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Research Article

Moringa oleifera (Shigru): A Miraculous Medicinal Plant with Many Therapeutic Benefits

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A B S T R A C T

Two species of Moringa are recorded from India, of which one, *M. Oleifera*, is widely cultivated in the tropics for its edible fruits. *M. Oleifera* (Drumstick tree) is indigenous to the Himalayan foothills of South Asia from north-eastern Pakistan (33 °N, 73 °E) to northern West Bengal State in India and northeastern Bangladesh where it is commonly found from sea level to 1,400 m on recent alluvial land or near riverbeds and streams. It grows at elevations from sea level to 1400 m. Numerous medicinal uses of *Moringa oleifera* has, also recognized namely antihypertensive, diuretic and cholesterol lowering activities, antispasmodic, antiulcer and hepatoprotective activities, antibacterial and antifungal activities, antitumor and anticancer activities, aqueous leaf extracts regulate thyroid hormone and can be used to treat hyperthyroidism and exhibit an antioxidant effect. A recent report showed that *M. oleifera* leaf may be applicable as a prophylactic or therapeutic anti-HSV (Herpes simplex virus type 1) medicine and may be effective against the acyclovir-resistant variant. *Moringa* seeds have specific protein fractions for skin and hair care. Two new active components for the cosmetic industry have been extracted from oil cake. Purisoft® consists of peptides of the *Moringa* seed. It protects the human skin from environmental influences and combats premature skin aging. With dual activity, antipollution and conditioning/ strengthening of hair, the *M. oleifera* seed extract is a globally acceptable innovative solution for hair care. It works on multisystem and helps to alleviate the many diseases; hence it is termed as miraculous tree.

Keywords: Shigru, Moringa, Folk Medicine, Analgesic, Anti-Inflammatory, Shoothhar, Sweedjanan

Introduction

Moringa Oleifera is evergreen deciduous tree that grows in subtropical areas in the North India. It is also called magician plant, drumstick tree, horseradish plant, and Shigru in Sanskrit. It belongs to moringaceae family and moringa genus. It is rapid growing tree. It can be cultivated on any kind of soil and requires very less water. Fruit, seeds and leaves all are edible. Only roots are avoided because it contains a neuro-paralytic toxin but it can be prepared decoction to treat urinary tract infections & infertility. It has long drumstick like fruit, which is green in color. Its leaves are high in protein content unlike other plants. It contains almost all vitamins found in fruits and vegetables. It is helpful in around 300 diseases. It has large number of health benefits and highly regarded as a medicinal plant. Moringa Oleifera has been used conventionally in the management and prevention of wide range of disorders. It is rich in antioxidants and several bioactive plant compounds. It is used in the treatment of diabetes and cancer. It can also be useful for the patients suffering from high cholesterol. The regular use of Moringa Oleifera has been found to be beneficial in the prevention of Arsenic toxicity.

Kingdom	Plantae
Subkingdom	Tracheobionta
Super division	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Dilleniidae
Order	Capparales
Family	Moringaceae
Genus	Moringa.
Species	Moringa oleifera *Lam.*

Syn.: *Moringa pterygosperma* Gaertn. 1791

Botanical Description of *Moringa oleifera* Lam[1,2]

Scientific Classification

Vernacular Name

Arabic : Rawag
Assamese : Saijna, Sohjna
Bengali : Sajina
Burmese : Daintha, Dandalonbin
Chinese : La Ken
English : Drumstick Tree, Horseradish Tree, Ben Tree
French : Moringe À Graine Ailée, Morungue
Gujarati : Midhosaragavo, Saragavo
Hindi : Mungna, Saijna, Shajna
Kannada : Nugge
Konkani : Maissang, Moring, Moxing
Malayalam : Murinna, Sigru
Marathi : Achajhada, Shevgi
Nepali : Shobhanjan, Sohijan
Oriya : Sajina
Portuguese : Moringa, Moringueiro
Punjabi : Sainjna, Soanjna
Sanskrit : Shobhanjana, Sigru
Sinhalese : Murunga
Spanish : Ángela, Ben, Moringa
Swahili : Mrongo, Mzunze
Tamil : Moringa, Murungai
Telegu : Mulaga, Munaga, Tellamunaga
Urdu : Sahajna

Genus Characters (*Moringa*)

A small or medium sized tree. Leaves up to 75 cm long, usually 3-pinnate; leaflets up to 1.7 cm long, or obovate, obtuse at apex, glabrous; rachis and its branches slender, articulate, glandular at the articulations. Flowers c.2.5 cm across, white, scented, in large panicles. Petals spathulate. Capsules up to 60cm long or longer,9-ribbed; Seeds trigonous with winged angles.

Family characters (*Moringaceae*)

Unarmed trees with soft wood. Leaves alternate, 2-3 pinnate, the pinnae and pinnules imparipinnate, opposite; leaflets opposite, quite entire, obovate, caduceus, as well as the pinnae and pinnules, with glands at the base; stipules 0. Flowers large, white, or white streaked with red, hermaphrodite, irregular, in axillary pannicles. Calyx cup shaped, 5 cleft; segments unequal, petaloid, deciduous from above the base, imbricate. Petals 5, unequal, the upper smaller, the lateral ascending, the anterior the larger, disk lining the calyx-tube. Disk lining the calyx tube. Stamens inserted on the edge of the disk, declinate, 5 perfect opposite the petals alternating with 5(or 7) which are reduced to anther less filaments; anthers dorsifixed 1celled. Ovary stipitate; ovules numerous in 2 series, on parietal placentas; style slender, tubular; stigma perforated. Capsule elongate, beaked, 3-6angled, 1 celled, loculicidally 3 valved. Seeds many, in pits of the valves; testa corky, winged or not; albumen o; embryo straight; cotyledons Plano convex; radicle very short, superior; plumule many - leaved-Genus 1. Species 3 – Mediterranean, India.

Species of Moringa[3]

Moringa Adans. (Moringaceae)

A small genus of quick-growing tree distributed in India. Arabia, Asia Minor and Africa. Two species are recorded from India, of which one, *M. Oleifera*, is widely cultivated in the tropics for its edible fruits.

***M. oleifera* Lam. Syn. *M. Pterygosperma* Gaertn**

Habitat. - A small or medium-sized tree, about 10 m. High, found wild in the sub-Himalayan tract, from Chenab eastwards to Sarda, and cultivated all over the plains of India.

Bark thick, soft, corky, deeply fissured; young parts tomentose; Leaves Usually tri-pinnate; leaflets elliptic; flowers white, fragrant, in large panicles; pods pendulous, greenish, 22.5-50.0 cm. or more in length, triangular, ribbed; seeds trigonous with wings on angles.

***M. concanensis* Nimmo**

M. concanensis Nimmo is a small tree resembling *M. Oleifera* found in Rajasthan, dry hills of Konkan, Andhra Pradesh and Coimbatore. Leaves bi-pinnate, somewhat longer than those of *M. Oleifera*. Flowers pinkish yellow. Various parts of the tree are used in indigenous medicines in the same way as those of *M. Oleifera.*

It is the red flowered species (Sind.- Mooah. Rajput.-Sainjnah) met with in Rajputana and Sind. Its roots like those of M. Pterygosperma has a pungent flavor and is used as a substitute for horse-redish. (Murray).

Characteristics of *Moringa oleifera* Lam

Habit: A small or middle sized tree, about 10 m high.

Leaves: Usually tripinnate, sometimes 45 cm long;rachis slender, thickened and articulated at the base, pinnae and pinnules opposite, deciduous, their rachides very slender, articulated and with a gland at the articulations: ultimate leaflets 12-20 by 6-10 mm, the lateral elliptic, the terminal obovate and slightly larger than the lateral ones; nerves obscure; petioles of the lateral leaflets 1.5-2.5 mm, those of the terminal 3-6 mm long.

Bark: Corky, wood soft, root pungent; young parts tomentose.

Flowers: White, Fragrent, in large puberculous panicles.

Calyx: Lobes linear-lanceolate, reflexed, puberculous outside.

Petals: Spathulate, veined.

Stamens: Fertile alternating with 5-7 antherless ones; filaments villous at the base.

Pods: Pendulous, Greenish,22.5 cm-50cm or more in length, triangular, 9 ribbed.

Seeds: Trigonous, the angles winged.

Distribution

Drumstick tree is indigenous to the Himalayan foothills of South Asia from northeastern Pakistan (33 °N, 73 °E) to northern West Bengal State in India, and northeastern Bangladesh where it is commonly found from sea level to 1,400 m on recent alluvial land or near riverbeds and streams. It grows at elevations from sea level to 1400 m.

It is cultivated and has become naturalized in other parts of India, Pakistan, and Nepal, as well as in Afghanistan, Bangladesh, Sri Lanka, Southeast Asia, West Asia, the Arabian Peninsula, East and West Africa, throughout the West Indies and southern Florida, in Central and South A from Mexico to Peru, as well as in Brazil and Paraguay.

Medicinal uses and Pharmacological Properties

Uses in Folk Medicine

All parts of the tree have been used in folk medicine practices.

Table 1: The medicinal effects and uses ascribed in folk medicine to various parts of *Moringa* are detailed below.[1,2]

Table 1

Plant Parts	Effect	Used for the treatment of
Leaves	Anti-bacterial, Anti-Tumor, Anti-Anemic Antihypertensive Antioxidant Antiseptic	Infection, Urinary Tract Infections Epstein-Bar Virus (EBV), Herpes Simplex Virus (HSV-1), HIV-AIDS, Helminthes, Trypanosomes, Bronchitis, External Sores/ Ulcers, Fever, Hepatic, Prostate, Radio protective, Diabetes/ hypoglycemia, Diuretic, Hypocholestemia, Thyroid, Hepatorenal, Colitis, Diarrhea, Dysentery, Ulcer/ Gastritis, Rheumatism, Headache, , Carotenoids, Energy, Iron deficiency, Protein, Vitamin/ mineral deficiency, Lactation Enhancer, Catarrh, Lactation, Scurvy and Tonic
Bark	Abortifacient, Aphrodisiac Anti-Tumor	Dental Caries/ Toothache, Common cold, External Sores/ Ulcer, Snakebite, Scorpion bite, Colitis, Digestive, Epilepsy, Hysteria, Headache, Birth Control and Scurvy
Roots	Abortifacient, Aphrodisiac, Rubefacient, Vesicant, Anti-spasmodic	Dental Caries/ Toothache, Common cold, Trypanosomes, External Sores/ Ulcers, Fever, Asthma, Cardiotonic, Diuretic, Hepatorenal, Diarrhea, Flatulence, Epilepsy, Hysteria, Headache, Gout, Hepatomegaly, Low back/ Kidney Pain, Scurvy and Splenomegaly

Exudate	Abortifacient and Rubefacient	Dental Caries/ Toothache, Syphilis, Typhoid, Earache, Fever, Asthma, Diuretic, Dysentery, Rheumatism, Headache
Flowers	anthelmintic, anti-tumor	Throat infection, common cold, rheumatism, diuretic, tonic, hysteria, abortion
Pods	Anthelmintic, anti-hypertensive	Skin cancer, diabetes, joint pain
Seeds	anti-tumor antispasmodic	Anthelmintic, Warts, Ulcer, rheumatism, arthritis, mineral/ vitamin deficiency

Numerous medicinal uses of *Moringa oleifera* has, also recognized in the Ayurvedic, Siddha and Unani systems of medicine.[3]

Antihypertensive, Diuretic and Cholesterol Lowering Activities

The widespread combination of diuretic along with lipid and blood pressure lowering constituents make this plant highly useful in cardiovascular disorders. *Moringa* leaf juice is known to have a stabilizing effect on blood pressure[4,5]. Nitrile, mustard oil glycosides and thiocarbamate glycosides have been isolated from *Moringa* leaves, which were found to be responsible for the blood pressure lowering effect[6-8]. Most of these compounds, bearing thiocarbamate, carbamate or nitrile groups, are fully acetylated glycosides, which are very rare in nature[8]. Bioassay guided fractionation of the active ethanol extract of *Moringa* leaves led to the isolation of four pure compounds, niazinin A[1], niazinin[1] B, niazimicin[4] and niazinin A and B which showed a blood pressure lowering effect in rats mediated possibly through a calcium antagonist effect.[9]

Another study on the ethanol and aqueous extracts of whole pods and its parts, i.e. coat, pulp and seed revealed that the blood pressure lowering effect of seed was more pronounced with comparable results in both ethanol and water extracts indicating that the activity is widely distributed.[10] Activity-directed fractionation of the ethanol extract of pods of *M. oleifera* has led to the isolation of thiocarbamate and isothiocyanate glycosides which are known to be the hypotensive principles.[8] Methyl *p*hydroxybenzoate and β -sitosterol (14), investigated in the pods of *M. oleifera* have also shown promising hypotensive activity.[10]

Moringa roots, leaves, flowers, gum and the aqueous infusion of seeds have been found to possess diuretic activity and such diuretic components are likely to play a complementary role in the overall blood pressure lowering effect of this plant.[11,12]

The crude extract of *Moringa* leaves has a significant cholesterol lowering action in the serum of high fat diet fed rats.[13] *Moringa* fruit has been found to lower the serum cholesterol, phospholipids, triglycerides, Low Density Lipoprotein (LDL), Very Low Density Lipoprotein (VLDL) cholesterol to phospholipid ratio, atherogenic index lipid and reduced the lipid profile of liver, heart and aorta in hypercholesteremic rabbits and increased the excretion of fecal cholesterol.[14]

Antispasmodic, Antiulcer and Hepatoprotective Activities

M. oleifera roots have been reported to possess antispasmodic activity.[11] *Moringa* leaves have been extensively studied pharmacologically and it has been found that the ethanol extract and its constituents exhibit antispasmodic effects possibly through calcium channel blockade.[15,9,16] The antispasmodic activity of the ethanol extract of *M. oleifera* leaves has been attributed to the presence of 4-[α-(L-rhamnosyloxy) benzyl]-o-methyl thiocarbamate[3] (*trans*), which forms the basis for its traditional use in diarrhea.[15] Moreover, spasmolytic activity exhibited by different constituents provides pharmacological basis for the traditional uses of this plant in gastrointestinal motility disorder.[9] The methanol fraction of *M. oleifera* leaf extract showed antiulcerogenic and hepatoprotective effects in rats.[17] Aqueous leaf extracts also showed antiulcer effect indicating that the antiulcer component is widely distributed in this plant.[17]

Moringa roots have also been reported to possess hepatoprotective activity. The aqueous and alcohol extracts from *Moringa* flowers were also found to have a significant hepatoprotective effect, which may be due to the presence of quercetin, a well known flavonoid with hepatoprotective activity.[18,19]

Antibacterial and Antifungal Activities

Moringa roots have antibacterial activity and are reported to be rich in antimicrobial agents[20]. These are reported to contain an active antibiotic principle, pterygospermin, which has powerful antibacterial and fungicidal effects.[18] A similar compound is found to be responsible for the antibacterial and fungicidal effects of its flowers.[21] The root extract also possesses antimicrobial activity attributed to the presence of 4- α -L-rhamnosyloxy benzyl isothiocyanate[22]. The aglycone

of deoxy-niazimicine (N-benzyl, S-ethyl thioformate) isolated from the chloroform fraction of an ethanol extract of the root bark was found to be responsible for the antibacterial and antifungal activities.[23] The bark extract has been shown to possess antifungal activity[24] while the juice from the stem bark showed antibacterial effect against *Staphylococcus aureus*.[14] The fresh leaf juice was found to inhibit the growth of microorganisms (*Pseudomonas aeruginosa* and *Staphylococcus aureus*), pathogenic to man.[25]

Antitumor and Anticancer Activities

Makonnen et al. (1998) found *Moringa* leaves to be a potential source for antitumor activity.[26] *O*-Ethyl- 4-(α -L-rhamnosyloxy)benzyl carbamate[11] together with 4(α -L-rhamnosyloxy)-benzyl isothiocyanate,[3] niazimicin[4] and 3-*O*-(6′-*O*-oleoyl- α -D-glucopyranosyl)-β-sitosterol.[15] have been tested for their potential antitumor promoting activity using an *in vitro* assay which showed significant inhibitory effects on Epstein–Barr virus-early antigen. Niazimicin has been proposed to be a potent chemopreventive agent in chemical carcinogenesis.[27] The seed extracts have also been found to be effective on hepatic carcinogen metabolizing enzymes, antioxidant parameters and skin papillomagenesis in mice.[28]

A seed ointment had a similar effect to neomycin against *Staphylococcus aureus pyodermia* in mice.[29]

It has been found that niaziminin, a thiocarbamate from the leaves of *M. oleifera*, exhibits inhibition of tumor-promoter-induced Epstein–Barr virus activation. On the other hand, among the isothiocyanates, naturally occurring 4-[(4′-*O*-acetyl- α -L -rhamnosyloxy) benzyl] significantly inhibited tumor-promoterinduced Epstein-Barr virus activation, suggesting that the isothiocyano group is a critical structural factor for activity.[26]

Other Diverse Activities

Moringa oleifera has also been reported to exhibit other diverse activities. Aqueous leaf extracts regulate thyroid hormone and can be used to treat hyperthyroidism and exhibit an antioxidant effect.[17,30,31] A methanol extract of *M. oleifera* leaves conferred significant radiation protection to the bone marrow chromosomes in mice.[20] *Moringa* leaves are effective for the regulation of thyroid hormone status.[31]

A recent report showed that *M. oleifera* leaf may be applicable as a prophylactic or therapeutic anti-HSV (Herpes simplex virus type 1) medicine and may be effective against the acyclovir-resistant variant.[32] The flowers and leaves also are considered to be of high medicinal value with anthelmintic activity.[33] An infusion of leaf juice was shown to reduce glucose levels in rabbits.[34] *Moringa oleifera* is coming to the forefront as a result of scientific evidence that *Moringa* is an important source of naturally occurring phytochemicals and this provides a basis for future viable developments. Different parts of *M. oleifera* are also incorporated in various marketed health formulations, such as Rumalaya and Septilin (the Himalaya Drug Company, Bangalore, India), Orthoherb (Walter Bushnell Ltd, Mumbai, India), Kupid Fort (Pharma Products Pvt. Ltd, Thayavur, India) and Livospin (Herbals APS Pvt. Ltd, Patna,India), which are reputed as remedies available for a variety of human health disorders.[14] *Moringa* seeds have specific protein fractions for skin and hair care. Two new active components for the cosmetic industry have been extracted from oil cake. Purisoft® consists of peptides of the *Moringa* seed. It protects the human skin from environmental influences and combats premature skin aging. With dual activity, antipollution and conditioning/ strengthening of hair, the *M. oleifera* seed extract is a globally acceptable innovative solution for hair care.[35]

Table 2.Some common medicinal uses of different parts of Moringa oleifera

Plant part	Medicinal Uses
Root	Antilithic, rubefacient, vesicant, carminative, antifertility, anti-inflammatory, stimulant in paralytic afflictions; act as a cardiac/circulatory tonic, used as a laxative, abortifacient, treating rheumatism, inflammations, articular pains, lower back or kidney pain and constipation[4,5,18]
Leave	Purgative, applied as poultice to sores, rubbed on the temples for headaches, used for piles, fevers, sore throat, bronchitis, eye and ear infections, scurvy and catarrh; leaf juice is believed to control glucose levels, applied to reduce glandular swelling[4,5,34]
Stem bark	Rubefacient, vesicant and used to cure eye diseases and for the treatment of delirious patients, prevent enlargement of the spleen and formation of tuberculous glands of the neck to destroy tumors and to heal ulcers. The juice from the root bark is put into ears to relieve earaches and also placed in a tooth cavity as a pain killer, and has anti-tubercular activity[24,36]
Gum	Used for dental caries, and is astringent and rubefacient; Gum, mixed with sesame oil, is used to relieve headaches, fevers, intestinal complaints, dysentery, asthma and sometimes used as an abortifacient, and to treat syphilis and rheumatism[37]

Flower	High medicinal value as a stimulant, aphrodisiac, abortifacient, cholagogue; used to cure inflammations, muscle diseases, hysteria, tumors, and enlargement of the spleen; lower the serum cholesterol, phospholipid, triglyceride, VLDL, LDL cholesterol to phospholipid ratio and atherogenic index; decrease lipid profile of liver, heart and aorta in hypercholesterolaemic rabbits and increased the excretion of faecal cholesterol[14,5,36,33]
Seed	Seed extract exerts its protective effect by decreasing liver lipid peroxides, antihypertensive compounds thiocarbamate and isothiocyanate glycosids have been isolated from the acetate phase of the ethanolic extract of Moringa pods[10,38]

Conclusion

Moringa oleifera is evergreen deciduous tree that grows in subtropical areas in the North India. It is also called magician plant, drumstick tree, horseradish plant, and Shigru in Sanskrit. It possesses antihypertensive, diuretic and cholesterol lowering activities, antispasmodic, antiulcer and hepatoprotective activities, antibacterial and antifungal activities, antitumor and anticancer activities, aqueous leaf extracts regulate thyroid hormone and can be used to treat hyperthyroidism and exhibit an antioxidant effect. It is used as a prophylactic or therapeutic anti-HSV (Herpes simplex virus type 1) medicine and may be effective against the acyclovir-resistant variant patients. It protects the human skin from environmental influences and combats premature skin aging. It is a miraculous tree widely used as a edible one and used abundantly in the preparation of various medicines.

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