



## A Review on CNS Effects of *Abelmoschus moschatus*

Giri.M\*, Vivek.J, Mahati.K

Department of Pharmacology, Krupanidhi College of Pharmacy, Chikkabellandur, Carmelaram Post, Bangalore-560035

### ABSTRACT

**Purpose:** 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. In the current review, the role of one such herbal extract, *Abelmoschus moschatus* (AM) in CNS disorders will be detailed.

**Approach:** Published articles from Pubmed and other sources were used to review and compile the CNS effects of AM.

**Findings:** AM seed extract has shown potent anti-oxidant effects leading to its protective effect in neurological disorders. In addition, it also shows antidepressant, anxiolytic, antiepileptic and sedative properties in animal models.

**Conclusion:** AM can be used as an adjuvant therapy in neurological and psychiatric conditions. Research into the precise mechanisms underlying the CNS effects of *Abelmoschus moschatus* will aid its use in myriad CNS conditions.

**Key words:** *Abelmoschus moschatus*, Antioxidant, Parkinson's disease, Herbal remedies

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### INTRODUCTION:

Herbs have been used as medicine since time immemorial. Many plant based natural products used in traditional medicine offer us new sources of drugs<sup>1</sup>. There is an increased consciousness regionally and globally in production and use of plants with healing property. 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<sup>2</sup>. 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<sup>3</sup>.

\*Corresponding author :

**Dr. Giri Mrudula**, Associate Professor,  
Dept of Pharmacology, Krupanidhi College of Pharmacy,  
Chikkabellandur, Carmelaram Post, Bangalore  
Email Id: girimrudula35@gmail.com.

### Scientific classification<sup>[4]</sup>

Plant name	: <i>Abelmoschus moschatus</i> Medik (AM)
Kingdom	: Plantae
Phylum	: Tracheophyta
Subphylum	: Euphyllophytina
Class	: Spermatosida
Subclass	: Mangoliidae
Order	: Malvales
Family	: Malvaceae
Genus	: <i>Abelmoschus</i> 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

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- \* Kannada: kasturi bende, kaadu kastoori
- \* Bengali: kalkasturi, latakasturi, mushakdan
- \* Urdu: Mushkdana
- \* Assamese: gorokhiakarai Sanskrit: Latakasturika <sup>[5], [6]</sup>.

#### Description:

AM is an erect hispid herbaceous trailing herb that grows up to 1.5 m tall with a long slender tap root. Leaves are alternate, 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 (Figure 1). 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 <sup>7, 8, 9</sup>.

#### 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 <sup>10, 11, 12</sup>.

#### Chemical Constituents:

Seeds contain 11.1 % moisture, 31.5 % crude fiber, 14.5 % lipid, 13.4 % starch, 2.3 % protein, volatile oil (0.2 - 0.6

%), ambrett oil and 5 % resin, -sitosterol, -D-glucoside, gums, resins and flavanoids. Phytochemical studies showed the presence of flavonoids, phenols, saponins, carbohydrates, terpenoids, myricetin <sup>13</sup>, alkaloids and steroids <sup>14, 15</sup>.



**Figure 1:** Plant of *Abelmoschus moschatus*

#### Traditional uses:

In India the roots, leaves and seeds of AM 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 <sup>16</sup>, diuretic, stimulant, cardio tonic, aphrodisiac, ophthalmic <sup>17</sup>, digestive, stomachic, carminative, constipating and deodorant, It is also effective against hysteria, skin disease, vomiting and intestinal disorders <sup>18</sup>. AM 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 gonorrhoea and venereal diseases <sup>19</sup>.

It is also reported for anti diabetic <sup>20</sup>, antimicrobial, antioxidant, anti proliferative, free radical scavenging <sup>21</sup>, Insulin sensitivity <sup>22</sup>, hepatoprotective <sup>23</sup>, anti lithiatic <sup>24</sup>, memory strengthening <sup>25</sup>, anti diuretic <sup>26</sup>, antibacterial <sup>27</sup>, anti fungal <sup>28</sup>, psychiatric and neurological disorders <sup>29</sup>.

#### Effect of AM in the CNS

Several important medicine properties have been ascribed to the seed extract of AM. 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

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 post-mitotic. 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 to apoptosis and neurodegeneration in the long run<sup>[30]</sup>. 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.

#### **AM as an antioxidant**

AM demonstrate good antioxidant and ROS scavenging activity. The antioxidant activities of AM extracts has been evaluated in a series of in vitro assays. The antioxidant activities of the seed and leaf extracts of AM 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 of AM 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 of AM possess significant antioxidant activity and could serve as free radical inhibitors or scavenger, or substitute, probably as primary antioxidants<sup>21</sup>.

#### **EFFECT OF AM ON LEARNING AND MEMORY<sup>25</sup>**

Some neurological and psychiatric conditions are associated with impaired cognition and impaired verbal and visuospatial memory. The AM 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 with AM (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). AM also decreased whole brain ache. AM 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<sup>31</sup>. AM seed extract has been investigated for its antidepressant effect in animal studies. The alcoholic extract of AM was tested in the forced swimming test in rats. Treatment with AM (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 AM 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<sup>32</sup> and many other countries<sup>33</sup>. 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<sup>34</sup>.

The anxiolytic potential of AM was tested in the light-dark test and in the elevated plus maze. The alcoholic extract of AM (200 and 400 mg/kg) significantly increased time spent in light arena compared to the dark arena. Treatment with AM (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 AM 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 AM extract was comparable to diazepam. In the Hole board test, treatment with the AM extract also significantly decrease in the number of head dips compared with control group. In summary, AM 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 AM extract**

Epilepsy is a medical condition where body muscles contract and relax rapidly and repeatedly, resulting in an uncontrolled 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<sup>35</sup>. Approved treatment for epilepsy includes phenytoin, carbamazepine and valproic acid, newer therapies include vigabatrin and lamotrigine. Treatment, particularly with older generation antiepileptic drugs (AED'S) is associated with severe side effects and impaired cognition<sup>35</sup>. 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 AM protected rats against seizures and increased the latency of onset of seizures in the PTZ model. AM delayed the duration of strychnine induced seizures and showed dose-dependent increase in the anti-convulsant activity, Administration of AM (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 AM extract has been documented. Sodium pentobarbital was administered 1hr before the oral treatment of mice with 200-400 mg/kg of AM. The latency to induce sleep was not modified but the hypnosis duration was significantly increased.

#### **CONCLUSION:**

*Abelmoschus moschatus* have several pharmacological properties such as anti diabetic<sup>20</sup>, Insulin sensitizing<sup>22</sup>, antimicrobial, antioxidant, anti proliferative, free radical scavenging<sup>21</sup>, hepatoprotective<sup>23</sup>, anti lithiatic<sup>24</sup>, anti diuretic<sup>26</sup>, antibacterial<sup>27</sup>, anti fungal<sup>28</sup>, memory strengthening<sup>25</sup> and also has an effect on some psychiatric and neurological conditions<sup>29</sup>. 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.

#### **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. Scheuing DR, Szekeres E, Bromberg S, inventors; The Clorox Company, assignee. Natural silver disinfectant compositions. United States patent US 8,637,088. 2014 Jan 28.
5. Bajpai A, Ojha JK, Sant HR. Medicobotany of the Varanasi District, Uttar Pradesh, India. *International Journal of Pharmacognosy*. 1995 Jan 1; 33(2):172-6.
6. 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 Feb 1; 24(2):233-9.
7. Abhishek B, Sumeet D, Balakrishnan BR. Morphological and anatomical studies of medicinal seeds of the *Abelmoschus moschatus* Medik. *International Journal of Pharmacy Teaching and*

- Practices. 2013; 4(3): 765-7.
8. Kutlu T, Yildirim I, Kirba S. Comparison of Antimicrobial Activity of Methanol and Ethanol Extracts of *Abelmoschus Moschatus* Dry Flowers. Issues. 2014; 1(1).
  9. Rajeswara R, Syamasundar K, Rajput D, Nagaraju G, Adinarayana G. Potential species of medicinal plants for cultivation in deccan region.
  10. 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).
  11. Oudhia P. My experiences with world's top ten Indian medicinal plants: Glimpses of research at farmer's field in Chhattisgarh (India). In Abstract Workshop-cum-Seminar on Sustainable Agriculture for 21st Century, IGAU, Raipur, India 2001 Jan; 20-21.
  12. 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.
  13. Rastogi RP, Mehrotra BN. Compendium of Indian medicinal plants. Central Drug Research Institute; 1990.
  14. Srivastava UC. Ambrette seed. Advances in Horticulture. 1995; 11:887-97.
  15. 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.
  16. Gul MZ, Bhakshu LM, Ahmad F, Kondapi AK, Qureshi IA, Ghazi IA. Evaluation of *Abelmoschus moschatus* extracts for antioxidant, free radical scavenging, antimicrobial and antiproliferative activities using in vitro assays. BMC complementary and alternative medicine. 2011 Aug 17; 11(1):1.
  17. Tewari S. Agriculture Diversification: Medicinal and Aromatic Plants. Agriculture Diversification: Problems and Perspectives. 2010, p-140.
  18. Panda H. Medicinal plants cultivation & their uses. Asia Pacific Business Press Inc.; 2002.
  19. Prajapati ND, Purohit SS, Sharma AK, Kumar T. Medicinal plants. Agrobios published company, 3rd edition, India. 2003, p-353.
  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. Gul MZ, Bhakshu LM, Ahmad F, Kondapi AK, Qureshi IA, Ghazi IA. Evaluation of *Abelmoschus moschatus* extracts for antioxidant, free radical scavenging, antimicrobial and antiproliferative activities using in vitro assays. BMC complementary and alternative medicine. 2011; 11(1):1.
  22. 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.
  23. 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.
  24. Christina AJ, Muthumani P. Phytochemical investigation and antilithiatic activity of *Abelmoschus moschatus* medikus. Int. J. Pharm. Pharm. Sci. 2013; 5(1):108-13.
  25. Nandhini S, Vadivu R, Jayshree N. Memory strengthening activity on seeds of *Abelmoschus moschatus*. Int J Res Pharm Chem. 2014; 4(2):346-50.
  26. Christina AJ, Muthumani P. Phytochemical investigation and antilithiatic activity of *Abelmoschus moschatus* medikus. Int. J. Pharm. Pharm. Sci. 2013; 5(1):108-13.
  27. 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.
  28. 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.
  29. 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.
  30. 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.
  31. American Psychiatric Association. DSM-III-R: Diagnostic and statistical manual of mental disorders. American Psychiatric Association; 1980.
  32. Kessler RC, Ruscio AM, Shear K, Wittchen HU. Epidemiology of anxiety disorders. In Behavioral neurobiology of anxiety and its treatment 2009, p-21. Springer Berlin Heidelberg.
  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. Rao BV, Srikumar BN, Rao BS. Herbal Remedies to Treat Anxiety Disorders. Anxiety. 2009; 85.
  35. Madhusudan M. Psychiatric symptoms in neurological practice. Annals of Indian Academy of Neurology. 2006; 9(2):72.
  36. Schmidt D, Schachter SC. Drug treatment of epilepsy in adults. BMJ. 2014 Feb 28; 348(254):130-136.