



Sahjan –A Green Super Food

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ABSTRACT

Sahjan, botanical name, *Moringa oleifera* Lam (synonym: *Moringa pterygosperma* Gaertner) belongs to a onogeneric family of shrubs and tree, Moringaceae. It is considered to have its origin in the northwest region of India (Agra and Oudh) and south of the Himalayan Mountains. Different parts of the plant contain various important minerals, protein, vitamins, carotene, amino acids and various phenolics. This review focuses on the detailed Morphological and Physical Characteristics, Phytochemistry, processing of *Moringa*, some common medicinal uses of different parts, role in malnutrition and importance and benefits of *Moringa* for the poor man.

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INTRODUCTION

Sahjan, botanical name, *Moringa oleifera* Lam (synonym: *Moringa pterygosperma* Gaertner) belongs to a onogeneric family of shrubs and tree, Moringaceae. It is considered to have its origin in the northwest region of India (Agra and Oudh) and south of the Himalayan Mountains. There is evidence that the cultivation of this tree in India dates back many thousands of years as the name "Shigon" for *M. oleifera* is mentioned in the "Shushruta Sanhita" which was written in the beginning of the first century A.D. The Indians knew that the seeds contain edible oil and they used them for medicinal purposes. It is probable that the common people also knew of its value as a fodder or vegetable (1).

The name *Moringa* is derived from *Murungaimuringa*- the Tamil/Malayalam word for drumstick. In the Dravidian language, there are many local names for this tree but all are derived from the generic root "Morunga". In English it is commonly known as Horseradish tree, Drumstick tree, Never Die tree, West Indian Ben tree, and Radish tree (2).

In some parts of the world *M. oleifera* is referred to as the 'drumstick tree' or the 'horse radish tree', whereas in others it is known as the kelor tree (3). While in the Nile valley, the name of the tree is 'Shagara al Rauwaq', which means 'tree for purifying'. In Pakistan, *M. oleifera* is locally known as 'Sohanjna' and is grown and cultivated all over the country (4, 5)

CULTIVATION

According to Odee (1), this tree can be found growing naturally at elevations of up to 1000 m above sea level. It can grow well on hillsides but is more frequently found growing on pastureland or in river basins. It is a fast growing tree and has been found to grow to 6 – 7 m in one year in areas receiving less than 400 mm mean annual rainfall.

The tree ranges in height from 5 to 10 m (6). It is found wild and cultivated throughout the plains, especially in hedges and in house yards. It thrives best under the tropical insular climate and is plentiful near the sandy beds of rivers and streams (4). It can grow well in the humid tropics or hot dry lands, can survive destitute soils, and is little affected by drought (6). This tree tolerates a wide range of rainfall. The minimum annual rainfall requirements is estimated at 250 mm and maximum at over 3000 mm and a pH of 5.0–9.0 (7).

Moringa oleifera, native of the western and sub-Himalayan tracts, India, Pakistan, Asia Minor, Africa and Arabia (8, 9) is now distributed in the Philippines, Cambodia, Central America, North and South America and the Caribbean Islands (6). It is now cultivated throughout the Middle East, and in almost the whole tropical belt. It was introduced in Eastern Africa from India at the beginning of 20th century. In Nicaragua the Marango (local name for *Moringa oleifera*) was introduced in the 1920s as an ornamental plant and

for use as a live fence. The tree grows best and is most commonly found in the Pacific part of Nicaragua but can be found in forest inventories in every part of the country. As a non-cultivated plant it is known for its resistance to drought and diseases.

Environmental requirements for moringa

Parameter	Requirement/Range
Climate	Tropical or sub-tropical
Altitude/Height	0-2000 meters
Temperature	25-35°C
Rainfall	250mm-2000mm.
Irrigation	needed for leaf production if rainfall < 800mm
Soil Type	Loamy, sandy or sandy-loam
Soil pH	Slightly acidic to slightly alkaline (pH 5-9)

Morphological and Physical Characteristics

Moringa is a fast growing, perennial tree which can reach a maximum height of 7-12 m and a diameter of 20-40 cm at chest height.

Stem - The stem is normally straight but occasionally is poorly formed. The tree grows with a short, straight stem that reaches a height of 1.5-2 m before it begins branching but can reach up to 3.0 m.

Branch - The extended branches grow in a disorganized manner and the canopy is umbrella shaped.

Leaves - The alternate, twice or thrice pinnate leaves grow mostly at the branch tips. They are 20-70 cm long, grayish-downy when young, long petiole with 8-10 pairs of pinnae each bearing two pairs of opposite, elliptic or obovate leaflets and one at the apex, all 1-2 cm long; with glands at the bases of the petioles and pinnae (6).

Moringa leaves are being used in projects to help to end starvation in countries like Africa because of protein and iron content. The leaves contain all the amino acids also. Moringa leaves have been reported to be a rich source of carotene, protein, vitamin C, calcium and potassium and act as a good source of natural antioxidants; and thus enhance the shelf-life of fat containing foods due to the presence of various types of antioxidant compounds such as ascorbic acid, flavonoids, phenolics and carotenoids (10, 11). In the Philippines, it is known as 'mother's best friend' because of its utilization to increase woman's milk production and is sometimes prescribed for anemia (12; 11).

Flowers - The flowers, which are pleasantly fragrant, and 2.5 cm wide are produced profusely in axillary, drooping panicles 10 to 25 cm long. They are white or cream colored and yellow-dotted at the base. The five reflexed sepals are linear-lanceolate. The five petals are slender-spatulate. They surround the five stamens and five staminodes and are reflexed except for the lowest (6).

Fruits - The fruits are three lobed pods which hang down from the branches and are 20-60 cm in length. When they are dry they open into 3 parts. Each pod contains between 12 and 35 seeds.

Seeds - The seeds are round with a brownish semi-permeable seed hull. The hull itself has three white wings that run from top to bottom at 120-degree intervals. Each tree can produce between 15,000 and 25,000 seeds/year. The average weight per seed is 0.3 g and the kernel to hull ratio is 75 : 25 (13).

Seed Oil- Mature seeds yield 38-40% edible oil called Ben oil from its high concentration of behnic acid, The refined oil is clear and odorless, and resists rancidity. The seed cake remaining after oil extraction may be used as a fertilizer or as a flocculent to pure water. Moringa seed oil also has potential for use as a biofuel (14).

(13) Physical characterization of pods and seeds are given in Table 1.

Table 1. Physical properties of pods and seeds of Moringa Determination	1	2	3
Average weight of pod (g)	7.60	-	7.95
Average weight of seeds (g) / pod	3.59	5.03	4.83
Average number of seeds / pod	12	17	16
Average weight (g) / 100 seeds	29.9	29.6	30.2
Average weight of kernels (g) / 100 seeds	21.2	-	22.5
Percent weight of kernel in relation to entire seed	72.5	-	74.5
Percent weight of hull in relation to entire seed	27.5	-	25.5
Moisture in kernel (%)	4.5	-	6.5
Moisture in hull (%)	9.2	-	12.9
Moisture in whole seed (%)	5.8	-	7.5

Phytochemistry

Moringa oleifera is rich in compounds containing the simple sugar, rhamnose and a fairly unique group of compounds called glucosinolates and isothiocyanates (15,16). The stem bark of this tree contains two alkaloids, namely moringine and moringinine (17). Vanillin, sitosterol, sitostenone, 4-hydroxymellin and octacosanoic acid have been isolated from the stem of *M. oleifera* (18). L-arabinose, -galactose, -glucuronic acid, and L-rhamnose, -mannose and -xylose, are found in purified, whole-gum exudates, while L-galactose, -glucuronic acid and L-mannose have been obtained on mild hydrolysis of the whole gum with acid (19).

Flowers contain nine amino acids, sucrose, D-glucose, traces of alkaloids, wax, quercetin and kaempferol; the ash is rich in potassium and calcium (20). Some flavonoid pigments such as alkaloids, kaempferol, rhamnetin, isoquercitrin and kaempferitrin also reported to be present in the flowers. (18,11).

Antihypertensive compounds thiocarbamate and isothiocyanate glycosides have been isolated from the acetate phase of the ethanol extract of *Moringa* pods (18). The cytokinins have been shown to be present in the fruit (21).

PROCESSING OF MORINGA

Leaves, flowers, seeds, pods and roots of *Moringa* are used for food, health and cooking. Various recipes of *Moringa* can be prepared as *Moringa* Tea, Superfood *Moringa* Smoothie, *Moringa* Leaf Sauce, Cooked Leaves, Cooked Pods, Cooked Peas, Cooked Flowers, and many more.

Different parts of *Moringa* plant have different kinds of benefits or uses as- Leaves (Nutritional, forage, biomass, plant growth hormone, medicinal); Flowers (Nutritional, medicinal, honey); Fruit (Nutritional, medicinal); Roots (Medicinal); Seeds (Cosmetics, food, water treatment, medicinal); Wood (Paper, alcohol production, animal feed, medicinal) and Bark (Rope making, gum for tanning hides, medicinal). *Moringa* leaves are processed to prepare leaf powder.

Processing of *Moringa* should start immediately after harvesting and transporting the leaves to the processing plant. The processing starts with different steps as Stripping the leaflets, Washing and Draining. For making *Moringa* leaf powder drying is done, which may be Room drying, Solar drying and Mechanical drying, followed by Milling and Sieving. Recommended particle sizes for powder are: Coarse (1.0 mm – 1.5 mm), Fine (0.5 mm – 1.0 mm) and Very fine (0.2 mm – 0.5 mm).

The temperature and humidity must be controlled in the packaging room, to avoid re-humidification of the product. After drying, the powder is left to cool and packed into clean, single-use polythene bags and sealed. This is enclosed in a second polythene bag and heat-sealed to maintain freshness and dryness prior to further use. The bags should be stored in a cool and dry place.

Table 1. 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,
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
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 Used for dental caries, and is astringent and rubefacient;
Gum	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

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

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

Role In Malnutrition -

According to (22), Moringa is used to combat malnutrition, especially among infants and nursing mothers. Five NGOs particularly- Trees for Life International, The Christian and Missionary Alliance, Church World Service, Education Concerns for Hunger Organization and Volunteer Partnerships for West Africa- have advocated Moringa as "natural nutrition for the tropics".

(22), told that "The nutritional properties of Moringa are now so well known that these 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 (National Research Council, 2006). Since Moringa is thrives in arid and semiarid environments, it may provide a food source during dry seasons.

To recognize the value of the plant, The Food and Agriculture Organisation of the United Nations featured *M. oleifera* as the Traditional Crop of The Month in September 2014 (23).

Importance and Benefits of Moringa for the Poor Man- Employment for farmers in rural areas

Its production requires little financial investment, creates employment, and can be cultivated without using chemicals. This tree requires regular but limited amounts of water and organic manure and gives bushy leaf-growth. By following these recommendations, a moringa plantation can produce leaves in abundance all year-round.

Generates income for food processing business

The processing of moringa leaves to make powder is done by using sun drying, an inexpensive and efficient method to obtain quality results. Milling does not require specific equipment and packaging has to be airtight and lightproof. The fundamental aspects of processing are hygiene and humidity control to ensure that the leaf powder stays perfectly dry until packaging.

Moringa leaves are an inexpensive source of proteins, vitamins and minerals for developing countries.

Dried and milled, moringa leaves are easily stored and used by families who can add the powder to their daily meals. The powder can also be used by food processing industries for fortification. Moringa leaves can help decrease the dependence of developing countries' on too expensive imported goods.

Uses as a leafy vegetable like the leaves of sweet potato, amaranth and hibiscus which are rich in nutrients.

The moringa leaf is a nutritionally rich, ecological, economical vegetable available in practically all countries with malnutrition issues. It is therefore essential to develop the production and consumption of this "green superfood".

REFERENCES

1. Odee, D. (1998). Forest biotechnology research in drylands of Kenya: the development of Moringa species. *Dryland Biodiversity* **2**, 7 - 8.
2. Ramachandran C, Peter KV, Gopalakrishnan PK. (1980). Drumstick (*Moringa oleifera*): a multipurpose Indian vegetable. *Econ Bot* **34**: 276-283.
3. Anwar F, and Bhangar MI. (2003). Analytical characterization of Moringa oleifera seed oil grown in temperate regions of Pakistan. *J Agric Food Chem* **51**: 6558-6563.

4. Qaiser M. (1973). Moringaceae. In Flora of West Pakistan, Nasir E, Ali SI (eds). No.38. University of Karachi Press: Karachi, 1-4.
5. Anwar F, Ashraf M, and Bhanger MI. (2005). Interprovenance variation in the composition of Moringa oleifera oilseeds from Pakistan. J Am Oil Chem Soc **82**: 45-51.
6. Morton JF. (1991). The horseradish tree, Moringa pterigosperma (Moringaceae). A boon to arid lands. Econ Bot **45**: 318-333.
7. Palada MC, and Changl LC. (2003). Suggested cultural practices for Moringa. International Cooperators' Guide AVRDC. AVRDC pub # 03-545 www.avrdc.org.
8. Somali MA, Bajnedi MA, Al-Faimani SS. (1984). Chemical composition and characteristics of Moringa peregrina seeds and seed oil. J Am Oil Chem Soc **61**: 85-86.
9. Mughal MH, Ali G, Srivastava PS, and Iqbal M. (1999). Improvement of drumstick (Moringa pterygosperma Gaertn.) – a unique source of food and medicine through tissue culture. Hamdard **Med** **42**: 37-42.
11. Dillard CJ and German JB. (2000). Phytochemicals: nutraceuticals and human health: A review. J Sci Food Agric **80**: 1744- 1756.
12. Siddhuraju P, Becker K. (2003). Antioxidant properties of various solvent extracts of total phenolic constituents from three different agro-climatic origins of drumstick tree (Moringa oleifera Lam.). J Agric Food Chem **15**: 2144-2155.
13. Estrella MCP, Mantaring JBV, and David GZ. (2000). A double blind, randomised controlled trial on the use of malunggay (Moringa oleifera) for augmentation of the volume of breastmilk among non-nursing mothers of preterm infants. Philipp J Pediatr **49**: 3-6.
14. Makkar HPS, and Becker K. (1996). Nutritional value and antinutritional components of whole and ethanol extracted Moringa oleifera leaves. Anim Feed Sci Technol **63**: 211-228.
15. Rashid U, Anwar F., Moser B. R., Knothe G., (2008), *Moringa oleifera* oil: A possible source of biodiesel. Bioresource Tecnology **99**:8175-8179
16. Fahey JW, Zalcmann AT, and Talalay P. (2001). The chemical diversity and distribution of glucosinolates and isothiocyanates among plants. Phytochemistry **56**: 5-51.
17. Bennett RN, Mellon FA, and Foidl N . (2003) Profiling glucosinolates and phenolics in vegetative and reproductive tissues of the multi-purpose trees Moringa oleifera L. (Horseradish tree) and Moringa stenopetala L. J Agric Food Chem **51**: 3546-3553.
18. Faizi S, Siddiqui B, Saleem R, Saddiqui S, and Aftab K. 1994a. Isolation and structure elucidation of new nitrile and mustard oil glycosides from Moringa oleifera and their effect on blood pressure. J Nat Prod **57**: 1256-1261.
19. Bhattacharya SB, Das AK, and Banerji N. (1982). Chemical investigations on the gum exudates from Sonja (Moringa oleifera). Carbohydr Res **102**: 253-262.
20. Ruckmani K, Kavimani S, Anandan R, Jaykar B. (1998). Effect of Moringa oleifera Lam on paracetamol-induced hepatotoxicity. Indian J Pharm Sci **60**: 33-35.
21. Nagar PK, Iyer RI, and Sircar PK. (1982). Cytokinins in developing fruits of Moringa pterigosperma Gaertn. Physiol Plant **55**:45-50.
22. Fuglie LJ (2000). The Miracle Tree: *Moringa oleifera*: Natural Nutrition for the Tropics. The multiple Attributes of Moringa. p 172.
23. FAO/WHO (2015), Joint FAO/WHO Food Standard Programme, Codex Alimentarius Commission, XII, supplement 4, FAO/WHO, Rome.
24. The Wealth of India (A Dictionary of Indian Raw Materials and Industrial Products). (1962). Raw Materials, Vol. VI: L-M; Council of Scientific and Industrial Research: New Delhi, 425-429.

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