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Review Article

A Comprehensive Review of *Malvaviscus Arboreus* Encompassing Its Botany, Phytochemistry, And Pharmacological Potential

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ABSTRACT

Malvaviscus arboreus is a perennial flowering shrub, which is also known as sleeping hibiscus. It belongs to the family Malvaceae and is widely distributed in tropical and subtropical areas in Australia, Asia, and Africa. The native of the plant was found to be Mexico and Central America. It is a small shrub which grows up to a height of 2-3m. The petals of the flowers are curled and are seen in two colours – red and pink. This review gives a detailed explanation regarding botanical characteristics, phytochemical constituents, traditional uses, and pharmacological uses. This plant is rich in various phytoconstituents like flavonoids, anthocyanins, phenolic acids, fatty acids, sterols, and triterpenes. It was found that traditionally, the flowers and leaves of this species were used to treat various diseases like dysentery, nosebleeds, stomach pain, sore throat, and kidney diseases. Apart from traditional uses, the plant also exhibits various pharmacological uses like antioxidant, antimicrobial, hepatoprotective, gastroprotective, antifungal, anticancer, and anticonvulsant properties. This review suggests that M. arboreus is a promising source for developing plant-based medicines in the future.

INTRODUCTION

Malvaceae (Hibiscus or Malva family) is a family that contains a large number of flowering plants, comprising approximately 243 genera and representing 4,225 species, which include a wide variety of herbs, shrubs, and trees [1]. *Malvaviscus arboreus* is a perennial flowering shrub that belongs to the family Malvaceae. Some of the common names of the plant include Wax mallow, Drummond Wax Mallow, Turk's cap, and Sleeping Hibiscus etc [2]. As the flowers of the plant look like unopened Hibiscus flowers, the plant is named as sleeping hibiscus. The height of

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the shrub is 2-3m [3]. The flowers are captivating when viewed up close, with curled petals that remain closed, but with long, extending stamens. It is an old-fashioned, "pass-along" southern plant. This plant is moderately tolerant of salt [4]. South and Central America, the Southeastern United States, and Mexico are considered as native of this plant. But the plant was also introduced to several tropical and subtropical areas in Australia, Asia, and Africa [5]. It was found that the *M. arboreus* plant shows the presence of various phytoconstituents like flavonoids, anthocyanins, and phenolic acids, along with fatty acids, sterols, and triterpenes [2]. Due to the rich phytochemical composition and various biological activities, *M. arboreus* is recognized in traditional and medicinal practices around the world [6]. Several studies have shown that extracts of various parts of the plant have a wide variety of therapeutic benefits, such as antibacterial activity, antifungal activity, antioxidant activity, hepatoprotective activity, gastroprotective activity, and anticancer activity [7]. This review narrates in detail about the plant biology, several phytoconstituents present in the plant, and various pharmacological uses of the plant.

1. TAXONOMY [6]

Kingdom	Plantae
Subkingdom	Viridaeplantae
Division	Magnoliophyta
Class	Magnoliopsida
Order	Malvales
Family	Malvaceae
Genus	*Malvaviscus*
Species	*arboreus*

2. VERNACULAR NAMES [1,8]

English	Fire cracker, Wax mallow, Turk's turban, Ladies teardrop
Bengali	Lanka jaba
Kannada	Sanna dasavala
Malayalam	Mottuchemparathi
Manipuri	Juba kusum
Assamese	Tikoni-joba, Pahimuja-joba

3. DISTRIBUTION

M. arboreus is widely grown in tropical and subtropical regions of the world as a garden ornamental plant. This species has spread beyond cultivation and become naturalized, mainly in open and disturbed habitats. *M. arboreus* is a fast-growing shrub due to which it can form dense patches. Today, it is widely distributed and now it is commonly seen in coastal areas, old gardens, roadsides, waste grounds, and secondary forests [9]. South and Central America, South-eastern United States, and Mexico are considered as native range of the plant. But gradually it is introduced to several tropical and subtropical areas in Australia, Asia, and Africa [5]. *M. arboreus* is native to Mexico and Central America. This plant is cultivated and naturalized in various places like China, Thailand, Vietnam, Singapore, the southeastern USA, the West Indies, the Galapagos Islands, New Zealand, and on several islands in the Pacific Ocean [9].

4. DESCRIPTION OF THE PLANT [9,10]



Fig. 1: *Malvaviscus arboreus* flower



Fig. 2: *Malvaviscus arboreus* plant

Stem and branches - *Malvaviscus arboreus* is a small shrub that grows up to a height of 1 meter. The branchlets are sparsely villous to glabrous. The petiole measures between 2 to 5 cm and is puberulent. Stipules are filiform, approximately 4 mm long, and are usually caducous.

Leaves - The leaf blade is broadly cordate to ovate-cordate in shape and is usually 3-lobed, or sometimes it may be entire. The leaves are 6-12 cm in length and 2.5-10 cm in width. They have glabrous or stellate pilose on both surfaces and contain 3 or 5 basal veins. The leaf base is broadly cuneate to nearly rounded or cordate, with crenate margins, and has an acuminate apex.

Flowers - *M. arboreus* can produce flowers throughout the year in partial shade and also in sunny conditions. The flowers are single, axillary, and pendulous with tube-shaped structure, slightly expand only at the top with length 2.3–5 cm. Pedicel is 3-15 mm and is villous or puberulent. Epicalyx lobes are spatulate, 8-15 mm, connate at base and are hairy. Calyx is campanulate, with 1 cm in diameter and contains 5 lobes which are slightly longer or shorter than bracteoles and are hirsute. There are 5 scarlet-red petals which are 2.5 - 5 cm. In addition to red-coloured flowers it also produces pink-coloured flowers. The staminal column is 5–7 cm long and exceeds the corolla tube. It contains 10 style branches.

Fruit - Ripe fruit is bright red and usually contains 3 or 4 seeds.

5. ACTIVE CONSTITUENTS

M. arboreus leaves and flowers show the presence of chemical constituents like flavonoids, anthocyanins, and phenolic acids, along with sterols, terpenoids, and fatty acids [11]. The phytoconstituents present in the leaves include protocatechuic acid, chlorogenic acid, gallic acid, p-coumaric acid, ferulic acid, and hydroxybenzoic acid. The ethanolic extract of the entire aerial parts contains cardenolides, carbohydrates, glycosides, and/or nitrogenous compounds. Flowers contain total soluble flavonoids such as kaempferol, myricetin, quercetin, and rutin [12]. The aerial parts also contain four phenolic acids, namely β-resorcylic, caffeic, protocatechuic, and 4-hydroxyphenylacetic acids, along with two flavonoids, which include trifolin and astragalin [5].

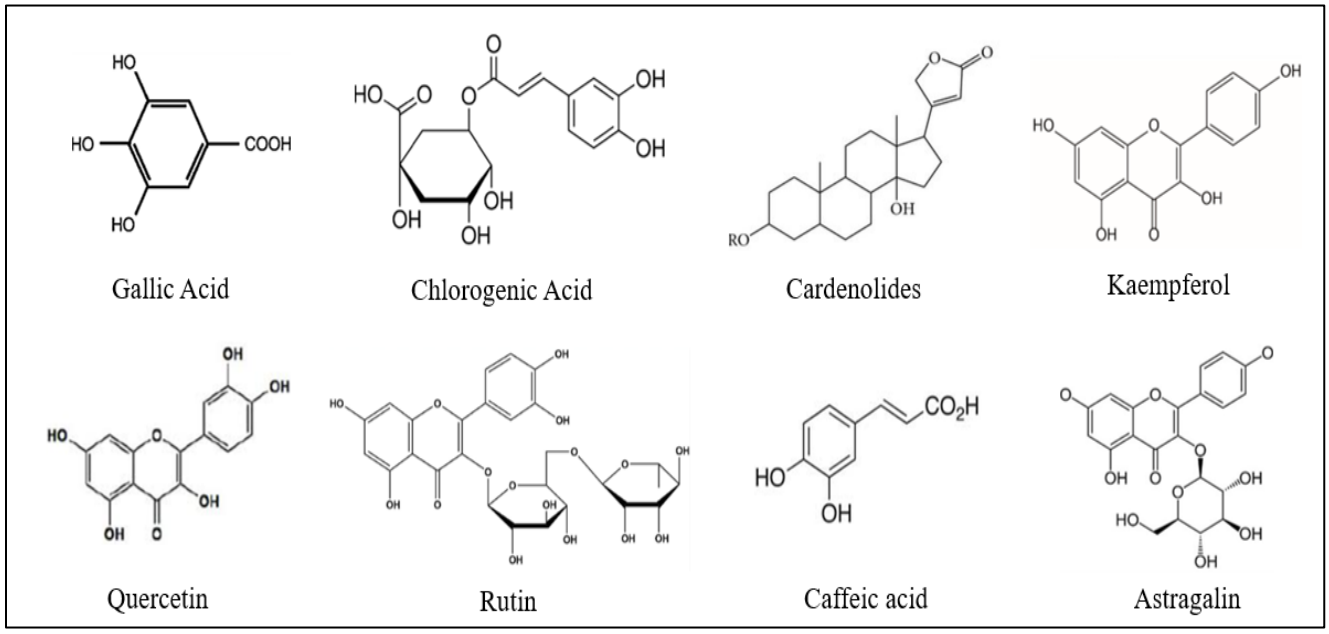


Fig. 3: Chemical Constituents of *Malvaviscus arboreus*

6. TRADITIONAL USES

Malvaviscus arboreus has been widely used in traditional medicine to treat a variety of diseases. Cystitis, diarrhoea, fever, and gastritis are treated with leaf decoction. The flower decoction is used as a gargle for sore throat, nursing infants with cold, bronchitis, diarrhoea, thrush, and tonsillitis [13]. A liniment can be made from the base of the plant, which is used for dressing burns. The flowers and leaves are used as emollients [14]. It was found that several ethnic groups use the flowers and leaves of this species to treat various diseases like dysentery, nosebleeds, stomach pain, and sore throat, including kidney diseases. In some cases, the stem is used to treat measles, hair loss, seborrhoea, lice, aphthae, and chinch pickets. In Oaxaca, it is used to calm gastrointestinal pain [15]. Previous studies have proved that this plant has anti-parasitic, antifungal, antimicrobial, emollient, and hepatoprotective activities. Traditionally, in the West Region of Cameroon, *M. arboreus* is used to treat many nervous system conditions, including epilepsy and memory disorders. Previous works have also proved that the flowers of *M. arboreus* have anticonvulsant properties [16]. Flowers, fruits, and leaves of *M. arboreus* are suitable for culinary purposes to prepare jellies, salads, and herbal teas [1]. Flowers, fruits, and leaves of *M. arboreus* are also used as hair dye [1].

7. PHARMACOLOGICAL USES

a) Antioxidant activity [12]:

Ethanolic extract of *Malvaviscus arboreus* Red Flower (ERF) has antioxidant properties. The anti-oxidant activity of ethanolic extract of red and white flowers are studied using assays for radical scavenging activity of DPPH and ABTS antioxidant potential test and ferric reducing antioxidant potential assay, CUPRAC, and Chelating power methods. The stable free radical DPPH (2, 2-diphenyl-1-picryl hydroxyl) assay is used to evaluate the primary antioxidant activity of plants, flowers, fruits, and dietary supplements. The results of the investigation revealed that the red flowers have the best antioxidant properties than white flowers.

a) Antimicrobial activity [1]:

The leaves of *Malvaviscus arboreus* Cav. were known to have antimicrobial activities against *Staphylococcus aureus, Salmonella typhimurium,* and *Bacillus cereus* due to the presence of essential oils. The antimicrobial activity was evaluated by Disk diffusion, microdilution, and bioautography methods. It has been proved that ethanolic extract of *Malvaviscus arboreus* red flower (ERF) has antimicrobial activities against *Enterococcus faecalis, Bacillus subtillus, Bacillus cereus, Staphylococcus aureus, Vibrio fluvialis, Vibrio damsela, Pseudomonas aeruginosa,* and *Salmonella typhimurium*.

b) Hepatoprotective activity [5]:

The total extract of the aerial parts and the different fractions of *M. arboreus* obtained using petroleum ether, dichloromethane, ethyl acetate, and aqueous have shown hepatoprotective activity against carbon tetrachloride (CCl_4)-induced hepatotoxicity. It was found that the ethyl acetate and dichloromethane fractions significantly reduced the liver injury in rats which is determined by the decreased levels of alanine transaminase (ALT), aspartate transaminase (AST), alkaline phosphatase (ALP), total bilirubin (TB), and malondialdehyde (MDA), in addition, these fractions increase total antioxidant capacities of the liver, but the ethyl acetate fraction was recorded to exhibit maximum effects. Metabolomic profiling of the crude extract of *M. arboreus* aerial parts by Liquid chromatography-high resolution electrospray ionization mass spectrometry (LC–HR–ESI–MS) showed the presence of a variety of phytoconstituents, mainly phenolics. These phenolics, along with their synergistic antioxidant and liver-protecting properties, contribute to the hepatoprotective activity of *M. arboreus.*

c) Gastroprotective activity [1,15]:

It was found that aqueous extract of *Malvaviscus arboreus* flowers showed gastroprotective activity. The gastroprotective properties of the aqueous extract of *M. arboreus* were mainly due to the presence of glycosylated flavonoids. A mixture of Kaempferol-O-sambubioside and Kaempferol-O-sophoroside (MaSS) isolated from flowers of this species was evaluated for its preventive effect against ethanol-induced gastric lesions in rats. The preventive effect of MaSS against ethanol-induced gastric lesions is due to its influence on local levels of cytokines, namely IL-6 and IL-10.

d) Antifungal activity [1]

It was proved that *Malvaviscus arboreus* shows antifungal activity due to the volatile components extracted from the leaves, stems, and flowers. Stems of this plant showed antifungal activity to a greater extent than the extract obtained from the leaves. The extract obtained from the flowers of *M. arboreus* showed the least antifungal activity.

e) Anticancer activity [17]

Anticancer activity of *Malvaviscus arboreus* is determined by various *in vitro* methods. The anticancer activity is interpreted using a parameter, which is expressed in IC50 value that can inhibit cell proliferation by 50% of the population. MTT assay is used to evaluate the cytotoxic potential of *Malvaviscus arboreus.* In this assay, tetrazolium salt MTT [3-(4,5-dimetiltiazol-2-yl)-2,5-diphenyl tetrazolium bromide] is reduced to formazan by the succinate tetrazolium reductase system, in the mitochondria of living cells. The intensity of formazan was measured using an ELISA reader at a wavelength of 595nm. The colour intensity of formazan is directly proportional to the number of living cells.

The IC50 value of *Malvaviscus arboreus* was found to be 152,45 µg/mL.

f) Anticonvulsant activity [16]:

The aqueous lyophilisate extract of flowers, leaves, stems, and roots of *M. arboreus* was evaluated for anticonvulsant activity at various doses. The anticonvulsant effect of the aqueous lyophilisate extract of *M. arboreus* leaves was evaluated on different models of acute epileptic seizures, where seizures are induced by picrotoxin (PIC) (7.5 mg/kg), strychnine (STR) (2.5 mg/kg), and pilocarpine (350 mg/kg). It was found that the aqueous lyophilisate extract of *M. arboreus* leaves showed the best anticonvulsant effect. It significantly protected the animals from convulsions induced by PTZ (71.43%) ($p < 0.01$), PIC (57.14%) ($p < 0.05$), and STR (42%), and it was found that it did not inhibit pilocarpine-induced seizures.

CONCLUSION

Malvaviscus arboreus is a plant that has remarkable botanical, phytochemical, and pharmacological significance. The plant is widely distributed in various parts of tropical and subtropical regions of the world, including China, Thailand, Vietnam, Singapore, the southeastern USA, the West Indies, the Galapagos Islands, New Zealand, and on several islands in the Pacific Ocean. It is a rich source of various phytoconstituents like flavonoids, anthocyanins, phenolic acids, sterols, terpenoids, fatty acids, etc. The presence of these bioactive components is responsible for various medicinal properties like antioxidant, antimicrobial, hepatoprotective, gastroprotective, antifungal, anticancer, and anticonvulsant activities. Apart from these uses, the plant is used for culinary purposes to prepare jellies, salads, and herbal teas. In the future, further studies on the plant can be done to develop novel, plant-based therapeutic agents that can be used to treat a wide variety of diseases.

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