Moringa oleifera Lam.

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MORINGACEAE (HORSE-RADISH TREE FAMILY)

Moringa pterygosperma Gaertn, *M. moringa* (L.) Millsp., *M. nux-ben* Perr., *Hyperanthera moringa* Willd., *Guilandina moringa* Lam.

Acacia blanc, árbol de las perlas, árbol de los espáragos, ben ailé, ben tree, benzolive tree, drumstick tree, horseradish tree, marango, moringa pea tree, moringue aptére, mother's best friend, mrongo, never-die, oil of ben tree, palo blanco, paraíso francés, pois quenique, resedá, sohnja, water purifying tree, and many more local common names (Jahn 1986, Little and Wadsworth 1964, Morton 1991, Palada 1996)

One of 14 species in the genus (Verdcourt 1985), *Moringa oleifera* originated in the western Himalayas and eastern Punjab (Brandis 1906) and now grows pantropically, either domesticated or semiwild.

Moringa oleifera is a deciduous-to-evergreen shrub or small tree, rarely reaching 15 m and usually less than 25 cm d.b.h. Initially fast-growing at up to 4.5 m in 9 months, the tree rarely grows older than 20 years (von Maydell 1986). It favors alluvial soils in semiarid regions, thriving at elevations of 800 to 1,200 m, but occurring from lowlands to about 1,500 m. When grown at 1,660 m it fails to develop flowers (Jahn 1991). The species accepts a pH of about 4.5 to 8 and grows well in a wide range of soils except those with saline conditions and stiff clay. It grows best in well-drained sandy loam. *Moringa oleifera* grows well where precipitation is between 760 and 2,150 mm, and when it can access ground water, it will tolerate precipitation levels below 300 mm (Troup 1921).

Moringa oleifera exhibits considerable variability in weight of cotyledons, seed size or yield, and phenology, and especially in the length, appearance, and quality of pods (Duke 1987, Jahn 1989, Morton 1991). Some of this variability is inherent or environmentally controlled, and some may result from long-term vegetative reproduction, as is customary when producing annual plants (Jahn 1989). Pods can be sweet to bitter. One of the best Indian cultivars, Bombay, has curly fruits. Others are characterized by long pods (Chavakacheri Murunga), tender pods (Jaffna), and red-tipped pods (Chem Murunga).

Moringa oleifera is a highly valuable, multipurpose tree, and in parts of the tropics it is cultivated as a vegetatively reproduced annual crop (Jahn 1989). It is used in home gardens or similar agroforestry contexts (Dale and Greenway 1961, Folkard and Sutherland 1996, Keay 1989, Palada 1996), for intercropping and as field borders, windbreaks, live stakes, and live fences. The wood is very soft, burns smoke free, and yields a blue dye. In India, the pulp has been used to make paper. Most of the tree is edible: the tuberous root cores can be substituted for horseradish; the bark (ben gum) can be used as seasoning; and the leaves, young shoots, and fresh or canned fruits can be used as vegetables or pickles and in soups and sauces rich in protein (up to 27 percent), calcium, phosphorus, vitamins A and C, carotene, and the amino acids methionine and cystine (Price 1993). The flowers with their radish-like flavor can be eaten or used to make tea. They also produce a good honey. The seeds can be consumed fresh as peas; or pounded, roasted, or pressed into a sweet, nondesiccating oil (ben oil) of high quality. This oil is used in art, salads, soap, smoke-free lamp fuel, and hairdressing; as a fine lubricant or purgative; and as a fixative for volatile odorous substances in perfumery. The tree's most unique property is the ability of its dry, crushed seeds and seed presscake, which contain polypeptides, to serve as natural coagulants for water treatment (Folkard and Sutherland 1996; Jahn 1989, 1991). With as little as 0.5 to 1.5 seed per liter, turbid, foul water can be rendered clear and potable. The level of purification compares favorably with that obtained using traditional chemical purifiers such as alum. Other applications (Morton 1991) include: using leaves for fodder (poultry, livestock, pigs, and camels) and mulch; using seed presscake as a soil fertilizer/con-

ditioner; using bark for mats, rope fiber, and tanning; and using roots and flowers (Eilert and others 1981) as a natural fungicide against damping-off. Virtually every part of *M. oleifera* is used in some type of native medicine, such as diuretics, skin treatments, and cures for scurvy and various bladder and prostate ailments (Duke 1987, Irvine 1961, von Maydell 1986, Morton 1991). In Cuba the tree is considered an antidote for machineel (*Hippomane mancinella*) poisoning (Bureau of Plant Industry 1915).

The white, cream, pink, purplish, or yellowish flowers are borne in axillary, drooping, 10-to-25 cm long panicles. Each flower is about 2 to 2.5 cm across and exhibits five unequal petals slightly larger than the five reflexed sepals (Keay 1989, von Maydell 1986). Seed-produced plants can start flowering at 8 months. The main flowering period in India is January to April, but many trees are in bloom from September onward (Cowen 1965). In Cuba, Florida, and Nigeria, *M. oleifera* flowers throughout the year (Keay 1989, Menninger 1962, Morton 1991). Flowers usually precede or coincide with fresh leaves in deciduous trees (Brandis 1906). The pendulous fruits (pods or drumsticks) are borne singly or in pairs. They range from 15 to 120 cm, but are usually between 30 and 50 cm long and about 2 cm thick. They are green to purple and bluntly triangular or nearly cylindrical in cross section, exhibit nine ribs, and taper to a point.

Under intensive culture, green pods can be harvested as early as 6 or 7 months after seeding, but in India pods can suffer from attacks of a fruitfly (*Gitonia* spp) (Jahn 1989). Drumsticks mature in about 6 weeks, then open along three valves, revealing 20 to 25 seeds embedded in a dry, white, tissue-like pith, and arranged in a single row. Seeds are round to triangular, brown to black, and usually bear three papery wings. They are less than 2 cm across, including wings.

When dry, the brownish-gray seed pods are collected from the trees and are easily shelled by hand. The sticky film coating the seeds is removed by washing in a strainer. Seeds average about 3,000 to 9,000 per kg (Food and Agriculture Organization 1975, Francis and Rodriguez 1993). A single tree may annually yield 1,500 to 24,000 seeds (Jahn 1989). The germination rate may be as high as 100 percent, but has decreased 10 to 52 percent after 1 month of storage. Some lots show 25 to 60 percent germination after 1 year, but seeds do not survive 2 years of storage (Verma 1973). However, according to Jahn (1986), seeds in sealed jars remain viable for several years and no pretreatment is necessary.

Direct seeding and nursery production are easy (Jahn 1989). Seeds are sowed 1 to 2.5 cm deep under half-shaded conditions, with one to two waterings daily (Verma 1973). A mix of equal parts of black, red, and sandy soil and cow dung is recommended and, if available, a supplement of crushed animal bones (Jahn 1989). Seeds sprout as early as 3 to 4 days, but usually take from 1 to 2 weeks (Francis and Rodriquez 1993, Morton 1991, Price 1993), with best results during hot, moist weather (Jahn 1986).

Seedlings average 25 to 30 cm in two months. At 40 cm or more, which is reached in 3 months, seedlings may be outplanted (Jahn 1989, Price 1993). Outplanting should coincide with the rains. Seedlings should be spaced at 2 by 2 m for annual production, and 4 or 5 m for long-term production. Recommended pit size is about 0.5 by 0.5 by 0.5 m. For intensely managed seedlings such as annuals, 10 kg of farmyard manure and 100 g of urea should be added.

For the most part, selections are propagated vegetatively. The tree coppices well and reproduction from cuttings is easy.


2cm
1cm
1cm
2cm