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Pharmacologicals and Phytochemicals Potential of *Abutilon indicum*: A Comprehensive Review

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Abstract: *Abutilon indicum* (Bengali name: Jhampi, Petari, Indian name: Atibala, family: Malvaceae) is extensively grown in Bangladesh, India, Pakistan. The pharmacologicals and biologicals properties and chemicals constituents from the plant *A. indicum (L.)* which is widely used in folk medicine. *A. indicum* (Malvaceae) is a hairy under-shrub with golden yellow flowers, found in hotter parts of India.This plant is often used as a medicinal plant and is considered invasive on certain tropical islands. In traditional medicine, *A. indicum* is used as a aphrodisiac, demulcent, diuretic, laxative, pulmonary and sedative (leaves). The bark is astringent and diuretic; laxative, expectorant and demulcent (seeds); laxative and tonic, anti-inflammatory and anthelmintic (plant); analgesic (fixed oil); diuretic and for leprosy (roots). The plant is very much used in Siddha medicines. In fact, the bark, root, leaves, flowers and seeds are all used for medicinal purposes by Tamils. The leaves are also used to treat for pile complaints. The flowers are traditionally used to increase semen in men. The phytochemical analysis showed the Presence of Alkaloid, Saponins, Amino acid, Flavonoids, Glycosides and steroids. This plant exhibits several potential pharmacological activities.

Keywords: Phytochemicals, Pharmacologicals, Alkaloids, Steroids, Glycosides Phyto Sterols, Analgesic, Abutilon Indicum, Diuretic and Leprosy

1. Introduction

Nature is a best friend of our pharmacy field. Natural drugs are effective in action without side effects. *Abutilon indicum* (Linn.) sweet (Malvaceae) commonly called 'Country Mallow' is a perennial plant up to 3 m in height. *A. indicum* abundantly found as a weed in the sub-Himalayan tract and in the hotter parts of India. *A. indicum* is reported to have hypoglycemic, hepatoprotective, antimicrobial, male contraceptive, and antidiarrheal activities [1]. The Leaves of Abutilon indicum are up to 12cm long, cordate, ovate, acuminate, tothed rarely subtrilobate, petioles3.8 75cm long. Stipules 9mm long linear acute, deflexed pedicles often 2.5-5 long auxiliary solitary jointed very near the top. Calyx 12.8mm long divided to the middle lobes ovate, apisculate. Corolla 2.5 cm in diameter, opening in the evening. Staminal tube hairy of the base filaments long carpals usually 15-20, longer than the calyx with a distinct small acute point hairy ultimate shining dark brown seed brown black densely minutely scrobiculate. It is fairly common road side weed which grown in hotters part of the India as weed [2]. Plants are an essential and integral component in the world of prescription medicine and have the ability to make various chemical constituents like flavonoids, proteins, alkaloids, and steroids [1], glycosides, phyto sterols, and phenolic compounds, Carbohydrates, amino acids, Saponins, glycosides are isolated from these plants [3], which are in turn used to alleviate many diseases like as body ache, bronchitis, jaundice, toothache, piles, diabetes, fever, leprosy, cystitis, ulcers, gonorrhea, diarrhea[1], cough, urine output, lung disease. They are also used in the treatment of ringing in the ears, deafness, high fever, mumps, pulmonary

tuberculosis, and cough. The whole herb is used in ayurvedic preparations to treat Hemorrhoids, Diabetes, Menorrhoea. Leaf extracts of *A. indicum* shows hypoglycemic activity in rats [3].

2. Pharmacological Activities and Medicinal Use of *A. indicum*

Plants are the major sources of drugs or molecules which demonstrates mild to significant pharmacological activities against tremendous organisms and diseases. Pharmacological activity and phyto-constituents demonstrate in the table-1.

2.1. Anti Asthmatic Activity of A. indicum

This study reported the effectiveness of powder of dried aerial parts of *Abutilon indicum* in decreasing the severity of commonly observed symptoms of bronchial asthma i.e. cough, chest tightness, wheezing and dyspnoea. It was also demonstrate to significantly increase the pulmonary function measured as forced vital capacity (FVC), forced expiratory volume in 1 Sec (FEV1) and peak expiratory flow rate (PEFR) in patients having mild to moderate bronchial asthma. In another study, methanolic extract inhibited experimentally induced rat peritoneal mast cell degranulation and edema formation. The significant reduces in carageenan induced rat paw edema at the dose of 250 and 500 mg/kg, p.o. indicated anti inflammatory activity and this activity was postulated towards the anti-asthmatic effect [4].

2. Anti-Ulcer Activity of A. indicum

Present study was carried out to investigate antiulcer activity of methanol extract of *A. indicum* leaves in pylorus ligated and ethanol induced ulceration in the albino rats. Preliminary methanol extract of *A. indicum* was conducted to the acute oral toxicity study according to the OECD guideline no. 425. Based on two dose levels i.e. 250 and 500 mg/kg were selected for the further study. Ranitidine at 50 mg/kg was used as the standard drug. Methanol extracts of *A. indicum* leaves showed significant ($P<0.05$) decrease in the gastric volume, free acidity and total acidity. However pH of the gastric juice was significantly ($P<0.05$) increased only at higher dose, 500 mg/kg. It showed also significant ($P<0.05$) decrease in number of ulcers and ulcer score index in pylorus ligation and ethanol induced ulceration models. The results demonstrate significant antiulcer properties in a dose dependent manner. The anti ulcer properties of the extract may be attributed to the presence of phytochemicals like flavonoids (quercetin), alkaloids and tannins present in the plant extract with various biological activities [5].

2.3. Anti-Arthritic Activity of A. indicum

The present study deals with anti-arthritic activity in-vitro pharmacological models such as, inhibition of protein denaturation, effect of membrane stabilization, and proteinase inhibitory action. Herbal extract (aq.) with two different concentrations (100mcg/ml and 250mcg/ml.) was used and results were compared with (250mcg/ml) acetyl salicylic acid. The herbal extract showed dose dependent activity which was found to be better than that of acetyl salicylic acid [6].

2.4. Hepatoprotective Activity of A. indicum

The aqueous extract of the leaves of *A. indicum* demonstrated significant hepatoprotective activity at 100 and 200 mg/kg dose levels in CCl_4-treated rats. The blood samples were collected and the serum was estimated for SGOT [serum aspartate aminotransferase], SGPT [serum alanine aminotransferase], SAP (serum alkaline phosphatase) and total bilirubin content. CCl_4-induced changes were significantly reduced in the *A. indicum*-treated animals [7].

2.5. Analgesic and Anti-Inflammatory Activity of A. indicum

In the present study, the analgesic and anti-inflammatory activity of plant extracts of *A. Indicum* was studied. The analgesic activity was found out by eddy's hot plate method by using standard Pentazocin. The anti-inflammatory activity was found out by Carragenan induced paw edema method by using standard Diclofenac sodium. The anti-inflammatory and analgesic activity of Chloroform, Pet.ether, Ethanol & Aqueous extracts were tested against at a dose level of 400 mg/kg body wt. The anti-inflammatory activity showed *P < 0.001 compared with standard. The analgesic activity showed * P<0.001compared with standard. In both the activity the methanol and aqueous extract have little more activity than the other extracts [3].

2.6. Cytotoxic and Antimicrobial Activity of A. indicum

The investigation was conducted with crude methanolic extract of leaf of *A. indicum* for its cytotoxic and antimicrobial activity. Antimicrobial activity of the extract was evaluated against various Gram-negative, Gram-positive bacteria and fungi using disk diffusion technique. For cytotoxic activity, brine shrimp lethality bioassay was performed to estimate LC_{50} values. The average zone of inhibition produced by carbon tetrachloride extract was found 7-10 mm at a concentration of 400µg/disc. The chloroform extract exhibited no antibacterial activity except *Sarcina lutea* (8.4 mm). In brine shrimp lethality bioassay, LC_{50} obtained from the best-fit line slope were 0.419, 3.01, 5.62, 1.51, and 11.20 µg/ml for positive control (vincristine sulfate), n-hexane, carbon tetrachloride, chloroform and aqueous fraction respectively. The cytotoxicity exhibited by chloroform soluble fraction of methanol extract was promising. The carbon tetrachloride extract showed mild to moderate antimicrobial activity [8].

2.7. Antioxidant Potential and Radical Scavenging Effects of A. indicum

Antioxidant activity of methanolic extract of *A. indicum* leaves was investigated for its free radical scavenging

activity by determining the nitric oxide and superoxide radical scavenging activity. Maximum scavenging of nitricoxide and superoxide radical found were 28.74 % and 49. 62 % respectively at 250 µg/ml concentration [15] . *A. indicum* L. (Malvaceae) and A. *muticum* DC. (Malvaceae) are traditional medicinal herbs used for anthelmintic, hepatoprotective, analgesic and hypoglycemic properties. These effects may be correlated with the presence of antioxidant compounds. Extracts from the aerial parts and roots of both species were prepared and evaluated for their total antioxidant capacity (TAC), total phenolic content, and total flavonoid content. The Trolox equivalent antioxidant capacity (TEAC) of all the extracts of both plants was found, employing ABTS and FRAP assays. TEAC values ranged from 3.019 to 10.5µM for *n*-hexane and butanol fractions of *A. indicum* and from 2.247 to 14.208µM for *n*-hexane and butanol fractions of *Abutilon muticum* respectively, using the ABTS assay. The FRAP assay showed reducing powers of the fractions in the order of butanol > ethyl acetate > chloroform > *n*-hexane and butanol > chloroform > hexane > ethyl acetate for *A. indicum* and *Abutilon muticum*, respectively. EC_{50} and T_{EC50} values for the extracts of both plants were determined using the DPPH free radical assay. The reaction kinetics with this free radical indicated the presence of both slow reacting and fast reacting antioxidant components in the extracts of both plants. The antioxidant/radical scavenging capacity of the extracts was found to be a dose-dependent activity. The results obtained in the present study indicate that both *Abutilon* species are potential sources of natural antioxidants [9].

2.8. Antifungal Activity of A. indicum

A new steroidal compound 20, 23-dimethylcholesta-6, 22-dien-3β-ol has been isolated from the stem tissues of *A. indicum*. The structure of the compound was elucidated by spectral and chemical studies. The compound was found to be 100% effective at 5000 ppm in controlling the mycelial growth of *Aspergillus terreus var. aureus* and *Aspergillus parasiticus var. globosus* using the poison food technique. For other fungi like *A. versicolor*, *A. flavus,* and *A. fischeri*, it was fungistatic [10,11].

2.9. Antibacterial Activity of A. indicum

Chloroform, ethanol and aqueous extracts of the leaves of A. indicum were investigated for antibacterial activity against Staphylococcus aureus, Bacillus subtilis, Klebsiella pneumoniae, Salmonella typhi, Escherichia coli and Pseudomonas aeruginosa. Among the various extracts maximum antibacterial activity was exhibited by ethanol extract (14, 25, 14, 25, 17, 18 mm) followed by chloroform extract (13, 17, 8, 15, 15, 20 mm) while aqueous extract, showed no activity [12,11].

2.10. Anti-Diabetic Activity of A. indicum

Administration of the extract (0.5 and 1 g/kg body weight) in an oral glucose tolerance test led to a significant reduction in plasma glucose levels in 30 minutes after the administration in moderately diabetic rats, as compared with untreated rats (P ‹b.05), and this was at a faster rate than the use of an glibenclamide, antidiabetic drug. The inhibition of glucose absorption through the small intestine was investigated using an everted intestinal sac. The results demonstrated that the extract at concentrations of 0.156 to 5 mg/mL caused a reduction of glucose absorption in a dose response manner. The hight response was noted at a dose of 2.5 mg/mL. The promotion of the extract on insulin secretion was confirmed by incubating β cell of pancreatic islets and INS-1E insulinoma cells with the extract at 1 to 1000 µg/mL. These results suggest that the aqueous extract from the A indicum plant has antidiabetic properties, which inhibited glucose absorption and stimulated insulin secretion. Phytochemical screening also revealed that the extract contained flavonoids, alkaloids, tannins, saponins and glycosides that could account for the observed pharmacologic effects of the plant extract [13].

2.11. Larvicidal Activity of A. indicum

Larvicidal activity of crude ethyl acetate, hexane, acetone, petroleum ether and methanol extracts of five medicinal plants such as *A. indicum*, *Aegle marmelos*, *Jatropha gossypifolia, Euphorbia thymifolia* and *Solanum torvum* were assayed for their toxicity against the early fourth-instar larvae of *Culex quinquefasciatus*. The larval mortality was observed after 24 h exposure. All extracts demonstrated moderate larvicidal effects. However, the maximum larval mortality was found in petroleum ether extract of *A. indicum.* In the present study, bioassay-guided fractionation of *A. indicum* led to the separation and identification of a β-sitosterol as a potential new mosquito larvicidal compound with LC_{50} value of 11.49, 3.58 and 26.67 ppm against *Aedes aegypti* L, *Anopheles stephensi* Liston and *C. quinquefasciatus* Say (Diptera: Culicidae), respectively. H NMR, C NMR and mass spectral data confirmed the identification of the active compound. β-sitosterol has been recognized as the active ingredient of many medicinal plant extracts. All the crude extracts when screened for their larvicidal activities indicated toxicity against the larvae of *C. quinquefasciatus*. This article reports the isolation and identification of the β-sitosterol as well as bioassay data for the crude extracts. There are no reports of β-sitosterol in the genus *A. indicum* and their larvicidal activities are being evaluated for the first time. Results of this study demonstrated that the petroleum ether extract of *A. indicum* may be considered as a potent source and β-sitosterol as a new natural mosquito larvicidal agent [14].

2.12. Cardioprotective Activity of A. indicum

The ethanolic extract of the roots obtained from *A. indicum* (Malvaceae) was evaluated for protection against Isoproterenol (150 mg/kg body wt, s.c) induced myocardial infarction in male Wistar rats. Isoproterenol induced rats showed significant elevation in the levels of serum marker

enzymes such as Creatinine Kinase- MB, Lactate dehydrogenase (LDH), Aspartate transaminase (AST) and Alanine transaminase (ALT) with significantly increased lipid peroxides and significant decrease in antioxidant parameters viz., Super oxide dismutase (SOD), Catalase (CAT) and Glutathione peroxidase (GPx) in heart homogenate and also increased serum uric acid level. Oral pretreatment with ethanolic root extract of *A. indicum* (100 mg/kg body wt) daily for a period of 28 days, reduced significantly the elevated serum marker enzymes and lipid peroxidation and elevated the levels of SOD, CAT and GPx in the heart homogenate and decreased serum uric acid level. Histopathological observation also revealed a marked protection by the extract in myocardial necrotic damage. Our results show that treatment with ethanolic root extract of *A. indicum* (100 mg/kg body wt) was safe and highly effective in preventing cardiovascular dysfunction in rats, possibly due to antioxidant property as revealed by the amelioration of histopathological changes and biochemical markers of cardiac tissue damage. However, ethanolic root extract of *A. indicum* (500 mg/kg body wt) was found to produce myocardial injury on its own and failed to reverse the Isoproterenol induced myocardial injury[15].

2.13. Lipid Lowering Activity of A. indicum

Giri et al. [16] studied the lipid lowering activity of *Abutilon indicum* (L.) leaf extracts in rats using triton and diet induced hyperlipidemic models. The ethanolic and water extract at 400mg/kg dose levels inhibited the elevation in serum cholesterol and triglyceride levels on Triton WR 1339 administration rats. The extracts at the same dose level significantly attenuated the elevated serum total cholesterol and triglycerides with an increase in high-density lipoprotein cholesterol in high-fat diet-induced hyperlipidemic rats. The lipid lowering activity of the EtOH and aqueous leaf extracts of *A. indicum* may be attributed to the phytoconstituents present, such as triterpenoids, flavonoids, tannins, glycosides, and saponins in it, as reported for other plant extracts. Saponin derived from *Medicago sativa* were reported to reduce blood cholesterol by competing with cholesterol at binding sites or interfering with cholesterol biosynthesis in the liver. Phenolic active principle present in *Anethum graveolens* were observed to be responsible for lowering TC and LDL-C and elevating HDL-C in hypercholesterolaemic rats [12]. Furthermore, it was supposed to be act by interfering with the biosynthesis of cholesterol and utilization of lipids [4].

2.14. Anti-Diarrhoeal Activity of A. indicum

Leaf extracts of *Abutilon indicum* were evaluated for anti-diarrhoeal activity by gastro-intestinal motility, castor oil-induced diarrhoea and prostaglandin E2- induced enteropooling in rats wherein the methanolic and aqueous extracts showed significant antidiarrhoeal activity in castor oil-induced diarrhoea and prostaglandin E2- induced diarrhoea. These extracts were reported to reduce diarrhoea by inhibiting intestinal peristalsis, gastrointestinal motility and PGE2 induced enteropooling [4,17].

2.15. Wound Healing Activity of A. indicum

The ethanolic extract of *Abutilon indicum* was studied for wound healing activity-using incision, excision and dead space wound models in albino rats. This extract at a dose of 400-mg/kg showed significant increase in wound contraction rate, skin breaking strength, granuloma strength and dry granuloma weight. Moreover, the decrease in epithelisation period [4].

2.16. Immunomodulatory Activity of A. indicum

Dashputre et al. [19] studied the immunomodulatory activity of ethanolic and aqueous extract of leaves of *A. indicum* (200mg/kg and 400 mg/kg) by heamagglutination antibody (HA) titre, delayed type hypersensitivity (DTH), neutrophil adhesion test and carbon clearance test. Study revealed that extract showed a significant increase in both primary and secondary HA titre. It also showed significantly potentiated DTH reaction and increase in percentage neutophil adhesion test. The results of the study reported that both the extracts were found to have a significant immunostimulatory activity on both the specific and non specific immune mechanisms. This activity was said to be attributed to the presence of flavonoids (quercetin), alkaloids, tannins, saponin glycosides and phenolic compounds [4].

2.17. Anti-Estrogenic Activity of A. indicum

Johri et al. [20] studied the anti-estrogenic effect of methanolic extracts of *A. indicum* on uterotropic and uterine peroxidase activities in ovariectomized rats. This extract was found to cause significant suppression of enzyme activity as well as uterotropic response induced by estradiol, whereas in the group, not treated with estradiol, a marginal stimulation in peroxidase activity was observed. These changes in peroxidase activity suggested that *A. indicum* must be a highly potent estrogen antagonist with an extremely low degree of estrogenicity [4].

2.18. Anti-Convulsant Activity of A. indicum

Anticonvulsant activity of *A. indicum* leaf extracts was investigated by Golwala et al. [18] using Pentylene tetrazole (PTZ) and Maximum Electro Shock (MES) induced convulsions in wistar rats. In PTZ induced convulsions, 100 mg/kg and 400 mg/kg of ethanolic extract was found to increase the onset of clonic convulsions and decreased onset of tonic seizures and thus exhibited a significant anti-convulsant effect. In MES induces seizures, 100 mg/kg and 400 mg/kg of ethanolic as well as aqueous extracts showed significant protective effect by increasing the onset of clonic convulsion time and decreasing extensor time as compared to control group. This anticonvulsant effect was attributed to linoleic acid and/or flavonoid constituents present in the extracts [4,18].

2.19. Hypoglycemic Activity of A. indicum

Seetharam et al. [21] studied the hypoglycemic activity of *A. indicum* leaf extracts in rats. Blood glucose level was measured by using oxidase-peroxidase method. The petrol and CHCl3 extract of *A. indicum* leaves did not show a significant hypoglycemic activity. On the contrary, the alcoholic extract after oral administration of 400 mg/kg exhibited significant reduction in the blood glucose levels. Similarly, the aqueous extract had shown significant reduction in blood glucose level. The significant hypoglycemic activity was attributed to the presence of flavanoids and glycosides since, flavonoids are known to regenerate the damaged pancreatic β-cells and glycosides stimulate the secretion of insulin in β -cells of pancreas [4].

Classification of *A. indicum* [2]:

Kingdom: Plantae

Order: Malves

Family: Malvaceae

Genus: Abutilon

Species: *Abutilon indicum*

Table 1. *Presenting various chemical constituents of plant A. indicum.*

Chemical Compounds	Parts	References
Proteins	Root	23
Alkaloids	Leaf	20
Amino acid	Leaves	19
Carbohydrates	Root	24
Free amino acids	Root	24
Saponins	Root, Leaf	23, 24
Glycosides	Root, Leaf, Flower	23, 24, 2, 4
p-b-D-Glucosyloxybenzoic acid	Whole plants	25
p-Hydroxybenzoic	Whole plants	25
Caffeic acid	Whole plants	25
Carbohydrates	Different parts of plants	23
Essential oil	Different parts of plants	23
Flavonoids	Root, Leaf	23, 24, 2
Sesquiterpenes	Different parts of plants	23
Fatty acids	Different parts of plants	23
Free Acid	Root	23
Sterols	Root, Leaves	23, 2
Tannin	Root,leaves, stem	23, 24
Resin	Root	23
Mucilage	Leaves	2
Organic acid	Leaves	2
Triterpenoids	Leaves	2
Lute Olin	Flowers	2
Apigenin	Flowers	2
Chrysoenol	Flowers	2
Glucopyranoside	Flowers	2
7-0-beta glucopyranoside	Flowers	2
Chrysoenol -7-0-beta - glucopyranoside	Flowers	2, 8
Galactomannose	Seeds	2
D-galactose	Seeds	2
D-mannose	Seeds	2
Luteolin	Flowers	2, 8
Quercetin 7-0-beta glucopyranoside	Flowers	2
Quercetin 3-0-alpha – rhamnopyranosyl(1-6)-beta glucopyranoside	Flowers	2
Abutlin	Flowers	2
(R)-N-(1-methoxycarbonyl-2-phenylethyl)-4-hydroxy benzamide	Flowers	2
Methylstigmasterol	Flowers	8
Quercetin	Flowers	8, 4
Triacontanoic acid	Flowers	8
Apigenin 7-0-beta rhamnopyranosyl	Flowers	8
Uresenol	Flowers	8
Glycopyronoside	Flowers	8
Glucose	Leaves	4
Fructose	Leaves	4
Galactose	Leaves	4
Linoleic	Root	4
Stearic	Root	4
Palmitic	Root	4
Lauric	Root	4
Myristic	Root	4
Caprylic,	Root	4
Capric	Root	4
Sitosterol,	Root	4
Abutilin A	Root	4
(R)-N-(1'-methoxycarbonyl-2'-phenylethyl)-4-hydroxybenzamide	Root	4

Table 2. *Presenting various pharmacological activities attributed to plant A. indicum.*

Activity	References
Hepatoprotective	7
Hypoglycemic	4
Anti diarrhoeal	4
Anti-Ulcer	5
Anti-arthritic	6,4
Analgesic	3
Anti-inflammatory	3
Cytotoxic	8
Antimicrobial	8
Antioxidant	22 ,9
Radical scavenging	22,9
Antifungal	10,11
Antibacterial	12,11
Anti-diabetic	13
Larvicidal	14
Cardioprotective	15
Wound healing	4
Lipid lowering	4
Immunomodulatory	4
Anti-estrogenic	4
Anti-convulsant	4

Fig. 1. *Root of A. indicum*

Fig. 2. *Flower of A. indicum*

Fig. 3. *Whole plant of A. indicum*

Fig. 4. *Fruit of A. indicum*

Fig. 5. *Leaves of A. indicum*

Fig. 6. *Stem of A. indicum*

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