



REVIEW ARTICLE

Phytochemical and Pharmacological Profile of *Abutilon Indicum* – A Review

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ABSTRACT

An Indian shrub *Abutilon indicum*, belongs to the family of Malvaceae traditionally known as tuturabenda or duvena kayalu. Multiple parts of the plant such as roots, leaves, flowers, seeds as well as whole plant is helpful in treating several ailments. It contains constituents such as alkaloids, flavonoids, tannins, mucilage, -sitosterol, asparagines, hexoses, n-alkane mixtures, alkanol, gallic acid and sesquiterpenes. The plant is found to possess Antioxidant activity, Nephroprotective activity, Diuretic activity, Anti-urolithiatic activity, Anti-diarrhoeal, Respiratory activity, Cardioprotective activity, Hepatoprotective activity, Anti-inflammatory activity, Antihypoglycemic activity, Antiulcer and gastroprotective activity, anticonvulsant activity, Antiarthric activity, Antipyretic activity, Wound healing activity, Antivenomic activity, Aprodisiac activity, Cytotoxic activity, Antifungal activity, Antibacterial activity, Antiviral activity, Antimalarial activity, Larvicidal activity, Immunodulatory activity. The present aim of this review is provide to detailed information on phytochemical and pharmacological profile of *Abutilon indicum*.

Keywords: *Abutilon indicum*, Phytochemical, Pharmacological activity.

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1. Introduction

Abutilon indicum is a small shrub which belong to the family of malvaceae that comprises of about 150 annual and /or perennial herbs. It is occurs in the sub-tropic and

tropic regions of Asia (India), America, Africa, Australia and is invasive to tropical islands¹. *Abutilon indicum*, the Indian Abutilon , Indian mallow is a hairy under-shrub with

golden yellow flowers and is found in the hottest parts of India. In Sanskrit it is called as “Atibala” which is described for its potential medicinal and therapeutical uses in the Indian traditional system of medicines². The whole plant as or different parts of the plants such as leaves, flowers, seeds, roots, and bark is used in the treatment of various disorders. The leaves contains steroids, saponin, carbohydrates, flavonoids and is used as demulcent, laxative, diuretic, aphrodisiac, sedative. The flowers contain flavonoids compounds and is used by the populations of tribals in the south parts of India as to increase the semen volume in human beings. Seeds contain water soluble galactomannans and they are used as laxatives, expectorants, demulcants. Roots have non-drying oils consisting of various fatty acids and are used as diuretics. Stem bark is used as diuretic and astringent. The mucilage extracted from leaves had diuretic and demulcent properties. Roots and seeds are also used in the form of decoctions to treat fever and cough and roots itself acts as a nervine tonic to cure paralysis and effective in strangury. The decoction of roots and leaves is used to treat dental problems. It is reported that application of leaf paste on the area of scorpion bite relieves pain where as the powdered form of dried leaves when mixed with wheat flour is used to treat uterus displacement in some of the tribes of Orissa in India^{3,4}. It is found to possess Antioxidant activity, Nephroprotective activity, Diuretic activity, Anti-urolithiatic activity, Anti-diarrhoeal, Respiratory activity, Cardioprotective activity, Hepatoprotective activity, Anti-inflammatory activity, Antihypoglycemic activity, Antiulcer and gastroprotective activity, anticonvulsant activity, Antiarthritic activity, Antipyretic activity, Wound healing activity, Antivenomic activity, Aprodisiac activity, Cytotoxic activity, Antifungal activity, Antibacterial activity, Antiviral activity, Antimalarial activity, Larvicidal activity, Immunomodulatory activity^{5, 6, 7, 8}. *Abutilon indicum* has been used in folklore medicines in India as well.

2. Plant Profile



Fig: 1 *Abutilon indicum*

Distribution

Abutilon indicum (Linn.) Sweet belongs to Malvaceae family and is commonly called as country mallow, kanghi, atibala. This is a perennial shrub up to 3 m in height. The plant is found in India, America, Sri Lanka and tropical regions. In sub-Himalayan tracts it is found as a weed up to 1200 m of hill as well as the hotter parts of India⁸.

Botanical description

The leaves are ovate, acuminate, toothed, rarely subtrilobate and 1.9 cm long. The flowers are yellow in colour, peduncle jointed above the middle. (The petioles 3.8-7.5 cm long, stipules 9 mm long, pedicels often 2.5-5 mm long, axillary solitary, jointed very near the top, calyx 12.8 mm long divided into middle lobes ovate, apiculate and corolla 2.5 cm diameter, yellow, opening in the evening). The fruits are capsules, densely pubescent, with conspicuous and horizontally spreading beaks. The stems are stout, branched, 1-2 m tall, pubescent. The seeds are 3-5 mm, reniform, tubercled or minutely stellate-hairy, black or dark brown⁹⁻¹².

Synonyms(s): *Sida indica* L.,

Scientific classification

Kingdom : Plantae
Order : Malvales
Family : Malvaceae
Genus : *Abutilon*
Species : *Abutilon indicum*

Uses

- All parts of *Abutilon indicum* are used in the treatment of various disorders.
- The root infusion is prescribed as a cooling medium in fever and is useful as astringent, haematuria, leprosy. It is also considered as a demulcent, diuretic, urethritis, in chest infusion^{2,4}.
- The leaves decoction is used in the treatment of toothache, tender gums and internal inflammation of bladder^{2,4}.
- The bark is found to possess diuretic, astringent, febrifuge, antihelmintic, alexeteric⁴.
- Seeds are used in the treatment of piles, gonorrhoea, laxative, expectorant and in chronic cystitis⁴.

Photochemistry

Leaves

The leaves of the plant are found to possess steroids, saponin, carbohydrates and flavonoids. The methanolic extract of leaves of plant isolation is reported to contain eudesmic acid, ferulic acid and caffeic acid by using ¹H-NMR, ¹³C-NMR, mass spectroscopy and chemical methods. Ethanol leaf extract plant contains flavonoids, terpenes, amino acids, aldehydes, hydrocarbon, ketones, fatty acids and esters and are found by using mass spectroscopy (GC-MS) and gas chromatography^{1,3,8,13}.

Fruits

Fruits are found to possess flavonoids and alkaloids³.

Seeds

Seeds are found to possess water soluble galactomannans consisting of galactose and mannose in the ratio of 2:3. The seed oils consist of saturated acids like cis 12,13-epoxyoleic (vermolic) acid, 9,10-methylene octadec-9-enoic (sterculic) acid, 8,9-methylene-heptadec-8-enoic (malvalic) acid. TLC-GLC studies of seeds oil revealed the presence of high amount of unsaturated acids¹⁴⁻¹⁷.

Roots

Roots consist of non-drying oils that are found to possess several fatty acids like linoleic acid, oleic acid, steric acid, palmitic acid, lauric acid, myristic acid, caprylic acid, capric

acid, sitosteroland amyirin from unsaponifiable matter and unusual fatty acid having C17 carbon skeleton³.

Aerial parts

The aerial parts of plant are found to possess n-alkane mixture, alkanol fraction, -sitosterol, fumaric acid, p-coumaric acid, vanillic acid, caffeic acid, p-hydroxybenzoic acid, gluco-vanilloyl glucose, fructose, aspartic acid, histidine, threonine, serine and leucine. The mucilage part consists of galactose and galacturonic acid. Shoots of flowers consists of saponins, flavonoids and alkaloids⁹.

Whole plant

The whole plant is found to possess mucilaginous substances and asparagines. The main class of compounds includes saponins, flavonoids, alkaloids, hexoses, n-alkane mixtures, alkanols. -sitosterol, vanillic acid, p-coumaric acid, caffeic acid, fumaric acid, abutilon A, p hydrobenzoic, galacturonic acid, caffeic acid are some of the important compounds reported. It consists of essential oils like -pinene, caryophyllene, caryophyllene oxide, endesmol, farnesol, borenol, geraniol, geranyl acetate, elemene and - cineole^{8,19}.

3. Pharmacological Profile

Antioxidant activity

Antioxidant activity of alcoholic extract of *Abutilon indicum* (whole plant) is investigated by using reducing power assay and DPPH free radical scavenging methods (87.7% inhibition at a concentration of 500µg/ml). The methanolic extract of *Abutilon indicum* is investigated using FRAP, DPPH and nitric oxide (inhibition activity of 28.74%) and superoxide radical scavenging (inhibition activity of 49%) methods and it showed 62% of inhibition at a concentration of 250µg/ml. The ethanolic extract of *Abutilon indicum* (whole plant) showed in vivo antioxidant activity using CCl₄ induced toxicity in rats by 500mg/kg. The n-hexane, chloroform, ethylacetate and butanol fractions are investigated for antioxidant by using ABTS, FTAP, DPPH and linoleic acid peroxidation methods. Leaves of *Abutilon indicum* was found to possess strong antioxidant activity with total protein content of 12.5 plus or minus 3.6 mg/g and is investigated for its antioxidant activity by using FRAP assay. Flowers of *Abutilon indicum* showed significant antioxidant activity at concentration of 100µg and it is more potent than standard drug in superoxide and hydroxyl radical scavenging activity but less potent in reducing power activity. Seed oil of *A. indicum* showed strong antioxidant activity when assayed with ABTS, FRAP, DAPH and linoleic acid peroxidation. The antioxidant activity of *Abutilon indicum* is due to its higher phenolic content²⁰⁻²⁴.

Nephroprotective activity

The ethanolic extract of *Abutilon indicum* plant showed to have protective effect against cisplatin-induced nephrotoxicity and acetaminophen-induced nephrotoxicity in rats. Oral administration of dose of 20mg/kg and 400mg/kg of extract for 7 days before cisplatin injection showed decreased cisplatin-induced nephrotoxicity in rats. Histopathological studies on rat kidney confirmed the decreased cisplatin-induced renal damage. In case of acetaminophen-induced nephrotoxicity oral administration of

dose of 400mg/kg shows greater protective effect than that the dose of 200mg/kg of extract. Serum creatine levels, alkaline phosphate levels and uric acids levels have undergone significant reduction. Histopathological examination of kidney confirmed the nephroprotective effect of the extract and improvement in the renal cellular damage²⁵⁻²⁷.

Diuretic activity

Abutilon indicum Linn (seeds) extract is evaluated for its diuretic activities in rats that are carried out by administration of normal saline along with the active constituents for the treatment. Increased levels of volume of urine, electrolytes like Na⁺ and K⁺ content in urine are the parameters used for the evaluation of diuretic activity. When an extract of 200mg/kg and 400mg/kg of *Abutilon indicum* is administered it results in increased diuresis (increased sodium level and not potassium levels). The aqueous extract of *abutilon indicum* (seeds) showed both diuretic and natriuretic activities. When a dose of 200mg/kg and 400mg/kg of plant extract is administered orally it shows a significant increase in diuresis and increase in sodium elimination but it does not effect the potassium levels when compared with furosemide at a dose of 20mg/kg. When an aqueous and ethanolic extract of *Abutilon indicum* (leaves) at dose of 200mg/kg and 400mg/kg are administered to rats orally it results in a significant increase in excretion of electrolytes like Na⁺, K⁺ and Cl⁻ in urine and urinary volume. As aqueous extract (400mg/kg) of *A. indicum* shows same effect as that of furosemide (25mg/kg) it was support in folklore use in the treatment of diuretic effects²⁵⁻²⁷.

Anti-urolithiatic activity

Urolithiatic activity of *Abutilon indicum* plant extract (400mg/kg and 800mg/kg) was evaluated by calcium oxalate calculi induction using CPD and gentamicin (40mg/kg) which showed a significant decrease in excretion of calcium oxalate urinary stones and loss of kidney weight²⁸.

Anti-diarrhoeal activity

The various extracts of *Abutilon indicum* like petroleum ether extract, methanolic extract and aqueous extracts are investigated for diarrhoea induced by castor oil and prostaglandin E-2 in rats. The methanolic extract and aqueous extract exhibits significant anti-diarrhoeal activity as they are found to inhibit the frequency of defecation, faecal drooping as compared to that of loperamide where as petroleum ether did not show any significant activity. These extracts that showed anti-diarrhoeal activity are mainly due to the mechanism of by inhibiting intestinal peristalsis, gastrointestinal motility and prostaglandin E-2 induced enteropooling²⁹.

Respiratory activity

The dried powder of *Abutilon indicum* (aerial plant parts) when administered orally at a dose of 1.0g with water three times daily for 4 weeks it has not shown any significant changes but when it is administered with anti-diarrhoeal drugs they showed a significant decrease in the bronchial symptoms like wheezing, cough and chest tightness. The methanolic extract of *Abutilon indicum* is evaluated for bronchial asthma treatment by using histamine and

acetylcholine induced bronchospasm in guinea pig and egg albumin induced rat peritoneal mast cell degranulation. The extract showed as significant mast cell stabilizing effect and anti-inflammatory activity when estimated using carrageenan induced rat paw oedema and doesn't exhibit any significant bronchodilating activity against histamine and acetylcholine induced bronchospasm^{30,31}.

Cardioprotective activity

The ethanolic extract of *Abutilon indicum* (roots) was investigated for its protective action against isoproterenol induced myocardial infarction in male wistar rats. The ethanolic extract of *Abutilon indicum* when administered orally at a dose of 100mg/kg was proved to be safe and is effective in preventing cardiovascular dysfunction in rats is possibly due to the antioxidant activity but when it is administered at a dose of 500mg/kg it showed to induce myocardial injury on its own and is failed to exhibit protective action against myocardial injury induced by isoproterenol³².

Hepatoprotective activity

The aqueous extract of *Abutilon indicum* (leaves) shown a dose dependent hepatoprotectivity in rats against CCl₄ induced hepatotoxicity and paracetamol induced hepatotoxicity. When the extract is pretreated at doses like 100mg/kg and 200 mg/kg, it showed a reduced the depleting levels of GSH and as well as elevating levels of SGOT, SGPT, ALKP and bilirubin. The methanolic (80%) extract of *Abutilon indicum* (aerial parts) had showed to have potent hepatoprotective activity in rabbits against CCl₄ induced hepatotoxicity and paracetamol induced hepatotoxicity. It is found to have significant decrease in serum enzymes (SGPT, SGOT, ALKP and bilirubin) when compared with silymarin. The ethanolic extract of *Abutilon indicum* (leaves) when administered orally at a dose of 100mg/kg and 200mg/kg shown hepatoprotective activity and the levels of hepatic antioxidant enzymes (SOD, CAT, GPx, GR, GST) returned to normal. This mechanism of hepatoprotection is due to the synergistic effect of the isolated flavonoids. The ethanol (70%) extract of *A. indicum* (flowers) showed as strong protective action against CCl₄ induced liver damage and significant reduction in elevated levels of SGPT, SGOT, ALP, ACP and direct bilirubin at a dose of 500mg/kg. This may be due to the flavonoid content in the extract³³⁻³⁵.

Anti-inflammatory and analgesic activities

The ethanolic extract of *Abutilon indicum* (whole plant) is evaluated for its anti-inflammatory by using carrageenan-induced paw oedema method in wistar rats. When different doses of 250, 500, 750 mg/kg are administered it showed a significant reduction in oedema volume (37%, 49%, 65.65%) in comparison to ibuprofen (76.34% at 10mg/kg) after treatment for 3 hours. Quercetin which is isolated for the ethanolic extract of *Abutilon indicum* (whole plant) has shown dose dependent anti-inflammatory activity when investigated by using carrageenan induced paw oedema in rats. The ethanolic extract of *Abutilon indicum* (whole plant) was found to display analgesic effects (due to the presence of eugenol) when evaluated in tail flick method and formalin induced paw licking method in wistar albino rats. The ethanolic leaves of *Abutilon indicum* extract is

reported to possess high anti-inflammatory activity by using lipoxygenase inhibition assay. The methanolic extract of *Abutilon indicum* showed to have significant effect in early stage of inflammation and it has oedema inhibition after 1st and 3rd hours when treated with a dose of 100 (47.36% and 42.62%) and 200mg (50.25% and 66.12%) compared with indomethacin (15.338% and 40.79% at dose of 10mg/kg) against carrageenan induced paw oedema in wistar rats. This effect is especially due to the presence of phenolic compounds (flavonoids) that has potent anti-inflammatory activity. When petroleum ether, chloroform, methanol and aqueous extract of *Abutilon indicum* (whole plant) were administered orally at dose of 400 mg/kg those showed significant anti-inflammatory activities by using respective models. The ethanol, aqueous and petroleum extracts of *Abutilon indicum* (roots) reported analgesic activity in tail flick method and acetic acid induced writhing test in Swiss albino mice³⁶⁻³⁹.

Antihyperglycemic activity

The aqueous extract of *Abutilon indicum* (whole plant) is found to possess anti-diabetic activity and is evaluated for anti-diabetic activity induced by streptozocin in rat. When a dose of 0.5g/kg and 1.0 g/kg is administered orally is found to be effective in moderately diabetic rats than severely diabetic induced rats this is due to significant reduction in plasma glucose levels in 30 minutes after administration. 0.5 g/kg shows faster reduction of glucose levels in moderately induced diabetics where as 1.0g/kg of dose showed a significant reduction in severely induced diabetic rats in comparison with that of glibenclamide. The extract is also administered at a dose of 250mg/kg or 500mg/kg orally for 14 days while significantly lowering the extract^{40,41}.

Antiulcer and gastro protective activity

Antiulcer activity of ethanolic extract of *Abutilon indicum* is investigated by using aspirin and pylorus ligation induced ulceration methods in the rats. When a dose of 100mg/kg and 200mg/kg (p.o) is administered orally twice daily for five days it showed a significant reduction in the PH level, formation of lesions and acid secretion compared with ranitidine (50mg/kg). The ethanolic extract of *Abutilon indicum* is shown to be effective against aspirin, pylorus ligation and alcohol induced ulcer models in rats. The ethanolic extract shows more gastroprotective activity (50.22% gastro protection) when compared with that of aqueous extract (gastro protection). The two extracts exhibit a significant inhibition of gastric lesions and reduced gastric volume and total acidity level. When a dose of 250mg/kg and 500mg/kg of hydro-alcoholic extract of *Abutilon indicum* is administered orally it showed a significant dose-dependent antiulcer effect against ethanol and pyloric ligation induced gastric ulcers in rats (omeprazole as standard drug). A dose of 250mg/kg and 500mg/kg of methanolic extract of *Abutilon indicum* showed a significant antiulcer property in pylorus ligated and ethanol induced ulceration in albino rats. This activity is mainly due to the presence of flavonoids (quercetin), alkaloids and tannins⁴²⁻⁴⁵.

Anticonvulsant activity

Anticonvulsant activity of ethanolic extract of *Abutilon indicum* was investigated by pentylenetetrazole induced

convulsions in rats. When a dose of 100mg/kg and 400mg/kg is administered orally it shows a significant anticonvulsant effect. It exhibit an increase in the latency, onset of clonic convulsions and decreases the onset of tonic seizures in case of pentylene tetrazole induced convulsions. Both of the extracts exhibits a highly anticonvulsant activity in case of maximal electro shock induced convulsions⁴⁶.

Anti-arthritis activity

In-vitro studies of anti-arthritis activity are investigated in male albino rats by using different extracts of *Abutilon indicum* (whole plant). Freund's adjuvant induced arthritis model is used for the evaluation of anti-arthritis activity. Methorexate (0.75mg/kg body weight) act as standard drug. The methanolic extract (400mg/kg) of *Abutilon indicum* showed anti-arthritis effect and showed reduction in paw volume ($p < 0.001$) on 7th and 14th days respectively in comparison with the standard drug methorexate⁴⁷.

Wound healing activity

The ethanolic extract of *Abutilon indicum* is evaluated for its wound healing activity by using excision wound model in the albino rats. It exhibited a significant wound contracting and increase in wound closure rate than that of the standard drug nitrofurazone⁴⁸.

Antivenom activity

The methanolic and hexane extracts of *Abutilon indicum* are investigated for its *in vitro* anti-venom activity by using *Echis carinatus*. These extracts both methanolic and hexane are able to inhibit acetylcholine esterase, phospholipase, hyaluronidase and phosphomonoesterase toxic enzymes but methanolic extract shows greater effect than that of the n-hexane extract. The inhibition of phosphomonoesterase and phosphodiesterase varies from that of maximum inhibition of 100% to that of minimum inhibition of phosphomonoesterase of 14% with the concentration at 250µg/ml⁴⁹.

Aphrodisiac activity

When a dose of 100mg/kg, 200mg/kg and 400mg/kg of aqueous extract of *Abutilon indicum* were administered orally it resulted in significant aphrodisiac effect. A dose of 200mg/kg and 400mg/kg of extract is administered it showed a significant increase in the frequency of penile erection episodes with the penile erection index of 229 and 332, when compared with that of erection index of sildenafil. All the other extracts also exhibited an increase in the level of sperm count as well as the number licking behaviour of females aiding the mating performance in the males⁵⁰.

Immunomodulatory activity

The ethanolic and aqueous extract of *Abutilon indicum* (leaves) are used for the screening of immunomodulatory activity on specific and non specific immunity. It is done by using hemagglutination antibody titer (HA), delayed type hypersensitivity (DTH), neutrophil adhesion test and carbon clearance test. Oral administration of ethanolic extract at a dose of 200mg/kg/day and aqueous extract of dose 400mg/kg/day increased the production of circulating antibodies titre and potentiated the DTH reaction. It showed the significant increase in the percentage of neutrophil adhesion fibers and phagocytic activity. This effect may be due to the presence of flavanoid contents in the extract⁵¹.

4. Conclusion

The present review provides valuable information regarding the various aspects of plant profile, phytochemical screening and pharmacological characteristics of the plant *Abutilon indicum*. It is reported that the plant contains a different class of chemical compounds like flavonoids, alkaloids, fatty acids, steroids, triterpenes, coumarins. This plant is shown to have proven to contain various pharmacological effects like antioxidant activity, nephroprotective activity, antidiuretic activity, anti-urolithiatic activity, antidiarrhoeal activity, anti-hepatoprotective activity, respiratory protective activity, cardio protective activity, wound healing activity, antivenom activity, immunomodulatory activity. According to the present review the plant *Abutilon indicum* is considered to be a good point of interest in further studies to explore the various pharmacological aspects as well as the development and exploration of new drugs from natural sources.

5. References

- [1] Manikantan R, Shila S. Isolation, characterization and structural elucidation of stigmasterol from *abutilon indicum*. International journal of creative research thoughts, 2017;5(4): 2320-2882.
- [2] Jasmet kaur Abat, Sanjay kumar and Aparajita Mohanty. Ethnomedical, phytochemical and ethopharmacological aspects of four medicinal plants of malvaceae used in Indian traditional medicines: A review. Medicines (basel), 2017; 4(4): 75.
- [3] Archana Sharma, R.A.sharma and Hemalatha singh. Phytochemical and pharmacological profile of *Abutilon indicum* L. Sweet; A review. International journal of pharmaceutical science review and research, 2013; 20(1):120-127.
- [4] Jacob Jessurun RS, Lavakumar S. Nephroprotective effect of ethanolic extract of *Abutilon indicum* roots in gentamycin induced acute renal failure. International journal of basic and clinical pharmacology, 2016;5(4).
- [5] Mr.T.Shekhavali, Dr.S.Roshan. A review on pharmacological activities on *Abutilon indicum* (Atibala). Research journal of pharmacology and pharmacodynamics, 2016;8(4): 171.
- [6] Lakshmyya, Narashma Raonelluri, Pramod kumar, Namda kishor Agarwal T Shivaraj Gouda and SRamachandra Setty. Phytochemical and pharmacological evaluation of leaves of *Abutilon indicum*. Indian journal of traditional knowledge, 2003; 2(1): 79-83.
- [7] S Rajeshwari and SP Sevakodiyone. Medicinal properties of *Abutilon indicum*. Open journal of plant science, 2021.
- [8] Alshymaa Abdel-rahman Goma, mamdouh nabil samar Yehia desoukey, Mohamed Salah Kamel. Journal of advanced biomedical and pharmaceutical sciences, 2018;56-74
- [9] Kirtikar KR., Basu BD, Indian Medicinal Plants, Edn 2, Vol. I, Dehradun, 1994, 314-317.

- [10] Prajapati ND, Purohit SS, Sharma AK, Kumar TA. Handbook of Medicinal Plants, AGROBIOS (India), Jodhpur, 2003, 3.
- [11] Chopra RN, Nair SL, Chopra IC, Glossary of Indian Medicinal Plants, CSIR, New Delhi, 1956, 2.
- [12] Nadakarni AK, Indian Materia Medica, Popular Prakashan (Pvt) Ltd., Bombay, 1995, 8-9.
- [13] A.saini, d.k.Gahlawat, C.Chauhan, S.K.gulia, S.A. Ganie, Archita and S.S.Yadav. Enthomedical uses and phytochemistry of *Abutilon indicum* (Linn.) Sweet. Journal of pharmacology and phytochemistry, 2015; 3(5):66-72.
- [14] Singh V, Mishra UC, Khare GC, Gupta PC, A neutral seed gum from *Abutilon indicum*, Carbohydrate Polymers, 33, 1997, 203-205.
- [15] Babu M, Husain S, Ahmad MU, Osman SM, .*Abutilon indicum* seed oil -Characterisation of HBr-Reactive acids, Fette Seifen , 82(2), 1980,63-66.
- [16] Badami RC, Deshpande GS, Shanbhag MR, Minor seed oils, VII. Examination of seed oils by gas-liquid chromatography, Journal of oil Technology Assoc India, 7, 1975,76-77.
- [17] Prakash D, Jain RK, Misra PS, Amino acid profiles of some under-utilised seeds, Plant Food Human Nutrition, 38, 1988, 235-241.
- [18] Gaind KN, Chopra KS, Phytochemical investigation of *Abutilon indicum*, Planta Medica, 30, 1976, 174-188.
- [19] Jain PK, Sharma TC, Bokadia MM, Chemical Investigation of Essential oil of *Abutilon indicum*, Acta Ciencia Indica, 8c (3), 1982, 136-139.
- [20] Kaushik D, Khokra SL, Kaushik P, Sharma C, Aneja K. Evaluation of antioxidant and antimicrobial activity of *Abutilon indicum*. Pharmacologyonline. 2010;1:102-8.
- [21] Kaushik P, Kaushik D, Khokra SL. In vivo antioxidant activity of plant *Abutilon indicum*. Journal of Pharmaceutical Education and Research. 2011;2(1):50-3.
- [22] Srikanth PP, Sirisha M, Sashikanth Chitti. Evaluation of Antioxidant and Anticancer Properties of Methanolic Extracts of *Abutilon indicum* and *Blumea mollis*. Journal of Pharmacy Research. 2012;5(4):2373-6.
- [23] Kalyani B. Hepatoprotective and antioxidant role of flower extract of *Abutilon indicum*. International Journal of Pharmaceutical and Biological Archive. 2011;2(1): 541-5.
- [24] Kashmiri MA, Yasmin S, Ahmad M, Mohy-ud-Din A. Characterization, compositional studies, antioxidant and antibacterial activities of seeds of *Abutilon indicum* and *Abutilon muticum* grown wild in Pakistan. Acta Chimica Slovenica. 2009; 56(2):345-52.
- [25] Ushakiran RT, Ashok K, Prathyusha S, Andateesh KD. Protective effect of *Abutilon indicum* l. (Malvaceae) against acetaminophen induced nephrotoxicity in rats. Innovare Journal of Life Science. 2013;1(2):40-3.
- [26] Gunasekaran BS, Dhanapal B, Palayan M. Diuretic activity of *Abutilon indicum* (Linn) Sweet seed extract. Journal of Herbal Medicine and Toxicology. 2010;4(1):49-52
- [27] Chauhan RK, Nagori B. Diuretic effects of *Abutilon indicum* (Linn.) leaves in rats. International Journal of Research In Pharmacy and Chemistry. 2014; 4(2):303-7.
- [28] Pradeep BK, Sravani E, Raja AP, Shashikanth P, Dinesh BK. Evaluation of antirolithiatic activity of *Abutilon indicum* ethanolic extract in male albino rats. Indian Journal of Pharmacology. 2011; 43:41-197.
- [29] Chandrashekhara V, Nagappa A, Channesh T, Habbu P, Rao K. Antidiarrhoeal activity of *Abutilon indicum* Linn leaf extract. Journal of Natural Remedies. 2004;4(1):12-6.
- [30] Paranjape AN, Mehta AA. A study on clinical efficacy of *Abutilon indicum* in treatment of bronchial asthma. Oriental Pharmacy and Experimental Medicine. 2006;6(4):330-5.
- [31] Paranjape AN, Mehta AA. Investigation into the mechanism of action of *Abutilon indicum* in the treatment of bronchial asthma. Global Journal of Pharmacology. 2008;2(2):23-30.
- [32] Rahman M, Reyad-ul-ferdous MD, Mahamud K, Ayshi SS, Sohel D. Pharmacologicals and phytochemicals potential of *Abutilon indicum*: A Comprehensive Review. American Journal of BioScience. 2015;3(2-1):5-11.
- [33] Porchezian E, Ansari S. Hepatoprotective activity of *Abutilon indicum* on experimental liver damage in rats. Phytomedicine. 2005;12(1-2):62-4.
- [34] Yasmin S, Kashmiri MA, Anwar K. Screening of aerial parts of *Abutilon bidentatum* for hepatoprotective activity in rabbits. Journal of Medicinal Plants Research. 2011;5(3):349-53.
- [35] Kalyani B. Hepatoprotective and antioxidant role of flower extract of *Abutilon indicum*. International Journal of Pharmaceutical and Biological Archive. 2011;2(1): 541-5.
- [36] Tripathi P, Chauhan N, Patel J. Anti-inflammatory activity of *Abutilon indicum* extract. Natural Product Research. 2012;26(17):1659-61.
- [37] Ponnudurai KK, Prabu D. Evaluation of anti-inflammatory activity of 75% v/v methanolic extract of *Abutilon indicum* (Linn.) sweet leaves. International Journal of Research in Ayurveda and Pharmacy. 2011;2(5):1574-6.
- [38] Nelluri NR, Kumar P, Agarwal NK, Gouda TS, Setty SR. Phytochemical and pharmacological evaluation of leaves of *Abutilon indicum*. Indian Journal of Traditional Knowledge. 2003;2(1):79-83.
- [39] Goyal N, Singh S, Sharma SK. Analgesic effects of various extracts of the root of *Abutilon indicum* Linn. Journal of Pharmacy and Bioallied Sciences. 2009;1(1):43-6

- [40] Krisanapun C, Peungvicha P, Temsiririrkkul R, Wongkrajang Y. Aqueous extract of *Abutilon indicum* Sweet inhibits glucose absorption and stimulates insulin secretion in rodents. *Nutrition research*. 2009;29(8):579-87.
- [41] Krisanapun C, Lee SH, Peungvicha P, Temsiririrkkul R, Baek SJ. Antidiabetic activities of *Abutilon indicum* (L.) sweet are mediated by enhancement of adipocyte differentiation and activation of the GLUT1 promoter. *Evidence-Based Complementary and Alternative Medicine*. 2011;2011:1-9.
- [42] Ponnudurai KP, Jebasingh D, Prabu D. Evaluation of anti-ulcer activity of ethanolic extract of *Abutilon Indicum* (Linn.) sweet leaves. *Der Pharmacia Sinica*. 2011;2(4):148-58.
- [43] Sharma SK, Sharma SM, Saini V, Mohapatra S. Evaluation of antiulcerogenic potential of *Abutilon Indicum*. *International Research Journal of Pharmacy*. 2013;4(3):233-6.
- [44] Venkateswarlu K, Vijayabhaskar K, Krishna OS, Devanna N, Sekhar KC. Evaluation of anti-ulcer activity of hydro alcoholic extracts of *Abutilon indicum*, *Helianthus annuus* and combination of both against ethanol and pyloric ligation induced gastric ulcer in albino wistar rats. *British Journal of Pharmaceutical Research*. 2015;5(1):42-51.
- [45] Dashputre N, Naikwade N. Evaluation of anti-ulcer activity of methanolic extract of *Abutilon indicum* Linn leaves in experimental rats. *International Journal of Pharmaceutical Sciences and Drug Research*. 2011;3(2):97-100.
- [46] Dharmesh K, Patel L, Santosh KV, Sunil BB, Munesh M, Piyush P. Anticonvulsant activity of *Abutilon indicum* leaf. *International Journal of Pharmacy and Pharmaceutical Sciences*. 2010; 2(1):66-71.
- [47] Bhajipale NS. Evaluation of anti-arthritic activity of methanolic extract of *Abutilon indicum*. *International Journal of Ayurvedic and Herbal Medicine*. 2012; 2(03):598-603.
- [48] Suresh G, Ganesana R, Dharmalingam M, Baskar S, Senthil P. Evaluation of wound healing activity of *Abutilon indicum* Linn, in wister albino rats. *International Journal of Biological and Medical Research*. 2011; 2(4):908-11.
- [49] Shrikanth VM, Janardhan B, More SS, Muddapur U, Mirajkar KK. In vitro anti snake venom potential of *Abutilon indicum* Linn leaf extracts against *Echis carinatus*. *Journal of Pharmacognosy and phytochemistry*. 2014; 3(1):111- 13.
- [50] Ganu G, Nagore DH, Rangari M, Gupta H. Pharmacological evaluation of ayurvedic plants for aphrodisiac activity in experimental animals. *Journal of Complementary and Integrative Medicine*. 2010;7(1):1-19.
- [51] Dashputre N, Naikwade N. Immunomodulatory activity of *Abutilon indicum* linn on albino mice. *International Journal of Pharma Sciences and Research*. 2010;1(3):178-84.