating important proinflammatory genes like TNF-α and NF-κB. These results highlight *A.indicum's* potential as a natural anti-inflammatory agent deserving of more investigation and validate its traditional usage in inflammatory illnesses.

Abutilon indicum's Anti-Hypoglycemic Action

In rats with diabetes caused by streptozotocin, *Abutilon indicum* exhibits notable anti-hyperglycemic actions. When given orally for 21 days at a dose of 50 mg/kg, the chloroform fraction of its ethanolic extract significantly lowered blood glucose levels in comparison to diabetic controls [Kaushik et al., 2010]. Additionally, it improved serum lipid profiles by raising HDL cholesterol and lowering LDL, triglycerides, and total cholesterol. In diabetic rats, the extract also maintained body weight, reduced glycosylated hemoglobin (HbA1c), and raised serum insulin levels. Stimulation of remaining pancreatic ß-cells and improved peripheral glucose utilization are probably involved in the antidiabetic effect. Alantolactone and isoalantolactone are two examples of sesquiterpene lactones, which are important bioactive substances. "These findings warrant more investigation into the active ingredients in *A.indicum* and support its traditional uses in the treatment of diabetes".

Abutilon indicum's Antimicrobial Properties

Major periodontal infections such as Aggregatibacter actinomycetemcomitans, Porphyromonas gingivalis, Prevotella intermedia, Fusobacterium nucleatum, and Tannerella forsythia are all significantly inhibited by *Abutilon indicum* [Pattanashetti et al., 2023]. Tannerella forsythia was most responsive to the dose-dependent inhibitory action of ethanolic leaf extracts at 25 µg/ml. Phytochemicals with anti-inflammatory and antibacterial qualities, including flavonoids, alkaloids, sterols, triterpenoids, and glycosides, are responsible for the antimicrobial activity. These results demonstrate A. indicum's potential as an adjuvant in periodontal therapy and validate its traditional usage in oral health, especially in light of rising antibiotic resistance. To confirm its effectiveness and safety in treating periodontal disorders, more clinical trials are required.

Abutilon indicum's Anti-Ulcer Action

In a number of experimental ulcer models, such as ethanol-induced, acetic acid-induced, and aspirin plus pylorus ligation ulcers in

rats, *Abutilon indicum* has demonstrated strong anti-ulcer action [Malgi et al., 2009]. Similar to the common anti-ulcer medication famotidine, oral treatment of 400 mg/kg of alcoholic and aqueous leaf extracts dramatically decreased ulcer indices, decreased stomach volume, free and total acidity, and raised gastric pH. Extracts of petroleum ether and chloroform showed negligible effects. Histopathological analysis verified gastro-protective benefits with less damage to the stomach mucosa. Flavonoids, which are recognized for their cytoprotective and antioxidant qualities, are principally responsible for the anti-ulcer effectiveness. These results support the conventional approach to treating ulcers caused by A. indicum and point to its potential as a natural treatment for peptic ulcer disease.

Anti-Convulsant Activity of *Abutilon indicum*

Abutilon indicum leaf extracts exhibit notable anticonvulsant activity, as demonstrated in experimental models using PTZ (pentylenetetrazole) and MES (maximal electroshock)-induced convulsions in Wistar rats [Golwala et al., 2010]. Ethanolic (AIE) and aqueous (AIA) extracts administered at doses of 100 mg/kg and 400 mg/kg significantly delayed the onset of clonic convulsions, reduced tonic seizures, and improved survival rates compared to controls. The ethanolic extract showed stronger protective effects, with up to 84% survival and 67% protection in PTZ models. In MES models, the extract similarly increased latency of seizures and decreased the duration of tonic extension. Phytochemicals such as flavonoids and fatty acids, notably linoleic acid, likely contribute to these neuroprotective effects. These results support A. indicum as a promising natural anticonvulsant agent for potential therapeutic use in epilepsy.

Activity of *Abutilon indicum* in Immunomodulation

According to Dasputre et al. (2010), *Abutilon indicum* has strong immunomodulatory effects that improve albino mice's immunological responses, both specific and non-specific. Elevated haemagglutination antibody titres against sheep red blood cells indicated a considerable increase in humoral immunity following oral administration of aqueous and ethanolic leaf extracts. Additionally, the extracts increased delayed-type hypersensitivity responses, which strengthened cell-mediated immunity. They also enhanced neutrophil adherence to nylon fibers and phagocytic activity in the reticuloendothelial system, both of which are signs of enhanced innate immunity. These effects are thought to be caused by phytochemical components like flavonoids, alkaloids, saponins, tannins, and glycosides. These results support the traditional Ayurvedic usage of A. indicum as a "Rasayana" and point to the possibility that it may strengthen the immune system and reverse immunosuppression.

Reported physicochemical parameters of *Abutilon indicum* from different plant parts;

Table I. Reported physicochemical parameters of *Abutilon indicum*

S. No	Plant Part	Parameter	Reported Value (% w/w)	Reference
1	Leaves	Loss on drying	7.8%	Sharma & Parmar, et al., Asian J Pharm Anal. 2011
2	Leaves	Total ash	12.5%	Sharma & Parmar, et al., Asian J Pharm Anal. 2011
3	Leaves	Acid-insoluble ash	2.6%	Sharma & Parmar, et al., Asian J Pharm Anal. 2011
4	Leaves	Water-soluble ash	3.4%	Kumar et al., Anc Sci Life. 2012
5	Leaves	Sulphated ash	13.1%	Kumar et al., Anc Sci Life. 2012

6	Leaves	Methanol-soluble extractive value	10.4%	Sharma & Parmar, et al., Asian J Pharm Anal. 2011
7	Leaves	Water-soluble extractive value	15.2%	Sharma & Parmar, et al., Asian J Pharm Anal. 2011
8	Leaves	Alcohol-soluble extractive value	6.32 ± 0.23%	Patel et al., Int J Pharm Sci Res. 2010
9	Leaves	Ethanol-soluble extractive value	9.64%	Kumar et al., Anc Sci Life. 2012
10	Leaves	Water-soluble extractive value	9.04%	Kumar et al., Anc Sci Life. 2012
11	Fruit	Loss on drying	7.7%	Bolleddu et al., AYU. 2021
12	Fruit	Total ash	10.5%	Bolleddu et al., AYU. 2021
13	Fruit	Acid-insoluble ash	2.4%	Bolleddu et al., AYU. 2021
14	Fruit	Water-soluble extractive value	9.64%	Bolleddu et al., AYU. 2021
15	Fruit	Alcohol-soluble extractive value	9.04%	Bolleddu et al., AYU. 2021
16	Whole plant	Loss on drying	3.2%	Shanmugapriya & Anuradha, et al., JAST.2019
17	Whole plant	Total ash	40%	Shanmugapriya & Anuradha, et al., JAST.2019
18	Whole plant	Water-soluble ash	26.56%	Shanmugapriya & Anuradha, et al., JAST.2019
19	Whole plant	Acid-insoluble ash	25%	Shanmugapriya & Anuradha, et al., JAST.2019
20	Whole plant	Alcohol-soluble extractive value	6.89%	Shanmugapriya & Anuradha, et al., JAST.2019
21	Whole plant	Water-soluble extractive value	38.68%	Shanmugapriya & Anuradha, JAST.2019
22	Leaves	Loss on drying	6.4%	Ary et al., Asian J Res Chem. 2011
23	Stem	Loss on drying	5.8%	Ary et al., Asian J Res Chem. 2011
24	Root	Loss on drying	5.2%	Ary et al., Asian J Res Chem. 2011
25	Seed	Loss on drying	4.6%	Ary et al., Asian J Res Chem. 2011
26	Flower	Loss on drying	8.6%	Ary et al., Asian J Res Chem. 2011
27	Leaves	Total ash	8.2%	Ary et al., Asian J Res Chem. 2011
28	Stem	Total ash	4.4%	Ary et al., Asian J Res Chem. 2011
29	Root	Total ash	5.0%	Ary et al., Asian J Res Chem. 2011
30	Seed	Total ash	5.0%	Ary et al., Asian J Res Chem. 2011

CONCLUSION

Abutilon indicum (L.) Sweet is a medicinally important plant with a wide range of pharmacological effects that support its traditional therapeutic use. Experimental evidence supports its hepatoprotective, anti-inflammatory, analgesic, anti-diarrheal, wound-healing, antidiabetic, anti-ulcer, antimicrobial, anticonvulsant, and immunomodulatory properties, which are largely due to its diverse phytochemical profile. Extractive values and physicochemical properties research lays the

groundwork for herbal formulation standardization and quality control. Nonetheless, despite promising preclinical results, detailed phytochemical studies and rigorously designed clinical trials are required to validate its efficacy and safety in humans. Overall, A. indicum is a promising candidate for the development of novel, evidence-based phytopharmaceuticals.

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