

Review Article

Abutilon indicum (Atibala): Ethno-Botany, Phytochemistry and Pharmacology- A Review

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ABSTRACT

Abutilon indicum (Linn.) (Malvaceae) is a shrub distributed throughout India. The various parts of the plant (leaves, roots, seeds and seed oil) are widely used by various tribal communities and forest dwellers for the treatment of variety of ailments. The plant is documented to possess beneficial effects as sweet, cooling, digestive, laxative, expectorant, diuretic, astringent, analgesic, anti-inflammatory, anthelmintic, demulcent and aphrodisiac. 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 (C₂₂₋₃₄), alkanols, and amino acids as main classes of compounds. A scrutiny of literature revealed some notable pharmacological activities like antibacterial, antipyretic, antimalarial, antifertility, hepatoprotective, hypoglycemic and wound healing. The present review is an attempt to highlight the various ethnobotanical and traditional uses as well as phytochemical and pharmacological reports on *A. indicum*.

Keywords: *Abutilon indicum*, ethnobotanical uses, phytochemistry, pharmacological activities

INTRODUCTION

Medicinal plants constitute important components of flora and are widely distributed in different regions of India. One such plant; *Abutilon indicum* (Linn.) family Malvaceae; commonly called as 'Country mallow' (English), 'Kanghi' (Hindi) and 'Atibala' (Sanskrit). It is a perennial shrub, softly tomentose and up to 3 m in height. The plant is found in India, Sri Lanka, tropical regions of America and Malesia. [1] It is found as a weed in sub-Himalayan tracts, hills up to 1200 m and in hotter parts of India. The leaves are ovate, acuminate, toothed, rarely subtrilobate and 1.9-2.5 cm long. The flowers are yellow in color, 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 in to middle, lobes ovate, apiculate and corolla 2.5 cm diameter, yellow, opening in the evening. The fruits are capsule, 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 brown. [2-5]

The various parts of *A. indicum* 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. Our through literature search revealed an interesting fact that though the plant is a proper remedy for a variety of ailments and is one of the ingredient in a number of important Ayurvedic formulations (Diabecon), a very little effort have been made to verify its efficacy through scientific screening in animal models and clinical trials.

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The present review highlights the various folk, ayurvedic uses, pharmacognostic, phytochemical and pharmacological studies conducted on *A. indicum* and also pinpoints the unexplored potential of it. The medicinal use of different parts of the plant is shown in Table 1.

MEDICINAL USES

Traditional Uses

Almost all the parts of Atibala are of medicinal importance and used traditionally for the treatment of various ailments. The roots of the plant are considered as demulcent, diuretic, in chest infection and urethritis. The infusion of the root is prescribed in fevers as a cooling medicine and is considered useful in strangury, haematuria and in leprosy. The leaves are found to be good for ulcer and as a fomentation to painful parts of the body. The decoction of the leaves is used in toothache, tender gums and internally for inflammation of bladder. The bark is used as febrifuge, anthelmintic, alexeteric, astringent and diuretic. The seeds are used in piles, laxative, expectorant, in chronic cystitis, gleet and gonorrhoea. [2, 5-7]

Ethno-botanical Uses

There are over 400 different tribal and other ethnic groups in India. Each tribal group is having their own tradition, folk language, beliefs and knowledge about use of natural resources as medicines. Almost all the parts of this plant are documented to be useful in ethnobotanical surveys conducted by ethnobotanists. It has been documented that the natives of India, Malaya, Philippine Islands and Indochina use its parts for medicinal purposes such as febrifuge, anthelmintic, antiemetic, anti-inflammatory, in urinary and uterine discharges, piles and lumbago. The leaves and seeds are crushed with water to form pastes which is applied to penis to cure syphilis. [8-10] The leaves are used in eye wash, mouth wash, in catarrh and bilious diarrhea. A leaf paste is taken

orally to cure piles and to relieve leg pains. [11] 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. [12] The leaf juice when mixed with jiggery is used for the treatment of snakebite as antidote. [13] The fruit is used to treat piles, gonorrhoea and cough. [14-15] Fruit decoction mixed with ammonium chloride is given orally to treat haemorrhagic septicemia. [16] Seed powder is used orally with water as aphrodisiac and laxative. [17] The root of the plant is used to treat gonorrhoea and leprosy. Root infusion is given to cure fever, dry cough and bronchitis.

Table 1: Medicinal Uses of *Abutilon indicum*

Part of the plant	Uses
Fruit	In Piles, gonorrhea and cough treatment. Fruit decoction mixed with ammonium chloride is given orally to treat hemorrhagic septicemia.
Leaves	Decoction of the leaves is used in toothache and tender gums. Internally for inflammation of bladder and in treatment of ulcer.
Bark	As Febrifuge, anthelmintic, alexeteric, astringent and diuretic.
Seed	As laxative, expectorant, in treatment chronic cystitis, gleet, gonorrhea and piles.
Roots	As Demulcent, diuretic, in chest infection and urethritis.

Uses ascribed in Ayurvedic and Unani system of medicine

Abutilon indicum is used as a drug in both Ayurvedic and Unani systems. [1] In Ayurvedic system; the bark has been recommended as febrifuge, anthelmintic, alexeteric. It is also known to improve the conditions like vata, tridosha, allaying thirst, vomiting and lessening perspiration. The root cures uterine haemorrhagic discharges. The milk of the plant cures urinary discharges. In Unani system the bark is good in strangury and urinary complaints. The leaves are prescribed for toothache, lumbago, piles and all kinds of inflammation. The mucilaginous seeds of the plant are considered as tonic. They are good for chest troubles, bronchitis, piles and gonorrhoea infection. [1-2]

PHARMACOGONSTICAL STUDIES

A detailed Pharmacognostic study of all the parts of *A. indicum* has been carried out by Dhanalakshmi et al.

Leaf: Evergreen, Base-cordate, stipulate, filiform, petiole 1.5-1.70 cm long, cylindrical, yellowish brown in colour, stellate and hairy. Lamina- simple, cordate, reticulate, crenate, dentate, acute to acuminate base-cordate, surface dull green in colour, minutely stellate, hairy above, glaucous below, glandular hairs present, coriaceous in texture.

Transverse section of leaf shows dorsiventral, covered with stellate, pitcher and flask shaped glandular hairs, 75-100 μ and 150-250 μ respectively epidermal cells 15 \times 10 μ with straight anticlinal walls, stomata anamocytic and amphistomatic with stomatal index 21.5 and 13.32 in abaxial and adaxial surfaces respectively, palisade 100-120 μ , spongy 50-60 μ , palisade two layered, distal end of petiole shows isolated collateral vascular bundles arranged in a circle, crystals lie below the vessels 25-40 μ , parenchymatous tissue seen, druses in spongy. [8]

Stem: The stem is yellow in colour, 0.3-0.9 cm in diameter with relative density of about 1.8, soft and flexible in

behavior. The longitudinal surface is smooth, yellow on either side with middle white. The bark is epidermal in origin, 0.1-0.2 cm in diameter, flattened, the outer surface is hairy, and greenish to yellow in colour, and the inner surface is smooth, greenish to yellow in color. Fracture is fibrous in nature.

Transverse section of stem shows undulate in outline, unicellular hairs 500-750 μ , multicellular hairs 100-140 μ present, former more numerous than latter, unicellular hairs pointed while multicellular hairs blunt, some giant unicellular hairs 1000 μ present, epidermal cells barrel-shaped, cortex 40-75 μ , filled with parenchymatous cells 7.5-5.0 μ , wood 100-150 μ , vessel 10-15 μ , pith 650-750 μ , formed of Parenchymatous cells 40-50 μ , medullary ray 100-115 \times 25-40 μ , druses in collenchymatous cells, phloem with prominent fibres, pith with mucilaginous cavity. [8]

Root: The root is true, 1.2-1.5 cm in diameter, cylindrical with smooth surface, yellow in colour with strong fragrance and saltish in taste.

Transverse section of root shows undulate in outline, bark 10-15 μ , periderm 10-12 layered, cortex reduced 150-165 μ , secondary wood arranged in definite rings, number of rings varies from 3-4, wood 200 μ , vessel 25-30 μ in diameter. [8]

PHYTOCHEMISTRY

Country mallow has been explored phytochemically by various researchers and found to possess number of chemical constituents as shown in Fig. 1. The whole plant contains mucilaginous substances and asparagines. saponins, flavonoids, alkaloids, hexoses, n-alkane mixtures (C₂₂₋₃₄), alkanol as main classes of compounds. Some important constituents reported in the plant are β -sitosterol, vanillic acid, *p*-coumaric acid, caffeic acid, fumaric acid, Abutilon A, (R)-N-(1'-methoxycarbonyl-2'phenylethyl)-4-hydroxybenzamide, *p*-hydroxybenzoic, galacturonic, *p*- β -D-glycosyloxybenzoic and amino acids. The plant *A. indicum* contains of essential oil which mainly consists of α -pinene, caryophyllene, caryophyllene oxide, endesmol, farnesol, borenol, geraniol, geranyl acetate, elemene and α -cineole along with number of other minor constituents reported in Table-2. [18-20, 22, 32]

The seed oil of the plant affords *cis* 12, 13-epoxyoleic (vernolic) acid, 9, 10-methylene octadec-9-enoic (sterculic) acid, as well as 8, 9-methylene-heptadec-8-enoic (malvalic) acid. [21] The seed oil affords palmitic, stearic, oleic, linolenic acids, along with cineole, elemene, eudesmol, farnesol, borneol. [23-25]

Aerial parts of the plant contain β -sitosterol, gossypetin-8- and -7- glucosides, cyanidin-3-rutinoside, tocopherol oil and some flavonoids. The leaves of the plant contain steroids, saponins, carbohydrates and flavonoids. The roots of the plant contain Gallic acid. [26-28]

The essential oil of flowering tops contain α -pinene, α -cineole, caryophyllene, borenol, geraniol, geranyl acetate, caryophyllene oxide, elements, eudesmol and farnesol as given in Fig. 2. [23, 26, 29-31]

PHARMACOLOGICAL USES

Following are the folk and traditional uses of the plant; it has been investigated scientifically in animal models to validate the potential of the plant in cure of variety of ailments.

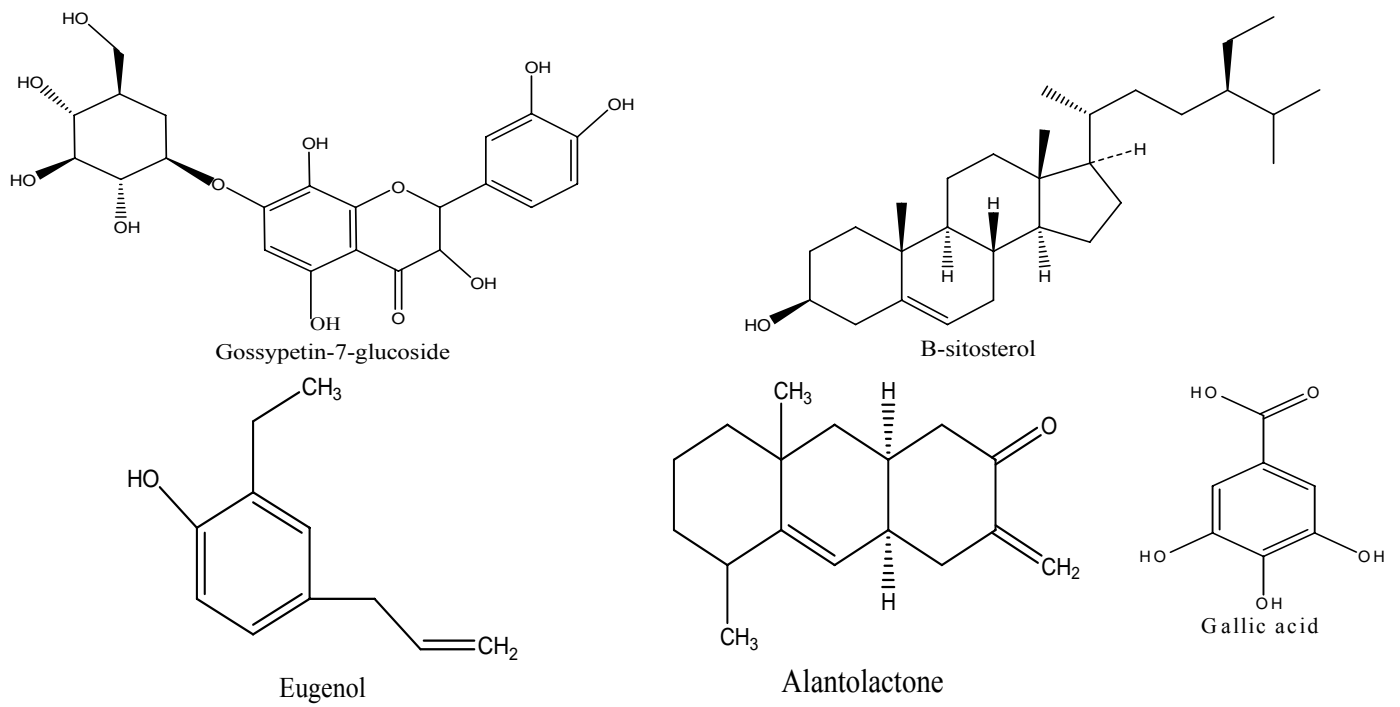


Fig. 1: Structure of some important phytoconstituents reported from *Abutilon indicum*

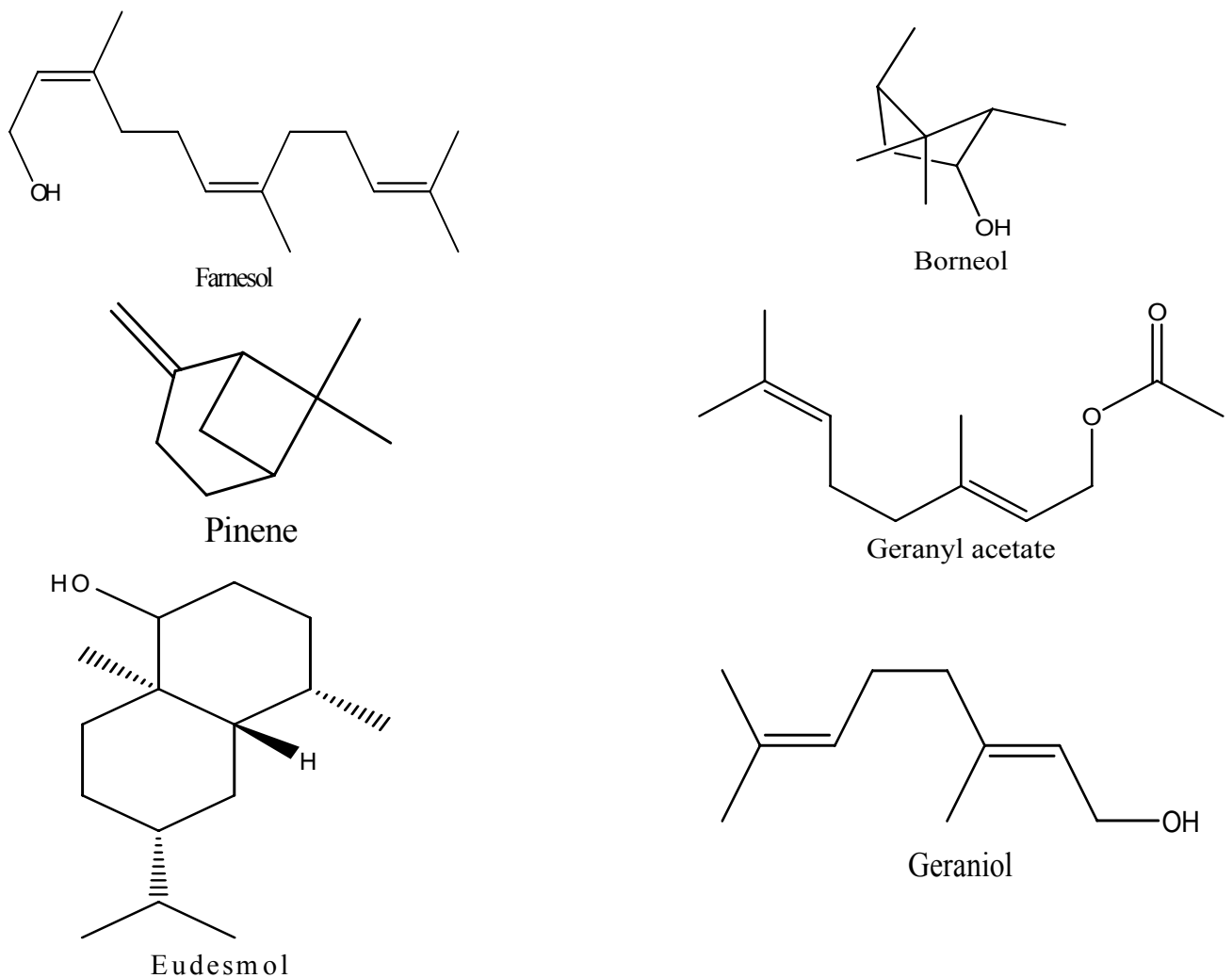


Fig. 2: Structures of some important essential oil constituents reported from *Abutilon indicum*

Table 2: Chemical constituents reported in essential oil of *Abutilon indicum*

Constituent	Flowering top	Whole plant	Concentration (flowering top)	RI Lit	Method of determination
<i>α-pinene</i>	✓	✓	(0.1%)	936	GLC/TLC
Caryophyllene	✓	✓	(11.6%)	1467	GLC/TLC
Caryophyllene oxide	✓	✓	(2%)	1578	GLC/TLC
<i>α-cineole</i>	✓	✓	(1%)	1024	GLC/TLC
Geraneol	✓	✓	(13.0%)	1267	GLC/TLC
Geranyl acetate	✓	✓	(2%)	1362	GLC/TLC
Elemenes	✓	✓	(0.5%)	1340	GLC/TLC
Eudesmol	✓	✓	(22.0%)	1618	GLC/TLC
Farnesol	✓	✓	(2.8%)	1694	GLC/TLC
Borneol	✓	✓	(0.6%)	1165	GLC/TLC
<i>α-cubenene</i>	×	✓	T	1355	GC/MS
<i>α-ylangene</i>	×	✓	T	1382	GC/MS
<i>α-copaene</i>	×	✓	T	1377	GC/MS
<i>α-curcumene</i>	×	✓	T	1553	GC/MS
<i>α-cedrene</i>	×	✓	T	1418	GC/MS
<i>α-bergamotene</i>	×	✓	T	1434	GC/MS
<i>α-humulene</i>	×	✓	T	1467	GC/MS
<i>α-valencene</i>	×	✓	T	1490	GC/MS
Cadinol	×	✓	T	1653	GC/MS
<i>α-ferulene</i>	×	✓	T	1750	GC/MS
Nerolidol	×	✓	T	1539	GC/MS

GENERAL PHARMACOLOGICAL ACTIVITIES

The both aqueous and ethanolic leaf extracts have LD₅₀ 3 g/kg. The fixed oil bears LD₅₀ value of 933.3 mg/kg *s. c.* and 2357.9 mg/kg *p. o.* [33, 38] The general pharmacological activities shown by different parts of the plant are given below:

Hepatoprotective

The aqueous extract of *Abutilon indicum* was tested for hepatoprotective activity against carbon tetrachloride and paracetamol induced hepatotoxicities in rats. The plant exhibited significant hepatoprotective activity by reducing carbon-tetrachloride and paracetamol induced change in biochemical parameters that was evident by enzymatic examination. The plant extract may interfere with free radical formation, which may conclude in hepatoprotective action. *A. indicum* showed significant hepatoprotective activity against carbon tetrachloride and paracetamol, comparable with the standard silymarin. [34-35]

Wound healing

The ethanolic extract of *A. indicum* at a dose of 400 mg/kg shows exhibited significant wound healing activity. The contraction of excision wound promotes from 4th day of treatment till 16th day. The epithelization of wound with ethanolic extract shows as much earlier as compared to control and standard (Silver sulphadiazine) group. [36]

Immunomodulatory

The whole fine powder of the plant at a dose of 500 mg/kg body weight, when compared to the control group showed statically highly significant rise in modulatory behaviour in all the models. [37-38]

Anti-diarrhoeal

The study revealed that, the methanolic and aqueous possessed significant anti-diarrhoeal activity in castor oil induced diarrhea and prostaglandin E₂-induced diarrhea, compared to the control group. [39]

Analgesic

Pet ether extract and benzene extract were found to possess very good analgesic activity. [40] Fixed oil of the plant when given in doses of 400 and 600 mg/kg exhibits good analgesic potential. [41] Eugenol (4-allyl-2-methoxyphenol) isolated from *Abutilon indicum* found to possess significant analgesic activity. [42]

Angiotensin Converting Enzyme (ACE) inhibitory activity

The root extract of *Abutilon indicum* was found to inhibit ACE in water, ethanol (96%), acetone by 18 %, 1 %, and 9 % respectively. [16]

Antimalarial

β-sitosterol isolated from the petroleum ether extract of leaf of *A. indicum* showed mosquito larvicidal activity. [43]

Antifertility Activity

Abutilon indicum caused significant suppression of enzyme activity as well as uterotropic response induced by estradiol, where as in the group not treated with estradiol, a marginal stimulation of these parameters was observed. [44]

Acetylcholinesterase Inhibitory activity

A methanolic extract of *Abutilon indicum* L. inhibited the activity of acetylcholinesterase by $30.66 \pm 1.06\%$ in dose of 0.1 mg/ml. [45]

Antimicrobial activity

Abutilon indicum extracts (fruit, root and leaf) does not show any significant inhibition against microorganisms *Bacillus cereus var mycoides*, *Bacillus pumilus*, *Bacillus subtilis*, *Bordetella bronchiseptica*, *Micrococcus luteus*, *Staphylococcus aureus*, *staphylococcus epidermis*, *Escherichia coli*, *Klebsiella pneumonia*, *Pseudomonas aeruginosa*, *Streptococcus faecalis*, *Candida albicans*, *Aspergillus niger*, *Saccharomyces cerevisiae*. [46] The absence of activity against above strains shows that plant is lacking antimicrobial activity. The screening of the seeds of *Abutilon indicum* (L.) shows Mycelial Inhibition (%) against *Absidia ramose* and *Aspergillus niger* by 6.97 and 37.25 respectively. [47]

Hypoglycemic activity

Alcohol and water extract of *Abutilon indicum* leaves (400 mg/kg, p. o.) shows significant hypoglycemic effect in normal rats 4 hour after administration (23.10 % and 26.95 % respectively). [48] Aqueous extract was also found very potent to reduce blood glucose levels. [27]

CONCLUSION

In recent years, ethno-botanical and traditional uses of natural compounds, especially of plant origin received much attention as they are well tested for their efficacy and generally believed to be safe for human use. They obviously deserve scrutiny on modern scientific lines such as phytochemical investigation, biological evaluation on experimental animal models, toxicity studies, investigation of molecular mechanism of action (s) of isolated phyto-principles and their clinical trials. It is best classical approach in the search of new lead molecules for management of various diseases. Thorough screening of literature available on *A. indicum* depicted the fact that it is a popular remedy among the various ethnic groups, vaidyas, hakims and Ayurvedic practitioners for cure of ailments. Following the traditional and folk claims very little efforts have been made by the researchers to explore the therapeutic potential of this plant and there is need to explore this plant very thoroughly.

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