ORIGINAL RESEARCH PAPER
Volume-8 | Issue-10 | October - 2019 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

# THERAPEUTIC AND MEDICINAL USES OF LATAKASTURI: A REVIEW

Ayurveda

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## ABSTRACT

Traditional and complementary medicine has helped discover several medicinally important herbs,understand their mechanism of action and use them as drugs to treat serious medical conditions .Herbal medicine is playing an essential role in health care, with about 75–80% of the world's population relying mainly on the use of traditional or alternative systems of medicines for their primary health care. Abelmoschus moschatus Medik., commonly known as musk okra belonging to the family Malvaceae, is used traditionally in the treatment of various health ailments throughout the world. The plant has been extensively studied by various researchers for its biological activities and therapeutic potentials. The present review summarizes information published in various academic journals and books, covering folkloric uses, chemical compositions, pharmacological activities of the extracts and isolated compounds, and safety profile of A. moschatus for further research studies.

## KEYWORDS

Abelmoschus moschatus, Malvaceae, myricetin

### INTRODUCTION

Lata kasturi or Abelmoschus moschantus Medic is a medicinal herb native to India. It is also found in Cambodia, Laos, Thailand, and Vietnam. It is known by different names like Latakasturi (Ayurveda), Habb-ul-mushk (Unani) and Ambrette (English). Latakasturi has immense medicinal as well as non-medicinal values. Almost every part of this plant is used in some way or the other.

Latakasturi is an aromatic and medicinal plant native to India in the Malvaceae family. The fruit is a rich source of dietary fiber. The plant, which has many health benefits. Herbs have been used as medicine since time immemorial. Many plant based natural products used in traditional medicine offer us new sources of drugs[1] . Plants have evolved the ability to synthesize chemical compounds that help them, defend against attack from a wide variety of predators such as insects, fungi and herbivorous mammals. By chance, some of these compounds while being toxic to plant predators turn out to have beneficial effects when used to treat human diseases[2] . The use of plants to heal or combat illness is as old as humankind. In the present scenario, the demand for herbal products is growing throughout the world and major pharmaceutical companies are currently conducting extensive research on plant materials for their potential medicinal value [3]

### TAXONOMIC CLASSIFICATION

Plant name : Abelmoschus moschatus Medik (AM)
Kingdom : Plantae
Phylum : Tracheophyta
Subphylum : Euphyllophytina
Class : Spermatosida
Subclass : Mangoliidae
Order : Malvales
Family : Malvaceae
Genus : Abelmoschus Medik.
Species : AM Medik.
Common name: Musk Mallow, Musk okra, Ambrette, ornamental okra, annual hibiscus, yorka okra, galu gasturi, bamia moschata, Muskdana, Ornamental okra
Vernacular Names:
Hindi: Mushkdana, Kasturi-dana, Jangli bhindi
Manipuri: Bawrthsaisbe suak, Uichhuhlo
Marathi: Kasthooribhendi, Muskadaana
Tamil: kasturi-vendaik-kay-virai, kaattu kasturi
Malayalam: kasturi-venta-vitta, kattu-kasturi
Telugu: kasturi-benda-vittulu, karpoorabenda
Kannada: kasturi bende, kaadu kastoori
Bengali: kalkasturi, latakasturi, mushakdan
Urdu: Mushkdana[4,5]
Assamese: gorokhiakarai
Sanskrit: Latakasturika .

Abelmoschus is a genus of about 15 species of flowering plants belongs to the family of flowering plants called Malvaceae. Out of which Abelmoschus moschatus is cultivated in the tropical regions of Asia, Africa, and South America for its seeds which are used mostly for the isolation of fragrance components.[6] In India, it is found wild all over the hilly regions of Deccan and Karnataka and also at the foothills of the Himalayas.[7] The plant is traditionally used in the treatment of various health ailments. The plant is rich in a number of phenolic compounds, flavonoids, carbohydrates, proteins, sterols, tannins, fixed oil, and fats. A. moschatus has been extensively studied by various researchers for its biological activities and therapeutic potentials such as diuretic, antioxidant activity and free-radical scavenging, antiproliferative, antimicrobial, antilithiatic, hepatoprotective, memory strengthening, antidiabetic, hemagglutinating, anti-ageing, antidepressant, anxiolytic, anticonvulsant, hypnotic, and muscle relaxant activity. The present review summarizes information published in various academic journals and books, A. moschatus is annual, erect herb which grows up to 1.6 m in height. Leaves are polymorphous, more or less cordate, the lower ovate, acute or roundish-angled with the upper palmately 3–7 lobed divided nearly to the base. Lobes are narrow-acute or oblong-ovate, crenate, serrate or irregularly toothed, and hairy on both surfaces. Flowers are large, bright yellow with dark purple base in color and usually appear solitary axillary. Capsules are 6.5–7.5 cm long, ovate, acute, and hispid. Seeds are subreniform, black or grayish brown in color, concentrically ribbed, and scented.[8,9] covering phytochemical, pharmacognostic, pharmacological, and toxicity updates of A. moschatus.It is an erect hispid herbaceous trailing herb that grows up to 1.5 m tall with a long slender tap root. Leaves arealternate, rough, hairy and heart-shaped. They have 3 to 5 lobes and can grow to 15 cm long. Flowers resemble those of the hibiscus and are usually watermelon pink, although they are sometimes white or cream in colour. They last for only one day and their flowering depends on the timing of wet season. Seeds are contained within hairy capsules up to 8 cm long, which are tough but papery. The seeds have a sweet, flowery, heavy fragrance similar to that of musk [10,11,12].

### DISTRIBUTION:

Cultivated throughout India, usually sown in March-April, flowering starts from September, harvested from November to January, This species is native to the old world tropics, globally distributed in the Paleotropics. Within India, it is found throughout Peninsular India and in Himalayan foothills. It is cultivated in Maharashtra and Uttar Pradesh [13,14,15]

Reference: Dravya - Substance, Rasa - Taste, Guna - Qualities, Veerya - Potency, Vipaka - Post-digesion effect, Karma - Pharmacological activity, Prabhava - Therepeutics.

**Dravya**
**Rasa**
Tikta (Bitter), Madhura (Sweet), Katu (Pungent)

**Guna**
Laghu (Light), Ruksha (Dry)

**Veerya** Sheeta (Cold)

**Vipaka**
Katu (Pungent)

**Karma**
Kapha, Pitta

**Leaf**

| Kind | Shape | Feature |
|---|---|---|
| Simple | Alternate | Leaves alternate, rough, hairy,heart-shaped or 3-5 palmately lobed with serrated margins and linear-oblong or triangular lobes, 4-10cm x 4-9 cm |

**Flower**

| Type | Size | Color and composition | Stamen | More information |
|---|---|---|---|---|
| bisexual | 2-4cm long | Yellow | 8-12 | Flowering is October and April in some places, depending on the timing of the wet season |

**Fruit**

| Type | Size | Mass | Appearance | Seeds | More information |
|---|---|---|---|---|---|
| Hirsute | 6-8 cm long | Fruit a hirsute capsule, 6-8 cm long, ovoid-cylindrical | With hooked hairs | | {{{6}}} |

## PHYTOCHEMISTRY

Roots, leaves, fruits and seeds contain mucilage. Leaves, flower petals and fruit husk contain ß-sitosterol and its glycosides. Flowers contain flavonoids, myricetin, its glucoside and cannabistrin and petals contain myricetin and its glucoside.[1] The whole plant extracts of *A. moschatus* showed the presence of carbohydrates, proteins, flavonoids, sterols, tannins, phenolic compounds, fixed oil, and fats.[8] Seed contains moisture (11.14%), protein (2.3%), starch (13.35%), crude fiber (31.46%), fatty oils (14.5%), volatile oil (0.2–0.6%), and resin (5%). The volatile oil extracted from crushed seeds is called as crude oil or concrete. The main constituent of the seed oil is a sesquiterpene alcohol, farnesol (0.12% in the seeds). The characteristic musk-like odor of oil is due to the presence of a ketone, ambrettolide (0.3% in the crude oil) which is lactone of ambrettolic acid (16-hydroxy-7-hexadecenoic acid). The presence of acetic and ambrettolic acids in the ester forms has also been reported. Furfural is present in the water condensate of seed oil. The seed concrete contains large amount of higher fatty acids, chiefly palmitic acid[16] Other fatty acids present in crude volatile oil of seeds are octanoic acid, nonanoic acid, hexadecanoic acid, octadec-9-enoic acid, octadeca- 9,12-dienoic acid, decanol, dodecanol, (E)-nerolidol, (ZE)- farnesol, (EE)-farnesol, decyl acetate, dodecyl acetate, ZE)-farnesyl acetate, (EE)-farnesyl acetate, (EE)-farnesyl myristate, (EE)-farnesyl palmitate, (EE)-farnesyl stearate, (EE)-farnesyl oleate, (EE)-farnesyl linoleate, and (EE)- farnesyl-16-hydroxy-hexadec-7-enoate. The fatty oil extracted from the seeds is rich in linoleic acid and contains phospholipids-α cephalin, phosphatidylserine, and its plasmalogen and phosphatidylcholine plasmalogen. The seeds also contain 2-trans-6-trans-farnesyl acetate, 2-cis-6-trans-farnesyl acetate,1(acetoxyethyl)-1-hexylcyclopropane, and 1-(4-acetoxybutyl)-2-hexacyclopropane.[17] The volatile compounds were also identified in the seed coats of the plant, out of which 2-methylbutyl-2-methylbutanoate was most abundant compound.[18]

The yellow portion of the petals of the plant contains the flavonoids, myricetin, and cannabiscitrin. The flowers are reported to contain cyanidin-3-sambubioside and cyanidin-3- glucoside.[19] The leaves contain beta-sitosterol and its beta-D-glucoside, myricetin and its glucoside Seeds contain 11.1 % moisture, 31.5 % crude fiber, 14.5% lipid, 13.4 % starch, 2.3 % protein, volatile oil (0.2 - 0.6)

**Soil type**
Drained, Rich in nutrients.

## MEDICINAL PROPERTIES OF LATAKASTURI

- Antipyretic (Effective against fever)
- Antihysteric (Controls fit or uncontrolled laughter)
- Carminative (Prevents flatulence)
- Aphrodisiac (promotes sexual desire)
- Antispasmodic (Relieves spasm of involuntary muscles)
- Antivenom (Effective against venom)
- Diuretic (Increases the amount of urine)
- Nervine (calm the nerves)
- Tonic (Improves health and vitality)
- Laxative (Clears the bowel, stool softener)

## AYURVEDIC PROPERTIES OF LATAKASTURI

Latakasturi is widely used in Ayurveda, Unani system and Siddha streams of medicine. It is used to treat a large number of diseases like asthma, bronchitis, diarrhoea, gonorrhoea, hysteria, loss of libido and other urogenital problems.

The decoction of the seeds is used to treat fever, nervous disorder, sore throat, and hysteria.

The tincture of the seeds is used to give comfort during cramps and intestinal disorder. It is believed they are antispasmodic and carminative in nature.

The powder of the seeds after dissolving in water is used to treat urinary problems. It cures blood and protein discharge in urine and scanty urination.

The infusion of the Latakasturi flowers can be used as contraceptives.
The leaves and roots of this plant are used to treat gonorrhoea, boils, and swellings

## TRADITIONAL USES:

Fever, Controls hysteria, Stimulates sexual desire, Inflammation, Gastric, Blotches, Pimples, Diarrhea, Sore throats

## PROPERTIES AND TRADITIONAL CLAIMS

The seeds are diuretic, aphrodisiac, ophthalmic, cardiotonic, digestive, stomachic, constipating, carminative, pectoral, stimulant, antispasmodic, deodorant, insecticidal, and tonic.[20]In India the roots, leaves and seeds of are considered a valuable traditional medicine. Its sweet,acrid, bitter, aromatic seeds are used in one or the other way it is used in nervous disorders, and are considered cooling, antispasmodic , diuretic, stimulant, cardio tonic, aphrodisiac, ophthalmic , digestive, stomachic, carminative, constipating and deodorant, It is also effective against hysteria, skin disease, vomiting and intestinal disorders . It is externally used to relieve spasms of the digestive track, poor circulation, cramp, aching joints and also considered as insecticide. In unani system of medicine this seeds ally thirst, leucoderma and cure stomatitis, dyspepsia and urinary discharge. The leaves and root extract also cures gonorrhea and venereal diseases .[21] It is also reported for anti diabetic , antimicrobial, antioxidant, anti proliferative, free radical scavenging ,[22 23 24] Insulin sensitivity hepatoprotective , anti lithiatic ,[25 26 27] memory strengthing , anti diuretic , antibacterial , antifungal , psychiatric and neurological disorders [2829].

## EFFECT IN THE CNS

Several important medicine properties have been ascribed to the seed extract . Studies have demonstrated the antioxidant and free radical scavenging effect of the seed and leaf extracts. Several neurodegenerative disorders such as Parkinson's disease, Alzheimer's disease and: 2%), ambrett oil and 5 % resin, â -sitosterol, â-D-glucoside, gums, resins and flavanoids. Phytochemical studies showed the presence of flavonoids, phenols, saponins, carbohydrates, terpenoids, myricetin , alkaloids and[30,31] steroids .amyotrophic lateral sclerosis are associated with oxidative stress and apoptosis. Glial cells and neurons are easy targets of oxidative stress and due to their high metabolic rate and because these cells are largely postmitotic. Reactive oxygen species (ROS) attack glial cells and neurons leading to neuronal damage and death. It has been reported that deleterious effects of ROS on human cells may end in oxidative injury leading[32] apoptosis and neurodegeneration in the long run . Naturally available antioxidant products such as carotenoids, vitamin C, Amalaki (Indian

gooseberry), Ginseng, cinnamon and Tulsi among several others may help in attenuating ROS induced neuronal damage. In addition to antioxidant based mechanisms, Abelmoschus moschatus extract also demonstrates nootropic, antidepressant, anxiolytic, anticonvulsant and hypnotic activities.

**AS AN ANTIOXIDANT**

It demonstrate good antioxidant and ROS scavenging activity. The antioxidant activities ofextracts has been evaluated in a series of in vitro assays. The antioxidant activities of the seed and leaf extracts o were determined by total antioxidant, DPPH, and ferrous reducing antioxidant property (FRAP) method. Brain malondialdehyde content and reduced glutathione were also assessed. The seed extract showed significant radical scavenging activity as in 1, 1- diphenyl-2-picrylhydrazyl (DPPH), hydrogen peroxide,hydroxyl radical, superoxide and lipid peroxidation. It also produced significant reduction in malondialdehyde content and increase the brain reduced glutathione.The seed and leaf extracts possess significant antioxidant activity and could serve as free radical inhibitors or scavenger, or substitute, probably as primary antioxidants .[33]

**EFFECT OF AM ON LEARNING AND MEMORY**

Some neurological and psychiatric conditions are associated with impaired cognition and impaired verbal and visuospatial memory. The seed extract was tested in an animal model where amnesia was induced pharmacologically. Alzheimer's disease is a progressive neurodegenerative disorder characterized by gradual decline in memory. In a recent study ethanolic extract of seeds (100, 200 mg/kg. p.o) was administered for 7 successive days to young mice and the elevated plus maze was employed to evaluate learning and memory, and Piracetam (200 mg/kg, i.p) was used as a standard drug. In addition, ache activity was also measured. Pretreatment (100, 200 mg, p.o) for seven successive days significantly improved learning and memory in mice and reversed the amnesia induced by diazepam (1 mg/kg, i.p). also decreased whole brain ache. appears to be a promising candidate for improving memory and anticholinesterase activity and property and it would be worthwhile to explore the potential of this plant in the management of dementia and Alzheimer's disease.

**EVALUATION OF AM SEED EXTRACT IN PSYCHIATRIC AND NEUROLOGICAL DISORDERS**

Anti-depressant and Anxiety studies:Major depression is a psychiatric condition associated with low mood, feelings of guilt, suicidal behavior, impaired condition and psychosomatic symptoms such as poor appetite and impaired sleep . Seed extract has been investigated for its antidepressant effect in animal studies. The alcoholic extract o was tested in the forced swimming test in rats. Treatment with (200 and 400 mg/kg) significantly reduced immobility time in comparison to control values, this effect was also associated with a significant increase in climbing behavior indicating an increase in noradrenergic activity. Treatment with the extract at 200 and 400 mg/kg doses produced a greater decrease in the duration of immobility compared to the standard antidepressant drug imipramine. Anxiety is an emotional state characterized by feeling of tension, worried about thoughts, often accompanied by nervous behavior such as somatic complaints and rumination. Anxiety, fear and worry are natural human feelings. However, if these feelings occur and endure for an extended period, it affects both physical and mental health. This leads to clinical anxiety disorders. Anxiety disorders are the most common class of neuro-psychiatric disorders in USA and many other countries[34]. The life time prevalence of panic attacks (a form of anxiety disorder) is around 7 - 9 % in most countries and 1% alone in India with the prevalence of generalized anxiety disorder is very high i.e. 8.5 % in the general population .The anxiolytic potential was tested in the light-dark test and in the elevated plus maze. The alcoholic extract 200 and 400 mg/kg) significantly increased time spent in light arena compared to the dark arena. Treatment with (200 and 400 mg/kg) in rats resulted in a statistically significant increase in the frequency of the open arm entries and time spent in the open arms in the elevated plus maze. Treatment with the extract at doses of 200 and 400 mg/kg also produced a low number of entries in the closed arm compared to untreated controls. The effect of the extract was comparable to diazepam. In the Hole board test, treatment with the extract also significantly decrease in the number of head dips compared with control group. In summary, extract showed significant antidepressant and anxiolytic activity. Studies measuring neurotransmitter levels and receptor status might shed more light on the molecular mechanisms underlying these restorative effects.

**ANTI-CONVULSANT ACTIVITY OF EXTRACT**

Epilepsy is a medical condition where body muscles contract and relax rapidly and repeatedly, resulting in anuncontrolled shaking of the body. Epilepsy is a complex neurological disorder caused by an imbalance between the brain's excitatory and inhibitory drive. Epileptic seizures affect and damages several vulnerable brain including the hippocampus, neocortex, thalamus, amygdala and cerebellum . Approved treatment for epilepsy includes phenytoin, carbamazepine and valproic acid, newer therapies include vigabtrin and lamotrigine. Treatment, particularly with older generation antiepileptic drugs (AED'S) is associated[35] with severe side effects and impaired cognition .Therefore there is a need to develop more effective and better tolerated AED's. Alternative medicines such as traditional Chinese medicine and Ayurveda have a long history of treating epilepsy with medicinal plants and other herbal products. The anticonvulsant effect of AM ethanolic extract has been evaluated in different animal models of epilepsy such as pentylenetetrazole (PTZ) induced seizures, strychnine induced seizures and maximal electroshock induced seizures. A dose of 100 mg/kg of protected rats against seizures and increased the latency of onset of seizures in the PTZ model. It delayed the duration of strychnine induced seizures and showed dose-dependent increase in the anti convulsant activity, Administration of (200 and 400 mg/kg) showed a dose-dependent increase in the delay of the onset time of seizures induced by maximal electroshock induced convulsion and also decreased duration of tonic hind limb extension.

**SEDATIVE AND HYPNOTIC ACTIVITY OF ABELMOSCHUS MOSCHATUS EXTRACT**

The sedative effect of extract has been documented. Sodium pentobarbital was administered 1hr before the oral treatment of mice with 200-400 mg/kg . The latency to induce sleep was not modified but the hypnosis duration was significantly increased.

**DIURETIC ACTIVITY**

The diuretic activity of methanolic extract of *A. moschatus* seeds was evaluated at the dose of 50 and 100 mg/kg in rats. The plant extract administration resulted in significant increase in urine volume in dose-dependent manner. The percent increase in urine volume kg was 22 and 44 % by the dose of 50 and 100 mg/kg, respectively, as compared to the control group. There was also significant increase in the sodium excretion but only at the higher dose (100 mg/kg) of plant extract. The plant extract showed the additional advantage of potassium-conserving effect.[36] The petroleum ether, chloroform, and alcoholic extracts of leaves of the plant were also studied for diuretic potential at the dose of 200 mg/kg in rats. The alcoholic extract was found most effective in increasing urine output and urinary electrolyte excretion followed by chloroform and petroleum ether extracts.[37]

**ANTIOXIDANT ACTIVITY AND FREE-RADICAL SCAVENGING ACTIVITY**

The antioxidant and free-radical scavenging activity of the seed and leaf extract of *A. moschatus* were studied by total antioxidant, DPPH, and ferrous reducing antioxidant property methods. The extract of seed and leaf showed significant antioxidant activity with highest activity of 21.52 mgAAE/dw (milligram of ascorbic acid equivalents per gram of dry weight) by hydroalcoholic leaf extract of the plant. Both leaf and seed extracts showed DPPH radical scavenging activity. Hydroalcoholic seed extracts exhibited higher DPPH radical scavenging activity with IC50 value of 38.1 µg GAE/ml (microgram of gallic acid equivalents per gram of dry weight). Leaf extract of the plant showed considerably higher ferrous reducing power (6.28 mg AAE/gdw by hydroalcoholic extract) than the seed extract. The seed and leaf extract of the plant also showed significant lipid peroxidation inhibiting effect as well as hydrogen peroxide, hydroxyl radical, and superoxide radicals scavenging activity.[38]

**ANTIPROLIFERATIVE ACTIVITY**

The antiproliferative activity of the seed and leaf extracts of *A.* moschatus was evaluated using colorectal adenocarcinoma (COLO-205) and retinoblastoma human cancer (Y79) cell lines. The result indicated that hydroalcoholic seed extract showed 73.33 and 74.40% inhibitory activities, at the concentration of 200 µg/ml, against COLO-205 and Y79 cell lines, respectively. The hydroalcoholic leaf extract showed 78.25 and 78.8% inhibitory activities, at the concentration of 200 µg/ml, against cell lines COLO-205 and Y79, respectively.[38]

## ANTIMICROBIAL ACTIVITY

Hexane, ethyl acetate, methanol, and aqueous extracts of leaves of A. moschatus were evaluated for their antimicrobial activity against a number of pathogens using disc diffusion assay method. Results showed that the plant has significant antimicrobial activity against Staphylococcus aureus, Bacillus megaterium, Shigella flexneri, Proteus mirabilis, Proteus vulgaris, and Corynebacterium diphtheriae. The hexane fraction containing essential oil showed strong antibacterial activity against C. diphtheriae. Aqueous extract of A. Moschatus seeds exhibited antimicrobial activity against Bacillus subtilis, S. aureus, Escherichia coli, Pseudomonas aeruginosa, P. vulgaris, and Salmonella enterica paratyphi. Hydroalcoholic extract of leaves of plant also showed antimicrobial effect against Candida albicans.[39] A novel trypsin inhibitor (AMTI-II) with both antibacterial and antifungal activities was purified from the seeds of the plant. AMTI-II exhibited potent antibacterial activity toward S. aureus, E. coli, P. vulgaris, B. subtilis, Streptococcus pneumoniae, and Bacillus cereus, and it was moderately active against Klebsiella pneumoniae, P. aeruginosa, Pseudomonas syringae, and Streptococcus pyogenes. AMTI-II also found to moderately affects the growth of fungal species, C. albicans, Candida tropicalis, Aspergillusflavus, Saccharomyces cerevisiae, Candida glabrata and Aspergillus niger.[40]

## ANTILITHIATIC ACTIVITY

The hydroalcoholic extract of whole plant of A. moschatus was studied at the dose of 200 and 400 mg/kg against ethylene glycol-induced urolithiasis in rats. The plant extract caused significant decrease in urinary calcium, oxalate, and phosphate levels, and increase in the urinary magnesium level as compared to lithiatic control animals. It is concluded that the plant extract reduced and prevented the growth of urinary stones against ethylene glycol-induced lithiasis possibly through an antioxidant, nephroprotection, and its effect on the urinary concentration of stone-forming constituents and risk factors.[41]

## HEPATOPROTECTIVE ACTIVITY

The hepatoprotective activity of ethanolic and aqueous extracts of seeds of A. moschatus was studied at the dose of 300 mg/kg against paracetamol and ethanol-induced hepatotoxicity in rats. Administration of ethanolic as well as aqueous extract prevented paracetamol-induced lipid peroxidation of liver tissue and restored altered serum marker enzymes such as serum glutamic oxaloacetic transaminase, serum glutamate pyruvate transaminase, and alkaline phosphatase and total bilirubin levels toward normal. Hepatoprotective activity of ethanolic extract was found more significant than the aqueous extract. It is concluded that the A. moschatus seed has significant protective effect against paracetamol and ethanol-induced hepatotoxicity in rats.[42]

## MEMORY STRENGTHENING EFFECT

The ethanolic extract of A. moschatus seeds was evaluated for memory strengthening activity at the dose of 100 and 200 mg/kg in mice. Pre-treatment of plant extracts for seven successive days significantly improved learning-memory and reversed the diazepam-induced amnesia in mice. It also decreased whole brain acetylcholinesterase and malondialdehyde content and increases the brain glutathione. These results indicate that ethanolic seed extract of A. moschatus has memory strengthening, anticholinesterase activity, and antioxidant activity.[43]

## ANTIDIABETIC ACTIVITY

The hypoglycemic activity of myricetin isolated from A. moschatus was investigated in streptozotocin-induced diabetic rats. Results indicated that intravenous injection of myricetin causes significant decrease of the plasma glucose concentration in a dose-dependent manner.[44] It is It is concluded that hypoglycemic effect of myricetin is due to the enhancement of glucose utilization by activation of opioid μ-receptors of peripheral tissues in response to increased β-endorphin secretion.[45] Moreover, myricetin improved insulin sensitivity through the enhancement of insulin action on IRS-1-associated PI3-kinase and GLUT4 activity in soleus muscles of obese Zucker rats.[46]

## EFFECTS ON CENTRAL NERVOUS SYSTEM

Effect of oral administration of hydroalcoholic extract of A. moschatus seeds was evaluated at doses of 200 and 0 on various behavioral models such as forced swim test, tail suspension test, light-dark box test, elevated-plus-maze test, locomotor test, hole-board test, pentylenetetrazole-induced convulsions, strychnine-induced convulsions, maximal electroshock-induced seizure, pentobarbitone-induced sleeping time test, rotarod method, climbing test, and inclined screen test in laboratory animals. Results indicated that the both doses of A. moschatus seed extract (200 and 400 mg/kg) possesses antidepressant, anxiolytic, anticonvulsant, hypnotic, and muscle relaxant activity.[47]

## HEMAGGLUTINATING ACTIVITY

AMTI-I and AMTI-II isolated from the seeds of A. moschatus was evaluated for hemagglutinating activity against both normal and trypsin-treated erythrocytes of rabbit, rat, human, and sheep. Results showed that both the inhibitors, AMTI-I and AMTI-II, agglutinated trypsin-treated rabbit and rat erythrocytes at a much lower concentration compared to those of human and sheep. As low as 12.5 μg, AMTI-I and AMTI-II was sufficient to cause the visible agglutination reaction with trypsin-treated rabbit erythrocytes. The inhibitors agglutinated trypsin-treated rabbit and rat erythrocytes equally but the titer value obtained with native rabbit erythrocytes was 2 times higher than that obtained with untreated rat erythrocytes. Both AMTI-I and AMTI-II also agglutinated trypsin-treated human erythrocytes irrespective of the blood groups. It is concluded that the AMTI-I and AMTI-II exhibit stable and potent hemagglutinating property against human and animal erythrocytes and may be useful in agricultural field for the development of insect-resistant transgenic crops.[48]

## ANTI-AGEING PROPERTY

A cosmetic preparation containing A. moschatus seed extract was developed and studied for its effect on skin fibroblast in vitro and in vivo. Results of in vitro experiment showed that A. moschatus seed extract exhibits heparan sulfate-like properties and dose-dependently protects FGF-2 from thermal degradation. In vivo experiment also confirmed anti-ageing properties of A. moschatus seed extract and found to cause significant improvements in wrinkles, skin texture, skin elasticity, and skin density by preserving FGF-2 content of human skin.[49]

## SAFETY AND TOXIC PROFILE

Acute and 28 days subacute oral toxicity studies of hydroalcoholic seed extracts of A. moschatus were conducted in Swiss albino mice and Wistar albino rats.[50]Results indicated that a dose of 2000 mg/kg body weight of hydroalcoholic seed extracts of A. moschatus given orally appeared to be non-toxic. Acute oral toxicity and safety evaluation of seed oil in albino rats showed the oil is safe to use for edible purposes[51] An airborne photoallergic contact dermatitis with brownish pigmentation is reported by musk ambrette in incense.[52]

## CONCLUSION:

Abelmoschus moschatus have several pharmacological20 22 properties such as anti diabetic , Insulin sensitizing ,antimicrobial, antioxidant, anti proliferative, free radical21 23 24 scavenging , hepatoprotective , anti lithiatic , anti diuretic 26 27, antibacterial , anti fungal , memory25 strenthing and also has an effect on some psychiatric 29 and neurological conditions . In this review article, we have attempted to delineate the CNS effects of AM extract. As outlined in the article, AM has potent antioxidant activity due to which it might be beneficial in neurological conditions such as Parkinson's Disease, Alzheimer's Disease and other conditions that involve significant neurodegeneration and death due to reactive oxygen species and oxidative stress. AM also has an effect in epileptic disorders. The antidepressant and anxiolytic effects of AM have also been documented. Neurological disorders are often associated with psychiatric conditions such as depression and anxiety and treatment with AM might therefore not only restore neurological functions, but also improve psychiatric conditions, thereby causing faster recovery and remission. More studies and a detailed evaluation of the effects of AM are necessary to understand the mechanism of action of AM and use it as a therapeutic agent. effects of AM are necessary to understand the mechanism of action of AM and use it as a therapeutic agent.

## REFERENCES:


1. Mukherjee PK, Wahile A. Integrated approaches towards drug development from Ayurveda and other Indian system of medicines. Journal of Ethnopharmacology. 2006 Jan 3; 103(1):25-35.
2. Christina AJ, Muthumani P. Phytochemical investigation and antilithiatic activity of Abelmoschus moschatus medikus. Int. J. Pharm. Pharm. Sci. 2013; 5(1):108-13.
3. Cherniack EP, Senzel RS, Pan CX. Correlates of use of alternative medicine by the elderly in an urban population. The Journal of Alternative & Complementary Medicine. 2001; 7(3):277-80.
4. Warrier PK, Nambiar VP, Ramankutty C. Indian Medicinal Plants-A Compendium of 500 Species. 1st ed. India: Orient Longman Publishers; 1994. p. 4-6.
5. The wealth of India. A Dictionary of Indian Raw Materials and Industrial Products (Raw

Materials First Supplement Series. Vol. 1. New Delhi: National Institute of Science Communication and Information Resources, CSIR; 2004. p. 4.6 Rao YR, Jena KS, Sahoo D, Rout PK, Ali S. Safety evaluation of ambrette (Abelmoschus moschatus Linn) seed oil. J Am Oil Chem Soc 2005;82:749-52.
6. Khare CP. Encyclopedia of Indian Medicinal Plants: Rational Western Therapy, Ayurvedic and Other Traditional Usage, Botany. 1st ed. Berlin Heidelberg (NY): Springer-Verlag Publisher; 2004. p. 247-8.
7. Pullaiah T. Encyclopedia of World Medicinal Plants. 1st ed. New Delhi: Regency Publication; 2006. p. 12-3.
8. Kirtikar KR, Basu BD. Indian Medicinal Plants. 2nd ed. Dehradun: International Book Distributor; 2005. p. 330-2.
9. Abhishek B, Sumeet D, Balakrishnan BR. Morphological and anatomical studies of medicinal seeds of the Abelmoschus moschatus Medik. International Journal of Pharmacy Teaching
10. Kutlu T, Yıldırım I, Kırbag S. Comparison of Antımicrobial Activity of Methanol and Ethanol Extracts of Abelmoschus Moschatus Dry Flowers. Issues. 2014 ; 1(1).
11. Rajeswara R, Syamasundar K, Rajput D, Nagaraju G, Adinarayana G. Potential species of medicinal plants for cultivation in deccan region.
12. Grenand P, Prévost MF, Fleury M. Le voyage discret des plantes. Abelmoschus moschatus (Malvaceae) et Zingiber zerumbet (Zingiberaceae) en Amérique tropicale. Revue d'ethnoécologie. 2012 ; 20(1).
13. Oudhia P. My experiences with world's top ten Indian medicinal plants: Glimpses of research at farmer's field in Chhattisgarh (India). InAbstract Workshop-cum-Seminar on Sustainable Agriculture for 21st Century, IGAU, Raipur, India 2001 Jan; 20-21
14. Oudhia P, Tripathi RS. The possibilities of commercial cultivation of rare medicinal plants in Chhattisgarh (India). In Abstract. VII National Science Conference, Bhartiya Krishi Anusandhan Samittee, Directorate of Cropping System Research, Meerut, India 2001 Apr; 12-14.
15. Liu IM, Liou SS, Lan TW, Hsu FL, Cheng JT. Myricetin as the active principle of abelmoschus moschatus to lower plasma glucose in streptozotocin-induced diabetic rats. Planta Med 2005;71:617-21
16. Nautiyal OH, Tiwari KK. Extraction of ambrette seed oil and isolation of ambrettolide with its characterization by 1H NMR. J Nat Prod 2011;4:75-80.
17. Camciuc M, Bessire JM, Vilarem G, Gaset A. Volatile components in okra seed coat. Phytochemistry 1998;48:311-5.
18. The wealth of India. A Dictionary of Indian Raw Materials and Industrial Products (Raw Materials) First Supplement Series. Vol. 1. New Delhi: National Institute of Science Communication and Information Resources, CSIR; 2004. p. 4.
19. Warrier PK, Nambiar VP, Ramankutty C. Indian Medicinal Plants-A Compendium of 500 Species. 1st ed. India: Orient Longman Publishers; 1994. p. 4-6.
20. Rane RV, Meenakshi K, Shah M, George IA. Biological synthesis of silver nanoparticles using Abelmoschus moschatus. Indian Journal of Biotechnology. 2014 ;13:342-6.
21. Liu IM, Tzeng TF, Liou SS. Abelmoschus moschatus (Malvaceae), an aromatic plant, suitable for medical or food uses to improve insulin sensitivity. Phytotherapy Research. 2010 ;24(2):233-9.
22. Abhishek KS, Sanjiv S, Chandel HS. Evaluation of hepatoprotective activity of Abelmoschus moschatus seed in paracetamol induced hepatotoxicity on rat. IOSR Journal of Pharmacy. 2012 ;2(5):43-50.
23. Christina AJ, Muthumani P. Phytochemical investigation and antilithiatic activity of Abelmoschus moschatus medikus. Int. J. Pharm. Pharm. Sci. 2013; 5(1):108-13.
24. Nandhini S, Vadivu R, Jayshree N. Memory strengthening activity on seeds of Abelmoschus moschatus.IntJResPharmChem.2014;4(2):346-50.
25. Christina AJ, Muthumani P. Phytochemical investigation and antilithiatic activity of Abelmoschus moschatus medikus. Int. J. Pharm. Pharm. Sci. 2013; 5(1):108-13.
26. Arokiyaraj S, Choi SH, Lee Y, Bharanidharan R, Hairul-Islam VI, Vijayakumar B, Oh YK, Dinesh- Kumar V, Vincent S, Kim KH. Characterization of Ambrette Seed Oil and Its Mode of Action in Bacteria. Molecules. 2014; 20(1):384-95.
27. Dokka MK, Seva L, Davuluri SP. Antifungal activity of trypsin inhibitors from the seeds of Abelmoschus moschatus. International Journal of Pharmaceutical Sciences and Research. 2015; 6(9):3920.
28. Sheik HS, Vedhaiyan N, Singaravel S. Evaluation of Abelmoschus moschatus seed extract in psychiatric and neurological disorders. International Journal of Basic & Clinical Pharmacology. 2014; 3(5):845-53.
29. Srivastava UC. Ambrette seed. Advances in Horticulture. 1995; 11:887-97.
30. Pareek SK, Gupta V, Bhat KC, Negi KS, Sharma N.Medicinal and aromatic plants. Plant genetic resources: horticultural crops. Narosa Publishing House, New Delhi. 2005:279-308.
31. Uttara B, Singh AV, Zamboni P, Mahajan RT. Oxidative stress and neurodegenerative diseases: a review of upstream and downstream antioxidant therapeutic options. Current neuropharmacology. 2009; 7(1):65-74.
32. Nandhini S, Vadivu R, Jayshree N. Memory strengthening activity on seeds of Abelmoschus moschatus.IntJResPharmChem.2014;4(2):346-50.
33. Kovess-Masfety V, Alonso J, Brugha TS, Angermeyer MC, Haro JM, Sevilla-Dedieu C. Differences in lifetime use of services for mental health problems in six European countries. Psychiatric Services. 2007
34. Madhusudanan M. Psychiatric symptoms in neurological practice. Annals of Indian Academy of Neurology. 2006; 9(2):72.
35. Mantena KR, Soni D. Diuretic activity of extract of Abelmoschus moschatus L. Asian Pac J Trop Biomed 2012;1:1-3.
36. Christina AJ, Muthumani P. Phytochemical investigation and diuretic activity of Abelmoschus moschatus Medikus. Int J Pharm Chem Sci 2012;1:1311-4.
37. Gul MZ, Bhakshu LM, Ahmad F, Kondapi AK, Qureshi IA, Ghazi IA, et al. Evaluation of Abelmoschus moschatus extracts for antioxidant, free radical scavenging, antimicrobial and antiproliferative activities using in vitro assays. BMC Complement Altern Med 2011;11:64.
38. Maheshwari P, Kumar A. Antimicrobial activity of Abelmoschus moschatus leaf extracts. Curr Trends Biotechnol Pharm 2009;3:260-6.
39. Dokka MK, Davuluri SP. Antimicrobial activity of Dehradun: International Book Distributor; 2005. p. 330-2. a trypsin inhibitor from the seeds of Abelmoschus moschatus L. Int J Curr Microbiol Appl Sci 2014;3:184-99.
40. Christina AJ, Muthumani P. Phytochemical investigation and antilithiatic activity of Abelmoschus moschatus medikus. Int J Pharm Pharm Sci 2013;5:108-13.
41. Singh AK, Singh S, Chandel HS. Evaluation of hepatoprotective activity of Abelmoschus moschatus seed in paracetamol induced hepatotoxicity on rat. IOSR J Pharm 2012;2:43-50.
42. Nandhini S, Vadivu R, Jayshree N. Memory strengthening activity on seeds of Abelmoschus moschatus. Int J Res Pharm Chem 2014;4:346-50.
43. Liu IM, Liou SS, Lan TW, Hsu FL, Cheng JT. Myricetin as the active principle of abelmoschus moschatus to lower plasma glucose in streptozotocin-induced diabetic rats. Planta Med 2005;71:617-21.
44. Liu IM, Liou SS, Cheng JT. Mediation of beta-endorphin by myricetin to lower plasma glucose in streptozotocin-induced diabetic rats. J Ethnopharmacol 2006;104:199-206.
45. Liu IM, Tzeng TF, Liou SS, Lan TW. Myricetin, a naturally occurring flavonol, ameliorates insulin resistance induced by a high-fructose diet in rats. Life Sci 2007;81:1479-88.
46. Sheik HS, Vedhaiyan N, Singaravel S. Evaluation of Abelmoschus moschatus seed extract in psychiatric and neurological disorders. Int J Basic Clin Pharmacol 2014;3:845-53.
47. Dokka MK, Konala G, Davuluri SP. Hemagglutinating activity of trypsin inhibitors from the seeds of Abelmoschus moschatus l. Int J Adv Res 2014;2:892-903.
48. Rival D, Bonnet S, Sohm B, Perrier E. A hibiscus abelmoschus seed extract as a protective active ingredient to favour FGF-2 activity in skin. Int J Cosmet Sci 2009;31:419-26.
49. Sheik HS, Vedhaiyan N, Singaravel S. Acute and sub acute toxicity studies of some indigenous medicinal plants. Int J Pharm Phytopharmacol Res 2013;3:166-9.
50. Rao YR, Jena KS, Sahoo D, Rout PK, Ali S. Safety evaluation of ambrette (Abelmoschus moschatus Linn) seed oil. J Am Oil Chem Soc 2005;82:749-52
51. Goncalo S, Gil L, Goncalo M, Baptista AP. Pigmented photoallergic contact dermatitis from musk ambrette. Contact Dermatitis 1991;24:229-31.