

Moringa Oleifera: The Miracle Tree

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Abstract— Moringa oleifera commonly known as drumstick tree or horseradish tree. It can withstand both severe drought and mild frost condition hence widely cultivated across the world. Due to its high nutritive value it is used for either nutritional or commercial purpose. Its leaves are rich in vitamins minerals and other essential phytochemicals and also used to treat malnutrition. It has potential antioxidant, anticancer, anti-inflammatory, anti-diabetic properties. Its seeds are natural anti-coagulant. This review explores the beneficial, nutritive and therapeutic potential of this “miracle tree”.

Key words: Moringa Oleifera, Miracle Tree, Nutritive Value, Antioxidant

I. INTRODUCTION

Moringa oleifera is the most widely cultivated species of a monogeneric family, the Moringaceae, that is native to the sub-Himalayan tracts of India, Pakistan, Bangladesh and Afghanistan. This rapidly-growing tree (also known as the horseradish tree, drumstick tree, benzolive tree, kelor, marango, mlonge, moonga, mulangay, nébéday, saijhan, sajna or Ben oil tree), was utilized by the ancient Romans, Greeks and Egyptians; it is now widely cultivated and has become naturalized in many locations in the tropics. It is a perennial softwood tree with timber of low quality, but which for centuries has been advocated for traditional medicinal and industrial uses. It is already an important crop in India, Ethiopia, the Philippines and the Sudan, and is being grown in West, East and South Africa, tropical Asia, Latin America, the Caribbean, Florida and the Pacific Islands. All parts of the Moringa tree are edible and have long been consumed by humans. According to Fuglie the many uses for Moringa include: alley cropping (biomass production), animal forage (leaves and treated seed-cake), biogas (from leaves), domestic cleaning agent (crushed leaves), blue dye (wood), fencing (living trees), fertilizer (seed-cake), foliar nutrient (juice expressed from the leaves), green manure (from leaves), gum (from tree trunks), honey- and sugar cane juice-clarifier (powdered seeds), honey (flower nectar), medicine (all plant parts), ornamental plantings, biopesticide (soil incorporation of leaves to prevent seedling damping off), pulp (wood), rope (bark), tannin for tanning hides (bark and gum), water purification (powdered seeds). Moringa seed oil (yield 30-40% by weight), also known as Ben oil, is a sweet non-sticking, non-drying oil that resists rancidity. It has been used in salads, for fine machine lubrication, and in the manufacture of perfume and hair care products. In the West, one of the best known uses for Moringa is the use of powdered seeds to flocculate contaminants and purify drinking water, but the seeds are also eaten green, roasted, powdered and steeped for tea or used in curries. This tree has in recent times been advocated as an outstanding indigenous source of highly digestible protein, Ca, Fe, Vitamin C, and carotenoids suitable for utilization in many of the so-called “developing”

regions of the world where undernourishment is a major concern.[1]

II. PLANT DETAILS

A. Taxonomic Classification

- 1) Kingdom :- plantae
- 2) Family :- moringaceae
- 3) Genus :- moringa
- 4) species :- oleifera

B. Botanical Description

Moringa oleifera is a small, graceful, deciduous tree with sparse foliage, often resembling a leguminous species at a distance, especially when in flower, but immediately recognized when in fruit. The tree grows to 8 m high and 60 cm dbh. Bark smooth, dark grey; slash thin, yellowish. Twigs and shoots shortly but densely hairy. Crown wide, open, typically umbrella shaped and usually a single stem; often deep rooted. The wood is soft.

Leaves alternate, the old ones soon falling off; each leaf large (up to about 90 cm long), with opposite pinnae, spaced about 5 cm apart up the central stalk, usually with a 2nd lot of pinnae, also opposite, bearing leaflets in opposite pairs, with a slightly larger terminal leaflet. Leaflets dark green above and pale on the under surface; variable in size and shape, but often rounded-elliptic, seldom as much as 2.5 cm long.

Flowers produced throughout the year, in loose axillary panicles up to 15 cm long; individual flower stalks up to 12 mm long and very slender; 5 pale green sepals 12 mm long, finely hairy, 5 white petals, unequal, a little longer than the sepals; 5 stamens with anthers, 5 without; style slender, flowers very sweet smelling.

Fruit large and distinctive, up to 90 cm long and 12 mm broad, slightly constricted at intervals, gradually tapering to a point, 3- (4-) angled, with 2 grooves on each face, light brown. It splits along each angle to expose the rows of rounded blackish oily seeds, each with 3 papery wings. The generic name comes from the Sinhalese name ‘morunga’[2]

C. Biology

The bisexual, oblique, stalked, axillary and heteromorphic flowers are highly cross-pollinated due to heteromorphism. The carpenter bees (*Xylocopa latipes* and *X. pubescens*) have been found the most reliable and appropriate pollinators. Sunbirds *Nectarinia zeylanica* and *N. asiatica* have also been observed to be active pollinators. [2]

D. Ecology

Readily colonizes stream banks and savannah areas where the soils are well drained and the water table remains fairly high all the year round. It is quite drought tolerant but yields much less foliage where it is continuously under water stress. It is not harmed by frost, but can be killed back to

ground level by a freeze. It quickly sends out new growth from the trunk when cut, or from the ground when frozen.[2]

E. Biophysical Limits

Altitude: 0-1 000 m, Mean annual temperature: 12.6 to 40 deg. C, Mean annual rainfall: At least 500 mm Soil type: A adapted to a wide range of soil types but does well in well drained clay or clay loam without prolonged waterlogging. Prefers a neutral to slightly acidic soil reaction, but it has recently been introduced with success in Pacific atolls where the pH is as high as 8.5.[2]

III. NUTRITIONAL SIGNIFICANCE



Fig. 1:-



Fig. 2:

Moringa trees have been used to combat malnutrition, especially among infants and nursing mothers. Three non-governmental organizations in particular—Trees for Life, Church World Service and Educational Concerns for Hunger Organization—have advocated Moringa as “natural nutrition for the tropics.” Leaves can be eaten fresh, cooked, or stored as dried powder for many months without refrigeration, and reportedly without loss of nutritional value. Moringa is especially promising as a food source in the tropics because the tree is in full leaf at the end of the dry season when other foods are typically scarce. A large number of reports on the nutritional qualities of Moringa now exist in both the scientific and the popular literature. Any readers who are familiar with Moringa will recognize the oft-reproduced characterization made many years ago by the Trees for Life organization, that “ounce-for-ounce, Moringa leaves contain more Vitamin A than carrots, more calcium than milk, more iron than spinach, more Vitamin C than oranges, and more potassium than bananas,” and that the protein quality of Moringa leaves rivals that of milk and eggs. These readers will also recognize the oral histories

recorded by Lowell Fuglie in Senegal and throughout West Africa, who reports countless instances of lifesaving nutritional rescue that are attributed to Moringa. In fact, the nutritional properties of Moringa are now so well known that there seems to be little doubt of the substantial health benefit to be realized by consumption of Moringa leaf powder in situations where starvation is imminent. Nonetheless, the outcomes of well controlled and well documented clinical studies are still clearly of great value. [1]

IV. PHYTOCHEMISTRY

Phytochemicals are, in the strictest sense of the word, chemicals produced by plants. Commonly, though, the word refers to only those chemicals which may have an impact on health, or on flavor, texture, smell, or color of the plants, but are not required by humans as essential nutrients. An examination of the phytochemicals of Moringa species affords the opportunity to examine a range of fairly unique compounds. In particular, this plant family is rich in compounds containing the simple sugar, rhamnose, and it is rich in a fairly unique group of compounds called glucosinolates and isothiocyanates. For example, specific components of Moringa preparations that have been reported to have hypotensive, anticancer, and antibacterial activity include 4-(4'-O-acetyl- α -L-rhamnopyranosyloxy)benzyl isothiocyanate, 4-(α -L-rhamnopyranosyloxy)benzyl isothiocyanate, niazimicin, pterygospermin, benzyl isothiocyanate, and 4-(α -L-rhamnopyranosyloxy)benzyl glucosinolate [6]. While these compounds are relatively unique to the Moringa family, it is also rich in a number of vitamins and minerals as well as other more commonly recognized phytochemicals such as the carotenoids (including β -carotene or pro-vitamin A).[1]

V. PHARMACOLOGICAL ACTIVITIES

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.

A. Cholesterol lowering

The crude extract of Moringa leaves has a significant cholesterol lowering action in the serum of high fat diet fed rats which might be attributed to the presence of a bioactive Phytoconstituents, i.e. β - sitosterol. 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 .[3]

1) Antihypertensive Action

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. 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.[3]

2) Antispasmodic, Antiulcer and Hepatoprotective Activities

M. oleifera roots have been reported to possess antispasmodic activity. 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. 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 (trans), which forms the basis for its traditional use in diarrhea. Moreover, spasmolytic activity exhibited by different constituents provides pharmacological basis for the traditional uses of this plant in gastrointestinal motility disorder. The methanol fraction of *M. oleifera* leaf extract showed antiulcerogenic and hepatoprotective effects in rats. Aqueous leaf extracts also showed antiulcer effect indicating that the antiulcer component is widely distributed in this plant. 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.[3]

3) Antidiabetic Activity

An extract from the moringa leaf has been shown to be effective in lowering blood sugar levels within 3hrs ingestion, though less effectively than the standard hypoglycemic drug, glibenclamide.[3]

4) Wound Healing Properties

Three wound models viz excision wound, incision wound and dead space wound were selected for assessing wound healing activity of ethanolic and ethyl acetate extracts of leaves. Ethyl acetate extracts (10% extract in the form of ointment) showed significant wound healing activity that is comparable with the standard vicco turmeric cream. Phytosterols and phenolic compounds present in these extracts promote the wound healing activity.[3]

5) Antipyretic Activity

The antipyretic activity of ethanolic, petroleum ether, solvent ether and ethyl acetate extracts of seeds was screened using yeast induced hyperpyrexia method. Paracetamol I.P (200mg/ kg) was used as standard for comparison. The ethanolic and ethyl acetate extracts of seeds showed significant antipyretic activity in rats.[3]

6) Analgesic Activity

The experimental studies using hot plate and tail immersion method have shown that alcoholic extract of leaves and seeds of Moringa oleifera possess marked analgesic activity (3). According to the authors it is equipotent to standard drug (Aspirin 25mg/ kg.) [3]

7) Anti-Inflammatory Activity

Poultice of leaves is beneficial in glandular swellings .The root extract exhibited significant anti-inflammatory activity in Carrageenan induced rat paw edema.[3]

8) Anti Asthmatic Activity

A study was carried out to investigate the efficacy and safety of seed kernels of Moringa oleifera in the treatment of bronchial asthma. The results showed an appreciable decrease in severity of symptoms of asthma and also simultaneous improvement in respiratory functions .[3]

9) In Blindness and Eye Infections

Though there are many causes of blindness Vitamin A deficiency causes impaired dark adaption and night blindness. Eating Moringa leaves, pods and leaf powder which contain high proportion of Vitamin A can help to prevent night blindness and eye problems in children. Ingesting drumstick leaves (Bcarotene and leutin) with oil helps in improving Vitamin A nutrition and perhaps delays the onset of cataract. Also the juice can be instilled into eyes in cases of conjunctivitis. [3]

10) Cardiac and Circulatory Stimulant

All parts of the tree are reported to be used as Cardiac and circulatory stimulant. Moringinine acts on the sympathetic nervous system and act as a cardiac stimulant. [3]

11) Antioxidant Activity

Antioxidant activity reported in oil from the dried seeds is higher than BHT and alpha Tocopheryl. Aqueous methanol (80%) and ethanol (70%) extracts of freeze dried leaves showed radical scavenging and antioxidant activities. The drumstick leaves are found to be a potential source of natural antioxidants. [3]

12) Antirolithiatic activity

The effect of oral administration of aqueous and alcoholic extract of *M. oleifera* root-wood on calcium oxalate urolithiasis has been studied in male Wistar albino rats. Ethylene glycol feeding resulted in hyperoxaluria as well as increased renal excretion of calcium and phosphate. Supplementation with aqueous and alcoholic extract of *M. oleifera* root-wood significantly reduced the elevated urinary oxalate, showing a regulatory action on endogenous oxalate synthesis. The increased deposition of stone forming constituents in the kidneys of calculogenic rats was also significantly lowered by curative and preventive treatment using aqueous and alcoholic extracts. Thus the results indicate that the root-wood of *M. oleifera* is endowed with antirolithiatic activity. [3]

13) Cosmetic Use

Various parts of *Moringa olifera* have cosmetic value. Cognis Laboratoires Serobiologiques team developed Puricare™ and Purisoft™, two active ingredients based on botanical peptides from the seeds of Moringa olifera tree that purify hair and skin and offer protection against the effects of pollution. Moringa seed oil, known as Behen oil is widely used as a carrier oil in cosmetic preparations. The healing properties of moringa oil were documented by ancient cultures. Moringa oil possesses exceptional oxidative stability which may explain why the Egyptians placed vases of Moringa oil in their tombs. It is high in oleic acid and similar in composition to olive oil. Moringa oil is light and spreads easily on the skin. It is good oil for use in massage and aromatherapy applications. It can be used in body and hair care as a moisturizer and skin conditioner. Other uses include soap making and for use in cosmetic preparations such as lip balm and creams. *Moringa oleifera* butter, a semisolid fraction of Moringa oil, is used in baby products to contribute a free radical resistant emollient with exceptionally long lasting skin softening and soothing effects.[3]

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