International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 2 Mar-Apr 2023, pp: 137-141 www.ijprajournal.com ISSN: 2249-7781

A Review on Malvaviscus Arboreus CAV.

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Submitted: 01-03-2023 Accepted: 12-03-2023

ABSTRACT
Malvaviscus arboreus is a flowering plant of the Malvaceae family. This plant has several medical applications, including the treatment of whooping cough, wounds, fever, hypertension, sore throat, bronchitis, gastritis, and liver difficulties, stomachache, diarrhoea, liver and gall bladder problems, cystitis, and renal illnesses. Botanical research has been done on the leaf, flower, petiole, and stem. Experiments from several research revealed that extracts from various parts had a wide variety of therapeutic benefits such as antibacterial activity, antifungal activity, antioxidant activity, hepatoprotective activity, gastroprotective activity, and anticancer activity.
Keywords: Malvaviscus arboreus, Therapeutic uses, Malvaceae, antioxidant activity, anticancer activity

I. INTRODUCTION

Malvaceae (Hibiscus or Malva family) is a large family of flowering plants, containing approximately 243 genera representing 4,225 species, including herbs, shrubs and trees. It is common all over the world in tropical regions. Malvaviscus is a small genus in the Mallow family, and several secondary metabolites with important biological and economic values have been found in this genus. Malvavicus arboreus cav. is a perennial plant belonging to the Malvaceae family with several culinary and medicinal properties. It is commonly known as Turkish Cap or Sleeping Hibiscus because its flowers never fully open. The plant is native to Central and South America, but has also been introduced to other tropical and subtropical regions. Due to its valuable phytoconstituents and biological potential, M. arboreus possesses worldwide folk and healing prominence[1].

Despite their close resemblance to Hibiscus plants, members of the genus Malvaviscus are typically characterized by five rather than ten large stigmas covering the central style, in addition to producing schizocarpic fruits consisting of five distinct segments[2].The flowers bloom all year round, but the number of flowers increases in autumn and winter. The flowers are solitary in the axils of each leaf and hang like ornaments. Red forms are the most common. A white form has been reported[3].It is traditionally used as a condiment. M. arboreus has been used to treat whooping cough, as an urinary antiseptic and as a diuretic, wounds, fever, hypertension, sore throat, bronchitis, gastritis, and liver problems ,stomachache, dysentery, liver and gall bladder problems, cystitis, and kidney diseases. Flowers, fruits and leaves of M. arboreus are also suitable for the preparation of jellies, salads, herbal dyes and herbal teas[4, 5].

Origin and Distribution

It is a perennial plant or shrub belonging to the mallow family. It is native to Central and South America, the southeastern United States, and Mexico. It has also been introduced in several tropical and subtropical regions of Australia, Asia and Africa[6].

Common Names

Turk's cap, Turk’s turban, ladies teardrop, Wax mallow Drummond Wax Mallow Sleeping Hibiscus[6, 7].

Vernacular Names

Assamese: Pahimuja-joba, Tikoni-joba
Bengali : Lanka jaba
English : Fire cracker
Kannada: Sanna dasavala
Manipuri: Juba kusum
Malayalam: Mottuchemparathi[8]

Plant Profile

Botanical name : Malvaviscus arboreus Cav.
Kingdom : Plantae
Subkingdom : Viridaeplantae (green plants)
Infrakingdom : Streptophyta (land plants)

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Superdivision : Embryophyta
Division : Magnoliophyta
Subdivision : Spermatophytina
Phylum : Tracheophyta
Class : Magnoliopsida
Superorder: Rosanae
Order : Malvales
Family : Malvaceae
Subfamily : Malvoidea
Tribe : Hibiscea
Genus : Malvaviscus
Species : Malvaviscus arboreus[1]

Description of the Plant

- Erect undershrubs or shrubs, about 1-4 m tall.
- Stems woody, branches with simple and stellate hairs, later becoming glabrate.
- Leaves alternate, unlobed or shallow 3-5 lobed after the middle part towards the apex, broadly ovate-elliptic to lanceolate, about 4-22 x 3-13 cm across, base rounded 5-9 veined, margins coarsely crenate-serrate or rarely entire, apex acute to acuminate, sparsely pubescent with simple and stellate hairs both above and beneath,
- Petiole puberulent, about 2-5 cm long, stipules linear spathulate, caducous, about 3-5 mm long.
- Flowers bisexual, ascending, pedicel slender, puberulent, about 5-15 mm long, involucellar bractlets linear spathulate, calyx 5 lobed, distinctly nerved, campanulate, lobes lanceolate, base connate, apex acute to acuminate, persistent, corolla showy, scarlet red, whitish, orange, campanulate or cylindric, about 2.5-3 cm long.
- Fruit capsule, globose-cylindrical, about 1.5 cm across, fleshy, edible. Seeds reniform or subglobose, brownish[8].

Microscopic Characters

Leaf

Transverse section of the midrib portion of dorsiventral leaf shows the presence of cortical and vascular tissues. A mass of sub-epidermal collenchymas is present under both lower and upper epidermis. The vascular system is formed of a large collateral vascular bundle forming a large arc of vascular tissues with the xylem to the upper side and the phloem to the lower one with islets of non-lignified pericyclic fibers below. Lamina and midrib region contains mucilage and calcium oxalate crystals. Upper epidermis made up of single layer of polygonal rectangular cells covered with striated cucticle which shows anomocytic stomata. The stoma has a round shape with osteoles and are surrounded by 3-5 subsidiary cells. Lower epidermis made up of single layer of polygonal rectangular cells covered with a smoth cuticle which shows anomocytic stomata the same as in the upper epidermis. The mesophyll is differentiated into a discontinuous upper palisade layer (formed of two rows of cylindrical columnar cells containing choloroplasts) and a spongy tissue (formed of 3-5 rows of thin-walled, rounded, and slightly irregular chlorenchymatous cells with wide intercellular spaces). Numerous clusters of calcium oxalate are scattered throughout the lamina region. The cortical tissue is formed of upper and lower epidermal collenchymatous layers. The vascular tissue consists of pericycle, phloem, cambium and xylem. Xylem is formed of lignified vessels, fibres, and wood parenchyma[1].

Petiole

The petiole's transverse section has an almost round shape. It is made up of an epidermal layer that has a cuticle that is smooth and has non-glandular hairs on it. Collagen and parenchymal cells make up the cortical tissue. Groups of lignified fibres serve as a representation of the pericycle. The vascular tissue is composed of nine to ten distinct collateral vascular bundles that surround broad parenchymatous pith and an indistinguishable and parenchymatous endodermis. In the parenchymatous tissues, calcium oxalate cluster crystals are dispersed[1].

Stem

The transverse section of the stem is circular in outline and shows an outer epidermis, cortex region, endodermis, pericycle, phloem, cambium, xylary region, and vascular tissue. The cortex region consists of 2–3 rows of small, rounded, and thick-walled collenchyma cells without intercellular spaces, followed by 3–5 rows of large, oval, and thin-walled parenchyma cells. The pericycle is parenchymatous with a few intermittent groups of lignified fibers, and the pericyclic fibers are long, having wide lamina and tapering ends. The phloem is comprised of thin cellulosic elements, including sieve tubes and companion cells, and contains clusters of calcium oxalate. The cambium is represented by several rows of tangentially arranged meristematic cells, and the cork is formed of one or two layers of

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brown, tangentially elongated, rectangular cells with thick walls[7].

Flowers

A transverse section of epicalyx shows upper and lower epidermises enclosing a wide parenchymatous cortex and numerous vascular bundles. The cortex region comprises several rows of almost rounded thin-walled parenchyma cells with numerous clusters of calcium oxalate. A transverse section in the calyx shows an upper glabrous epidermis and a lower hairy one enclosing a wide parenchymatous cortex and several vascular bundles. The upper (outer) epidermis is represented by one row of rectangular cells with thin cuticle. A transverse section in the petals shows upper and lower epidermises and a wide parenchymatous cortex, followed by small scattered vascular bundles. The upper and lower epidermises are formed of rectangular cells with thin cuticle, while in surface view; they appear as polygonal cells with wavy anticlinal walls .Trichomes and stomata are both absent. Both stomata and trichomes are completely absent. The two anther lobes contain numerous spherical spiny pollen grains. The anther wall is formed of an epidermis followed by a fibrous layer and remaining of the tapetum. The ovary shows outer and inner epidermises with a parenchymatous mesophyll in between. The epidermis of stigma consists of polygonal papillosed cells with straight anticlinal walls. A transverse section in the pedicel shows a slightly hairy epidermis, followed by a wide cortex, collateral vascular bundles, and wide parenchymatous pith. The epidermis is represented by one row of rectangular cells covered with thin cuticle carrying numerous non-glandular stellate hairs with 3–6 unicellular arms and thin cuticle. The cortex is formed of one row of small rounded collenchyma with no intercellular spaces followed by several rows of large parenchyma cells with thin cellulosic walls and wide intercellular spaces. Clusters of calcium oxalate are scattered in the cortex. The pericycle is formed of small rounded thin-walled parenchymatous cells with no pericyclic fibres. Some cells phloem parenchyma also contain clusters of calcium oxalate[7].

Medicinal Applications

Antimicrobial activity

The essential oils of leaves of Malvaviscus arboreus Cav. were shown to have antimicrobial activities against Staphylococcus aureus, Salmonella typhimurium and Bacillus cereus. Disk diffusion, microdilution and bioautography methods were used for antimicrobial activity evaluation. Plant material was extracted by hydrodistillation in Clevenger type equipment and the essential oil was obtained by condensation from the oil/water mixture. Using disk diffusion method and after an incubation period of 24 hours at 37° C, the maximum observed zone of inhibition was 10.00a ±2.00 mm and it was against S. aureus followed by 21.80c ±0.80 mm against S. typhimurium and 14.20b ±1.50 B. cereus. Direct bioautography with S. aureus, S. typhimorium and B. cereus was performed on silica gel GF254 TLC Aluminum plates. M. arboreus essential oil presented one inhibition zone on S. aureus growth without definition of specific fractions. The extracts showing an inhibition zone in the bioautography assay were chosen to test the minimum inhibitory concentration (MIC) with the agar dilution. In the microdilution test, B. cereus was the most susceptible microorganism. It has been reported that the leaf M. arboreus essential oil obtained by steam distillation presented a MIC of 20 mg mL-1 on both S. aureus and B. cereus[4].

It has been reported that ethanol extract of Malvaviscus arboreus red flower (ERF) have antimicrobial activities against Enterococcus faecalis, Bacillus subtillus, Bacillus cereus, Staphylococcus aureus, Vibrio fluvialis, Vibrio damsela, Pseudomonas aeruginosa, and Salmonella typhimurium; and the fungal strains Aspergillus fumigatus, Aspergillus terreus, Aspergillus niger, Aspergillus flavus, Aspergillus parasiticus, and Penicillium oxalicum. The ERF of M. arboreus showed an antibacterial effect against most of the tested strains with average inhibition zones ranging between 10 and 20 mm compared to the positive control. The ERF of M. arboreus exhibited a strong antibacterial activity against V. damsela with an inhibition zone of 20 _ 0.2 mm, moderate antibacterial activity against V. fluvialis and S. typhimurium with the inhibition zones being 16 mm, and showed lower effects against E. faecalis, S. aureus, and P. aeruginosa with inhibition zones of 10, 12, and 14 mm, respectively. On the other hand, the ERF of M. arboreus was ineffective against B. subtilus and B. cereus[9].

Antifungal activity

Volatile components extracted from the leaves, stems and flowers of Malvaviscus arboreus, shown to have antifungal activity. Stems of this plant were more strongly antifungal than the extract from the leaves. The extract from the flowers was

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least effective. The different plant parts were shown to have antifungal activity against Alternaria solani, Botrytis cinerea, Fusarium solani f. sp. cucurbitae, F. oxysporum f. sp. niveum, Pythium ultimum, Rhizoctonia solani and Verticillium dahlia[10].

Antioxidant activity

Ethanol Extract of Malvaviscus arboreus Red Flower (ERF) exhibit antioxidant activity. ABTS+, FRAP, DPPH, Metal Chelating Property, and ORAC were used to evaluate the antioxidant potential of the ERF of M. arboreus[8].According to another study ethanolic Extract of Malvaviscus arboreus shows radical scavenging activity. It was determined by DPPH method with IC50 value as parameter. The sample absorbance were measured by UV-Vis spectrophotometer (Shimadzu) with λ_{max} 515 nm and its IC50 value is 10,45 µg/mL[11].

Hepatoprotective activity

The total extract of the aerial parts and its derived fractions (petroleum ether, dichloromethane, ethyl acetate, and aqueous) of M. arboreus shows hepatoprotective action. Plant extract were orally administered to adult male albino rats for six consecutive days, followed by injection of CCl4. After that, all rats were sacrificed by cervical decapitation. Blood samples were then collected from each group to determine the serum levels of alanine transaminase (ALT), aspartate transaminase (AST), alkaline phosphatase (ALP), total bilirubin (TB). Liver tissues were also obtained to assess the levels of malondialdehyde (MDA), total antioxidant capacity (TAC), and for histopathological examination. M. arboreus has decreased the extent of liver damage with variable degrees, where the highest protective effects were observed for the ethanolic and dichloromethane fractions. The ethanolic and dichloromethane fractions significantly prevented the CCl4-induced elevation of serum ALT by 76.1% and 70.5% and AST by 71.8% and 74.3%, respectively. They also reduced the increased levels of ALP by 75.1% and 62.8% as well as TB by 84.4% and 70.6%, respectively. The ethanolic and dichloromethane fractions significantly diminished the CCl4-induced elevation of MDA levels by 95.6% and 66.6%, and improved the hepatic TAC by 58.6% and 74.7% respectively. It was found that ethyl acetate and dichloromethane fractions significantly reduce liver injury in rats along with enhancement of the total antioxidant capacities of their livers, with the maximum effects were recorded by the ethyl acetate fraction[6].

Gastroprotective activity

A mixture of Kaempferol-O-sambubioside and Kaempferol-O-sophoroside (MaSS) isolated from flowers of this species was tested as a preventive treatment on gastric lesions induced with ethanol in rats. MaSS was obtained by chromatographic methods and administered by oral pathway to male Sprague Dawley rats with ethanol-induced gastric lesions. MaSS obtained from M. arboreous prevents damage to the gastric mucosa against the harmful effects of ethanol. MaSS act as a preventive agent against gastric lesions is due to its actions on the local concentration of cytokines IL-6 and IL-10. This molecule is considered a regulator of acute inflammation, it also regulates chronic inflammation. The chemical precursor of MaSS is kaempferol, which is capable of reducing IL-6 levels in people with peptic ulcer disease, which is a risk factor for stomach cancer[12].

Anticancer activity

Ethanol Extract of Malvaviscus arboreus Red Flower (ERF) shows anticancer activity against hepatocarcinoma cell line HepG2. Using the SRB test on HepG2 anticancer activity of ERF was evaluated. The ERF prevented the growth of the HepG2 cell line with an IC50 of 67.182 g/L. Increase in cancer cell death point out that ERF had anticancer potential against HepG2 cells[9]. According to another study ethanolic extract of M. arboreus exhibit cytotoxic activity .MTT assay was used to determine the cytotoxic potential and the IC50 value was found to be 152,45 µg/mL[11].

II. CONCLUSION

Malvaviscus arboreus is an old plant with significant biological and economic value. The plant is well-known for its folklore and medicinal properties all over the world. Different parts of this plant have been used to treat whooping cough, wounds, fever, hypertension, sore throat, bronchitis, gastritis, and liver problems, cystitis, and kidney diseases. This review provided an overview of studies on the botanical studies and medicinal uses of M.arboreus.

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