

LOCAL NAMES

Amharic (shiferaw); Arabic (rawag); Bengali (sujina,sohjna,sajina); Burmese (dan-da-lun,dandalonbin); Cantonese (nugge); Creole Patois (benzolive tree); English (moringa tree,ben-oil tree,cabbage tree,clarifier tree,horseradish tree,drumstick tree,West Indian ben); Filipino (malunggay); French (acacia blanc,Neverdie,moringa ailé,Ben ailé,Pois quenique); German (Pferderettichbaum,Meerrettichbaum); Gujarati (midho-saragavo); Hausa (zogallagandi); Hindi (sanjna,suhujna,sondna,sohanjna,shajna,munga ara,sainjna,mungna); Igbo (okwe oyibo); Indonesian (kelor); Lao (Sino-Tibetan) ('ii h'um); Malay (sajina,merunggai); Mandinka (nebedayo); Nepali (shobhanjan,sohijan); Sanskrit (shobhanjana); Spanish (paraíso blanco,paraíso frances,reseda); Swahili (mronge,mzunze,mlonge,mrongo); Tamil (murunga,murangai); Thai (makhonkom,ma-rum,phakihum); Urdu (sahjnao); Vietnamese (chùm ngây); Yoruba (ewe-igbale)

BOTANIC 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. Bole crooked, often forked from near the base. 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'.

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.



Moringa oleifera foliage (Joris de Wolf, Patrick Van Damme, Diego Van Meersschaut)



Flowers on trees in Honduras (Anthony Simons)



Flowers on trees at Ramogi, Kenya (Anthony Simons)

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.

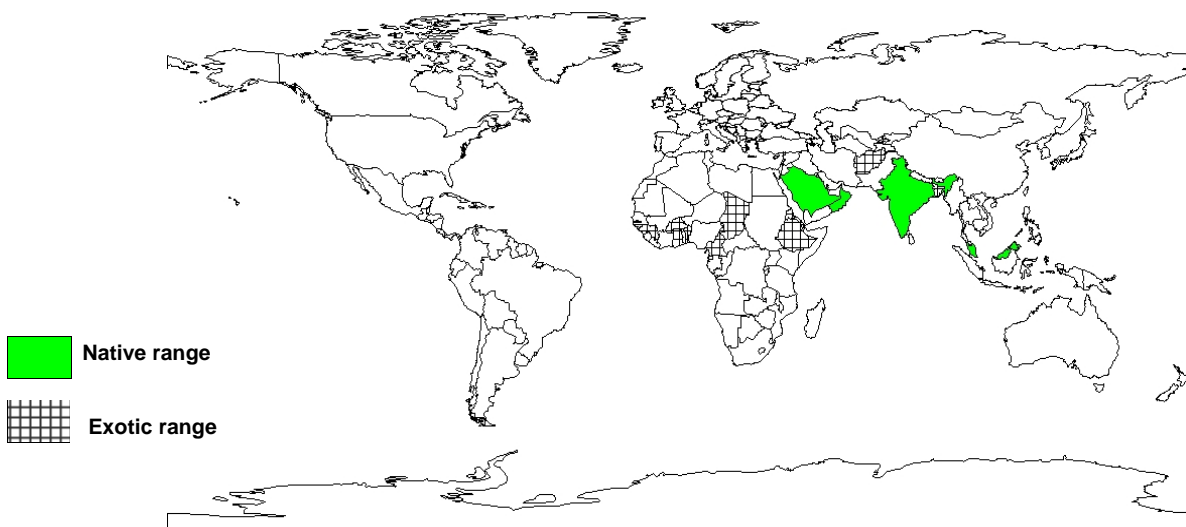
BIOPHYSICAL LIMITS

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.

DOCUMENTED SPECIES DISTRIBUTION

- Native: India, Malaysia, Oman, Qatar, Saudi Arabia, United Arab Emirates, Yemen, Republic of
Exotic: Afghanistan, Bangladesh, Benin, Burkina Faso, Cameroon, Chad, Eritrea, Ethiopia, Gambia, Ghana, Guinea, Haiti, Indonesia, Iran, Kenya, Kiribati, Liberia, Mali, Marshall Islands, Mauritania, Myanmar, Nepal, Niger, Nigeria, Northern Mariana Islands, Pakistan, Philippines, Senegal, Sierra Leone, Sudan, Tanzania, Thailand, Togo, Uganda, Vietnam, Zanzibar



The map above shows countries where the species has been planted. It does neither suggest that the species can be planted in every ecological zone within that country, nor that the species can not be planted in other countries than those depicted. Since some tree species are invasive, you need to follow biosafety procedures that apply to your planting site.

PRODUCTS

Food: The leaves, a good source of protein, vitamins A, B and C and minerals such as calcium and iron, are used as a spinach equivalent. They are an excellent source of the sulphur-containing amino acids methionine and cystine, which are often in short supply. Young plants are eaten as a tender vegetable and the taproots as an alternative for horseradish. Young pods are edible and reportedly have a taste reminiscent of asparagus. The green peas and surrounding white material can be removed from larger pods and cooked in various ways. Seeds from mature pods (which can be 40-50 cm long) can be browned in a skillet, mashed and placed in boiling water, which causes an excellent cooking or lubricating oil to float to the surface. The pleasantly flavoured edible oil, resembling olive oil, is an excellent salad oil. The flowers can be eaten or used to make a tea.

Fodder: Leaves are mainly used for human food and not to any great extent for livestock, but branches are occasionally lopped for feeding camels and cattle.

Apiculture: Its silviculture, involving regeneration by cuttings, coppicing and pollarding, keeps flowering on and off most parts of the year. This provides nectar to honey bees for a long period.

Fuel: The soft and light wood is an acceptable firewood for cooking but makes poor charcoal. It has a density of 0.5-0.7 and yields approximately 4600 kcal/kg.

Fibre: Bark, when beaten, produces a fibre used to make small ropes and mats. A study on the production of rayon-grade pulp from *M. oleifera* by a prehydrolyzed sulphate process in India shows that it is suitable as a raw material for the production of high alpha cellulose pulp for use in cellophane and textiles.

Timber: The wood is very soft and light and is useful only for light construction work.

Gum or resin: When the tree is injured, the stem exudes a gum that is used in calico printing, as a condiment, and for stomach and bladder ailments. The mucilaginous gum has a bland taste and belongs to the hog series of gums.

Tannin or dyestuff: Bark used for tanning hides and wood yields a blue dye.

Lipids: Oil extracted from the mature pods (oil of Ben) is yellowish, non-drying, good keeping qualities but eventually turns rancid. It is used as a lubricant, in cosmetics and perfumes, and to some extent is a substitute for sperm-whale oil.

Medicine: Moringa seeds are effective against skin-infecting bacteria *Staphylococcus aureus* and *Pseudomonas aeruginosa*. They contain the potent antibiotic and fungicide teriygospermin. The alkaloid spirachin (a nerve paralyser) has been found in the roots. Even when free of bark, the condiment in excess may be harmful. A decoction of the flowers is used as a cold remedy. The gum is diuretic, astringent and abortifacient and is used against asthma. Oil of Ben is used for hysteria, scurvy, prostate problems and bladder troubles. The roots and bark are used for cardiac and circulatory problems, as a tonic and for inflammation. The bark is an appetizer and digestive. The iron content of the leaves is high, and they are reportedly prescribed for anaemia in the Philippines.

Other products: In the Sudan, powdered seeds are deemed more effective than slices of okra (*Abelmoschus esculentus*) for treatment of bee honey; they can be used without boiling and can also be used to clarify sugarcane juice. The crushed leaves are used to clean pots and pans, and the Hausa and Yoruba of Nigeria even use them to clean walls.

SERVICES

Erosion control: *M. oleifera* is suited to areas where strong winds and long, dry spells occur simultaneously, causing serious soil erosion.

Soil improver: The green leaves make a useful mulch. The press cake left after oil extraction from the seeds can be used as a soil conditioner or as fertilizer.

Ornamental: The species is widely planted as an ornamental.

Boundary/barrier/support: Planted as a hedge in courtyards, *M. oleifera* provides wind protection, shade and support for climbing garden plants. Widely used for live fences and hedges in Kenya, Nigeria, Tanzania, India, and elsewhere. Stakes root easily and are stable, and cuttings planted in lines are used particularly around houses and gardens.

Intercropping: The tree provides semi-shade, useful in intercropping systems where intense direct sunlight can damage crops.

Pollution control: Suspension of the ground seed of *M. oleifera*, the benzolive tree, is used as a primary coagulant. It can clarify water of any degree of visible turbidity. At high turbidity, its action is almost as fast as that of alum, but at medium and low turbidity, good clarification is obtained if a small cloth bag filled with the powdered seeds is swirled round in the turbid water. To prepare the seed for use as a coagulant, remove the seed coat and wings. The white

kernel is then crushed to a powder, using a mortar or placing it in a cloth and crushing it with a stone. The powder should be mixed with a small amount of water, stirred, then poured through a tea strainer before being added to the turbid water.

TREE MANAGEMENT

Moringa is an extremely fast-growing tree, and within 1-3 months trees reach 2.5 m. Constant pruning of up to 1.5 m/year is suggested to obtain a thick-limbed and multibranched shrub. Trees are commonly grown for their leaves, and topping-out is useful to keep an abundant supply of leaves, pods and flowers within easy reach. *M. oleifera* responds well to mulch, water and fertilizer. Growth is stunted in areas with a high water table. It coppices and pollards well.

GERMPLASM MANAGEMENT

Seed storage behaviour is orthodox; viability can be maintained for several years in hermetic storage at 3 deg. C with 5-8% mc. Seeds should be collected from well-developed pods, but difficulties arise because seeds drop continually.

PESTS AND DISEASES

Root rot (*Diplodia* spp.) and papaya powdery mildew (*Leveillula taurica*) have been observed. The hairy caterpillar *Eupterote mollifera* causes defoliation but can be controlled by spraying the tree with fish oil, resin soap or BHC.

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SUGGESTED CITATION

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