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Therapeutic significance of *abutilon indicum*: An overview

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ABSTRACT

Abutilon indicum is known as "Atibala" in Sanskrit. Literally "Ati" means very and "Bala" means powerful, referring to the properties of this plant as very powerful. *Abutilon indicum* is a hairy herb or under shrub distributed throughout the tropica. In traditional systems of medicine, various plant parts such as roots, leaves, flowers, bark, seeds, and stems have been used as antioxidant, demulcent, laxative, diuretic, analgesic, anti-inflammatory and antiulcer agents. The leaves are reported to be used by traditional practitioners in cases of inflammatory joint disorders as folklore remedy. Psychosomatic medicinal use related to scorpion bite treatment is also reported in India. Plants are rich source of secondary metabolites with interesting biological activities. In general these secondary metabolites are an important source with a variety of structural arrangements and properties. It contributes the beneficial effect on health or plays an active role in interest in bioactive secondary metabolites of plant amelioration of disease. The medicinal properties of the plants have been investigated in the recent scientific developments throughout the world, due to their potential antioxidant activity, no side effects and economic viability. Antioxidant property of the plant is mainly due to the presence of phenolic compounds. The importance of medicinal plants and the contribution of phytomedicine to the well- being of a significant number of the world's population have attracted interest from a variety of disciplines. The present review is therefore an effort to give the detailed survey of literature on its Pharamacognosy, phytochemistry as well as traditional and pharmacological uses.

Keywords: *Abutilon indicum*, Atibala, Indian mallow, Pharamacognosy, Phytochemistry, Pharmacology.

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INTRODUCTION

The *Abutilon* genus of the Malvaceae family comprises of about 150 annual or perennial herbs, shrubs or even small trees widely distributed in the tropical and subtropical countries of America, Africa, Asia and Australia[1]. It needs only heat and sun and grows even in dry and poor soils. It is quite common in India on road sides and waste places, growing usually after the rains and flowering during winter. In Poland, it is also cultivated for its ornamental value. Various plants of *Abutilon* species are traditionally claimed for their varied pharmacological and medicinal activities. Furthermore, different plant parts contain specific phytoconstituents responsible for their biological activity. Also a huge literature is available stating the usefulness of various plants of this species for the treatment of pharmacological disorders and ailments. Some of the plants belonging to the species are amongst much acclaimed Ayurvedic herbs and in the recent past there has been a renewed scientific interest in exploring the species. The various parts of the plant *Abutilon* such as roots, leaves and seeds are documented to possess various medicinal properties in ethnobotanical surveys conducted by ethnobotanists and in traditional systems of medicine such as Ayurveda. The extracts of the whole plant *Abutilon* were scientifically evaluated for tonic and oja, vardhaka, augment and ojas, the subtle essence of all vital fluids, responsible for health, harmony and spiritual growth. Since then large variety of compounds have been isolated from genus *Abutilon* and majorities of them are flavonoids, steroids, terpenoids and phenolics. Valuable fibers are also drawn from different species of *Abutilon*. The fibers obtained from the plants like *A. indicum, A. polyandrum and A.asiaticum* are used for making ropes cordages, jute dyes, drugs, rugs ,wrapping cloth, tissue papers, making coarse cloth, cigarette paper, rubber, tyres, fabrics, shoe polishes etc. *Abutilon avicennae* provides a useful fiber named Chinese jute. Out of the 150 different species of *Abutilon* which are reported, only a few of these find medicinal importance out of which the prominent ones are:

1.Abutilon indicum.

2.Abutilon theophrashti.

3.Abutilon grandiflorum.

4.Abutilon muticum.

5.Abutilon pannosum.

6.Abutilon megapotamicum.

A lot of medicinally important attributes have been assigned to the species *Abutilon indicum* and a large number of reports indicates continuous scientific research on it with special reference to their medicinal cultivation and biotechnological applications. The manifold uses of *Abutilon*

indicum have created wide interest in its phytochemistry. In light of this, the present review aims at exploring the scientific findings on this plant. This study will provide referential information for the correct identification of the crude drug and its traditional uses, chemical constituents and medicinal properties.

Morphology of *Abutilon indicum*:-

Abutilon indicum (L.) Sweet commonly known as 'Country mallow' (English), 'Kanghi' (Hindi) and 'Atibala' (Sanskrit) is found in the outer Himalayan tracts from Jammu to Bhutan up to an altitude of 1500 m and extending through the whole of northern and central India. It grows as a weed and found abundantly in wastelands. It is herbaceous or shrubby, softly to mentose plant; stem is round, often tinged with purple color. The root is cylindrical 1.2 -1.5 cm in diameter with smooth surface, having fragrance with saltish taste and yellow in color. The stem is 0.3-0.9 cm in diameter and yellow. The leaves are evergreen, stipulate and cordate. The bark is flattened with hairy yellow outer surface and inner surface is smooth. The fractures are fibrous. The flowers are yellow in color, pedicillate and bisexual. The petiole is 1.5-7.0 cm long, yellowish brown in color, cylindrical with stellate hair. The lamina is crenate, reticulate, acute to acuminate, minutely stellate, dentate, dull green in color, hairy above and glaucous below. Glandular hairs are present while the texture is coriaceous. Fruit is a schizocarp like a capsule, densely pubescent, with conspicuous and horizontally spreading beaks. The seeds are 3-5 mm, reniform, tuberculed or minutely stellate hairy, black or dark brown furrowed, minute and glabrous[2]. Microscopically the stem is undulate in outline with unicellular and multicellular hairs which are blunt. The root is also undulate in outline, with secondary wood arranged in definite rings. Some giant unicellular hairs are also present. The leaves are dorsi-ventral and covered with flask shaped, stellate, pitcher glandular hairs. The epidermal cells have straight anticlinal walls while the stomata are anomocytic [3].

Ayurvedic Properties :-

GUNA (Properties) - Laghu, Snigdh, Pichil

RASA (Taste) - Madhur

VIPAK (Metabolism) - Madhur

VIRYA (Potency) - Sheet

PRABHAV (Impact) - Balya

Vernacular Names[5-9]:-

Sanskrit-Atibala, Kantika

Hindu-Atibala, Tara kanchi, Itawari, Jhili, Debi, Kanghi, Tara-kanchi

Bengali-Potary, Mirubaha, Atibala, Petari

English-Country mallow

Kannada-Gidutingi, Hetakisa, Hettukisu, Hettutti, Hetutti, Kisangi, Shrimudri.

Malyalam-Belocre, Katturam, Katturan, Katturam, Pettekaputti, Pitikkapattu.

Tamil- Ottuttutti, Tutti, Perundhuthi, Tutti-p-pattai, Kakkati, Kikkaci, Tuttikkirai.

Telgu- Adavibenda, Adivibenda, Botlabenda, Dudi, Muttavaciribenda.

Marathi- Akakai, Kansuli, Karandi, Madmi, Mudra, Mudrika, Petaari, Pidari.

Scientific Classification[4]:-

Kingdom	*Plantae* – Plants
Subkingdom	*Tracheobionta* – Vascular plants
Super division	*Spermatophyta* – Seed plants
Division	*Magnoliophyta* – Flowering plants
Class	*Magnoliopsida* – Dicotyledons
Subclass	*Dilleniidae* –
Order	*Malvales*–
Family	*Malvaceae*– Mallow family
Genus	*Abutilon* Mill. – Indian mallow
Species	*Abutilon indicum* (L.) Sweet – Monkeybush

TRADITIONAL USES:-

The various parts of the plant *Abutilon indicum* (L.) Sweet such as leaves, roots, flowers, seeds and seed oil are widely used by various tribal communities and forest dwellers for the treatment of variety of ailments. The plant has been a reputed remedy in the Siddha systems of medicine for piles, jaundice, leprosy and ulcer[10]. In Vedic periods, the roots of the Bala plants i.e. Atibala (*A.indicum* Linn.), Mahabala (*Sida rhombifolia Linn.*), Bala (*Sida cordifolia Linn.*) and Bhumibala (*Sida veronicaefolia Lam*) were used to remove poison, vata–pitta diseases, heart problems, bily blood, eye diseases and uterine disorders. Its seeds and roots both were used in fever in the form of decoction[11]. Following various folk claims for cure of numerous diseases, efforts have been made by researchers to verify the efficacy of the plant through scientific biological screenings. The plant contains saponins, flavonoids, alkaloids, hexoses, n-alkane mixtures (C_{22-34}), alkanols, and amino acids as main classes of compounds.

Leaves:-

Plant leaves are demulcent; given as decoction for bronchitis, bilious diarrohea, gonorrhea, bladder inflammation, urethritis and fevers. It is also used as eyewash, mouthwash, in toothache and tender gums; gonorrhoea, quick ulcer healing and inflammation of the bladder. In some of the places juice from the leaves of the plant is used in combination with the liquid

extract of Allium cepa to treat jaundice and hepatoprotective studies on experimental animal confirmed the above activity[12,13]. Its extract is also used in relieving thirst and in reducing fever. The leaf juice mixed with jaggery is used for the treatment of snakebite as antidote[14]. The bread prepared from the mixture of leaf powder and wheat flour is taken daily during night for about one month for cure of uterus displacement[15].

Flowers:-

The flowers are used to increase semen in men[16]. Flower paste is applied to boils and ulcers.

Seeds:-

Seeds are demulcent, laxative, expectorant and aphrodisiac; useful for gonorrhea and cystitis. In China it is used for tinnitus, deafness, earaches, fevers, hives, tuberculosis, weeping ulcers and as diuretic. In India, seeds are used for coughs and fevers, bronchitis, dysuria, diabetes, dysmenorrhea, diarrhea, boils and skin ulcers. The seeds from this plant are used in the treatment of cough, puerperal disease, urinary disorders, chronic dysentery and fever[17,18].

Roots:-

Infusion of root is useful in fever as a cooling medicine, stranguary, heamaturia. Root is used as a pulmonary sedative and diuretic[19] and can be taken for the relief of hematuria. It is also effective in the treatment of leprosy. Roots and bark are used as aphrodisiac, anti- diabetic and nervine tonic.

Stem bark:-

The bark is used as a diuretic, anthelmintic, pulmonary, sedative and also used in fever[20]. Bark is astringent and is used in stranguary and urinary complaints.

Fruit:-

Fruit decoction mixed with ammonium chloride is given orally to treat haemorrhagic septicemia[21]. The fruit is used to treat piles, gonorrhoea and cough[22,23].

Whole plant:-

The folk practitioner also use this plant for curing blood dysentery, fever, allergy and is also an aphrodisiac[24].The whole plant is used as anti-inflammatory, immune stimulating effect and in piles. It has been reputed in the siddha system of medicine as a remedy for jaundice, piles, ulcer and leprosy[25].

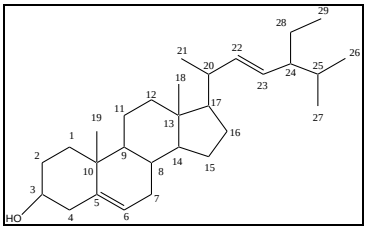
PHYTOCHEMICAL STUDY:-

The knowledge of individual chemical constituents of a medicinal plant is essential for understanding the pharmacological activity as well as potential toxicity and optimizing extraction procedures. A number of constituents have been reported from species of *A.indicum*

and they belong to lactones, sesquiterpenes, flavanoid aglycones, steroids, carbohydrates, phenols, tannins, alkaloids, flavanoids glycosides, proteins, alkaline sulphates and amino acids[26].

Leaves:-

Leaves contain tannins, mucilage, traces of asparagin, organic acid and, ash of leaves contains alkaline sulphates, chlorides, magnesium phosphate and calcium carbonate[27]. According to Rajlakshmi, ethanolic extract contain 72% more quercetin than flowers[28]. Leaves also contains alkaloids, sterols, titerpenoids, glycosides[29] essential oils as well various amino acids[30]. Baxi[31] isolated α- tocopherol and β–sitosterol (1) from leaves.

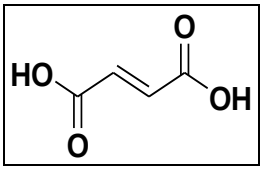


β–sitosterol (1)

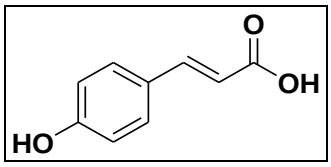
Singh and Gupta concluded that *A. indicum* leaves extract prevents alcohol induced oxidative stress and hepatic injury by the combined synergistic effects of its flavonoids viz. Luteolin, Chrysoeriol, Luteolin-7-O-beta glucopyranoside, Chrysoeriol-7-O-betaglucopyranoside, Quercetin-3-O-beta glucopyranoside.

Aerial parts:-

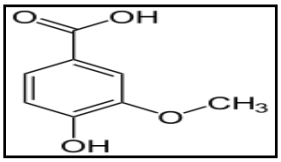
The aerial parts of the plant on extraction with petroleum ether led to the isolation of n-alkane mixture, an alkanol fraction and β–sitosterol; fumaric acid(2), p-coumaric acid(3), vanillic acid(4), caffeic acid(5), and p-hydroxybenzoic acid, p-β-D-glucosyloxybenzoic acid (6), gluco-vanilloyl glucose, fructose, aspartic acid (7), histidine, threonine, serine, and leucine[32]. Saponins, flavanoids and alkaloids are present in the shoot and flowers.



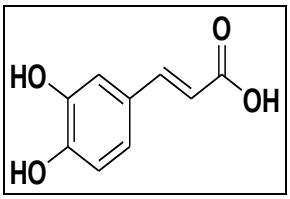
Fumaric acid (2)



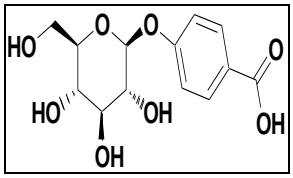
p-coumaric acid (3)



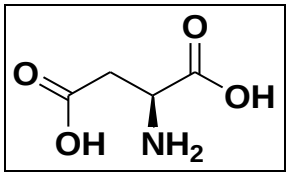
Vanillic acid (4)



Caffeic acid (5)



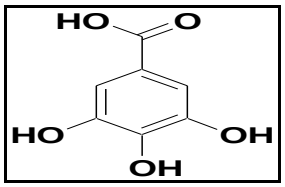
p - β-D-glucosyloxybenzoic acids (6)



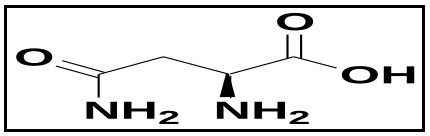
Aspartic acid (7)

Roots:-

Roots contain asparagin[33]. In 1989, Gallic acid (8) and fixed oil were reported from roots by Sharma and Ahmad[34]. The presence of β-amyrin (9) and different fatty acids in the roots of *A.indicum* was reported in 1984 by Dennis and Kumar[35]. Galactose and galacturonic acids are present in mucilage fraction[36].Bhattacharjee reported presence of sterols, terpenoids, terpenes, flavonoids, and steroids[37].



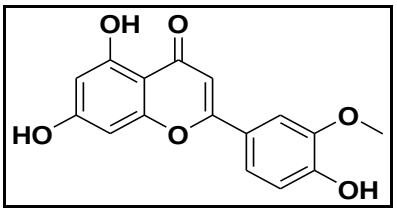
Gallic acid (8)



β-amyrin (9)

Flowers:-

The occurrence of Gossypetin -7- and 8- glucosides and cyanidin- 3- rutinoside in *A.indicum* was communicated by Sankara and Nair[38].Two sesquiterpene lactones i.e alantolatone and isoalantolactone have been first time reported by Sharma et al [39]. Matalawska [40] and Sirowska isolated and identified 7 flavanoids namely Luteolin, Chrysoreiol(10), Luteolin 7-O-β-glucopyranosideside, Chrysoreiol-O-β -glucopyranoside,Apigenin 7-O-β -glucopyranoside, Quercetin-3-O-β-glucopyranoside and quercetin 3-O-α-rhamnopyranosyl (1-6)-β-glucopyranoside from the flowers of *A.indicum*.



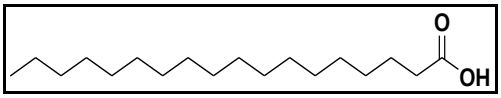
Chrysoreiol (10)

Oil obtained from the flowering tops yielded geraniol, geraniol acetate, α- pinene, borneol and tetradecane[41].

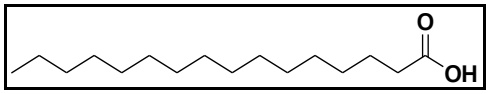
Seeds:-

Acid catalysed fragmentation, periodate oxidation and methylation showed that the seed-gum has branched structure consisting of linear chain ß-D (1,4) linked mannopyranosyl units, some of which are substituted at ortho-6 by two α –D (1,6) galactopyranosyl units mutually linked glycosidically as end groups[42]. Chemical analysis of the seed oil showed the presence of stearic, linolenic, oleic, and palmitic acid[43]. Seeds were analyzed for the crude pentosan, protein, and water soluble mucilage contents[44]. HBr reactive fatty acids viz, 12, 13-epoxyoleic (vernolic

acid); 9, 10 methylene-heptadec-8-enoic (Malvalic acid) were identified in the seed oil [45]. Amino acid profile of seed proteins (31%) contains threonine, glycine, serine, glutamine, lysine, methionine, isoleucine, proline, alanine, cystenine, tyrosine, phenylalanine, leucine, aspargine, histidine, valine, argininine[46]. TLC-GLC studies of seed oil revealed the presence of high amount of unsaturated acids. The essential oil of plant contains β-pinene, caryophyllene, caryophyllene oxide,1,8-cineole, ceraneol, ceranyl acetate, eudesmol, and farnesol[47]. Stearic acid (11) and palmitic acid (12) were the principal component from the saturated acids. Raffinose was obtained as a prime sugar component found in seeds[48].



Stearic acid(11)



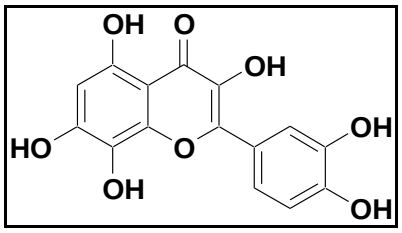
palmitic acid(12)

Fruits:-

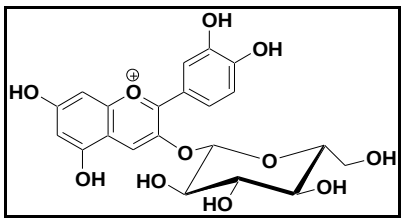
Singh and Dogra reported that fruits contain flavanoids and alkaloids [49].

Whole plant:-

In 1982 Jain and coworkers[50] isolated different chemical constituents from *A. indicum* and *A.glaucum*. They included Farnesol, Borneol, beta–pinene, Eudesmol, geraniol, beta – caryophyllene and their derivative. In 1990 Zahara[51] reported new Taraxasterol and Lupeol from *A.indicum.* Gupta and Saharia[52] isolated sitosterol and its acetyl derivative from *A.indicum*. In 1972 some flavonoids like quercetin, kaemferol, gossypetin(13), and cyanidin 3- glucoside(14) have been isolated from *A. indicum* by Sankara and Nair[53].



Gossypetin (13)



Cyanidin 3 - glucoside (14)

The investigation on the chemical constituents of the whole plant has resulted in the isolation of two new compounds, Abutilin A and (R)-N-(1'-methoxycarbonyl-2'-phenylethyl)-4-hydroxybenzamide, as well as 28 known compounds[54]. β -sitosterol as a potential new mosquito larvicidal compound was isolated from petroleum ether extract[55]. The plant was found to contain gum resin and mucilage[56]. Tannins were not present in 50% ethanolic extract of the plant[57]. In 2011 Pandey[58] and his coworkers isolated and characterized p-β-D-Glucosyloxybenzoic acid, p-Hydroxy benzoic acid and caffeic acid from the whole plant.

BIOLOGICAL ACTIVITY:-

Different parts of *Abutilon indicum* possess various biological activities such as antimicrobial, antifertility, anticonvulsive, antihelmintic, antidiarrhoeal, antimicrobial, wound healing, hepatoprotective, antihypertenstive, antitumor, antidiabetic, anti- inflammatory and free radical scavenging activity.

Anti inflammatory activity:-

Anti-inflammatory action of *Abutilon indicum* leaves by HRBC membrane stabilization technique was investigated by Rajurkar[59]. The ethanolic , chloroform and aqueous extracts of the leaves were screened for anti-inflammatory activity. All three fractions showed a biphasic effect on the membrane stabilization.

Lipid lowering activity:-

Giri et. al.[60] studied the lipid lowering activity of *Abutilon indicum* leaf extracts in rats using triton and diet induced hyperlipidemic models. 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[61-63].

Analgesic activity:-

Analgesic potential of various extracts of root of *Abutilon indicum* was evaluated by Goyal et. al.[64]. Petroleum ether extract showed higher analgesic activity. The activity may be related with central mechanism or due to peripheral analgesic mechanisms. Thus they authenticated the traditional use of *Abutilon indicum*.

Antioxidant and antibacterial activity:-

Kashmiri et. al.[65] investigated the antioxidant and antibacterial activity of *A. indicum* and *A.muticum* seeds. The seed oil of *A. indicum* and *A.muticum* showed broad spectrum activity against Gram-positive and Gram-negative bacteria. The findings reveal seeds of *Abutilon* species, indigenous to India to be potentially valuable herb for oil production, delivery of drugs and cosmetic active ingredients.

Activity on glucose absorption and insulin secretion:-

Krisanapun[66] evaluated the antidiabetic effects of the aqueous extract derived from the Thai *A. indicum* plant and to explore its effects on intestinal glucose absorption and insulin secretion. The observations suggested that the aqueous extract from the *Abutilon indicum* plant has antidiabetic properties, which inhibited glucose absorption and stimulated insulin secretion.

Hepatoprotective activity:-

Hepatoprotective activity of *Abutilon indicum* on experimental liver damage in rats was studied by Porchezhian and Ansari[13]. *A. indicum* exhibited significant hepatoprotective activity by reducing carbon tetrachloride and paracetamol induced change in biochemical parameters that was evident by enzymatic examination.

Hypoglycemic activity:-

Seetharam et. al.[24] studied the hypoglycemic activity of *A. indicum* leaf extracts in rats. The alcoholic and aqueous extracts exhibited significant reduction in the blood glucose levels. Flavonoids are known to regenerate the damaged pancreatic β-cells and glycosides stimulate the secretion of insulin in β -cells of pancreas.

Antimycotic activity:-

The screening for antimycotic activity was performed wherein methanolic extract of *A.indicum* leaves showed remarkable antifungal activity against Trichophyton rubrum. The study further reported antifungal potential of stem and flower extracts, however they were less effective as compared to the leaf extract [67].

Antidiarrhoeal activity:-

Leaf extracts of *A. indicum* were evaluated for antidiarrhoeal activity[68] .The methanolic and aqueous extracts showed significant antidiarrhoeal activity. These extracts were reported to reduce diarrhoea by inhibiting intestinal peristalsis, gastrointestinal motility and PGE2 induced enteropooling.

Anti-convulsant activity:-

Anticonvulsant activity of *A.indicum* leaf extracts was investigated by Golwala et. al.[69]. Ethanolic and aqueous extracts showed significant protective effect. This anticonvulsant effect was attributed to linoleic acid and flavanoid constituents present in the extracts.

Larvicidal activity:-

Larvicidal activity of crude hexane, ethyl acetate, petroleum ether, acetone and ethanolic extracts of *A.indicum* were assayed. Highest larval mortality was found in petroleum ether extract and β-sitosterol was found as a potential new mosquito larvicidal compound with LC_{50} value of 26.67 ppm against C. quinquefasciatus [70].

Wound healing activity:-

The ethanolic extract of *A.indicum* was studied for wound healing activity. 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.

Anti asthamatic activity:-

This study reported the effectiveness of powdered dried aerial parts of *A.indicum* in decreasing the severity of commonly observed symptoms of bronchial asthma i.e. dyspnoea, cough, chest tightness and wheezing. It was also found to significantly increase the pulmonary function in patients having mild to moderate bronchial asthma[71].

Diuretic activity:-

Seed extract of *A. indicum* were evaluated for its diuretic effect wherein the aqueous extract at 400 mg/kg exhibited statistically significant effect when compared with reference standard Furosemide. Hence, study elucidated that extract posses significant diuretic and natriuretic effect but not potassium sparing effect[72].

Immunomodulatory activity:-

Dashputre et al.[73] studied the immunomodulatory activity of ethanolic and aqueous extract of *A.indicum* leaves. This activity was said to be attributed to the presence of flavonoids (quercetin), alkaloids, tannins, saponin glycosides and phenolic compounds.

CONCLUSION:

The extensive survey of literature revealed that presence of fatty acids claims analgesic activities. In our earlier work we have selected the Malvaceae plant *Abutilon indicum* for phytochemical and microbial analysis. As a result several new source and known secondary metabolites were characterized spectroscopically. The petroleum ether extracts confirmed the presence of four known secondary metabolites in *Abutilon indicum* leaves i.e. (-) β- pinene, Eugenol, Geraniol and Palmitic acid[74]. The isolation of stigmasterol, 3, 3′, 4′, 5, 7-pentahydroxy flavone and (3β) -cholest-5-en-3-ol from the chloroform extracts[75] was also reported by us in our work. Eudesmic acid, ferulic acid and caffeic acid have also been isolated from the methanol extract of leaves of this plant[76].

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