Mangifera indica

L.

Anacardiaceae

LOCAL NAMES
Amharic (mango); Arabic (manga); Bengali (am); Burmese (thayet thayt-hypu,thar-yetthi,mempalam); Creole (mango); Creole Patois (margot); Dutch (maggo,kanjanna manja,manggaboom,manja,bobbie manja); English (mango); Filipino (paho,mango,mangga); French (manguier,mangue,margot,mangot); German (Mangoßaum); Gujarati (amri); Hindi (amb,mamidi,am,aam,marinamara,cutam); Indonesian (mempelam,mangga,ampelam); Khmer (svaay); Lao (Sino-Tibetan) (mwàngx); Luganda (muyembe); Malay (ampelam,taipa,mangga,mempelam); Mandinka (tubab duto,tubabuduto,duto); Nepali (Mango); Pidgin English (mango); Sanskrit (amra chuta); Sinhala (amba); Spanish (mangó,manga,manguira); Swahili (mwembe,muembe,maembe); Tamil (mau,mamaram,manga,mangas,ma,maa); Thai (mamuang,mammuang); Tigrigna (mangus); Vietnamese (xo[af]l,xoai)

The mango tree, Mangifera indica, at the end of the dry season in Burkina Faso. While everything else is dry at this time of the year, this tree is dark green and full of juicy fruits. (Robert Zwahlen)

M. indica fruits. (Chris Gardiner)

Grafted mango from Kodiaga Prison farm grown on farmers field in western Kenya (Anthony Simons)

BOTANIC DESCRIPTION
Mangifera indica is a large evergreen tree to 20 m tall with a dark green, umbrella-shaped crown. Trunk stout, 90 cm in diameter; bark brown, smoothish, with many thin fissures; thick, becoming darker, rough and scaly or furrowed; branchlets rather stout, pale green and hairless. Inner bark light brown and bitter. A whitish latex exudes from cut twigs and a resin from cuts in the trunk.

Leaves alternate, simple, leathery, oblong-lanceolate, 16-30 x 3-7 cm, on flowering branches, up to 50 cm on sterile branches, curved upward from the midrib and sometimes with edges a little wavy. Young leaves red, aging to shiny dark green above, lighter below, with yellow or white venation; petioles 4.5 cm long, striate and swollen at the base.

Inflorescence 16 cm or more in length, a much-branched panicle bearing many very small (4 mm) greenish-white or pinkish flowers. Flowers radially symmetrical, usually have 5 spreading petals, 3-5 mm long, 1-1.5 mm broad, streaked with red, imbricate, with the median petal prolonged like a crest at the base, finely hairy and fragrant, partly male and partly bisexual; stalk short; 5 stamens, 1 fertile, the other 4 shorter and sterile, borne in a disc. The flower has a conspicuous 5-lobed disc between the petals and stamens. Calyx yellow-green, very short, deeply 5-lobed; 5 sepals, each 2-2.5 mm long x 1-1.5 mm broad, green with whitish margin, or yellowish-green, hairy outside.

Fruit an irregularly egg-shaped and slightly compressed fleshy drupe, 8-12 (max. 30) cm long, attached at the broadest end on a pendulous stalk. The skin smooth, greenish-yellow, sometimes tinged with red. The underlying yellow-orange flesh varies in quality from soft, sweet, juicy and fibre-free in high-quality selected (clonal) varieties to turpentine flavoured and fibrous in wild seedlings. The single, compressed-ovoid seed is encased in the white fibrous inner layer of the fruit.

The generic name is derived from ‘mango’, the Indian name for the fruit, and the Latin ‘fero’ (‘I bear’).

BIOLOGY
Individual trees often flower irregularly; some trees do not flower for periods of 10-20 years, sometimes even longer. Flowering starts at the beginning of the rainy season and fruits ripen at the end of the rainy season. Bisexual and male flowers appear on the same cluster, in proportions that vary from 1:4 to 2:1. Evidence from various countries shows that some cultivars develop fruit without fertilization but that others need cross-pollination; the determining factors are not yet well understood. Pollinators are nectarivorous bats and insects such as flies, ants and possibly thrips, but bees are the most effective.

Rain and high humidity at blossoming reduce pollination and fruit setting. Usually only small proportions of the flowers develop into fruit. Hermaphrodite flowers are predominantly outcrossing and exhibit

protogynous dychogamy, but trees are generally self-compatible, and self-fertilization by pollen from the same flower is possible. It has been shown that 65-85% of hermaphrodite flowers remain unpollinated and that only 0.1-0.25% of them reach the harvesting stage, with fruit drop occurring at all stages. The time of development after fertilization to maturity of fruit is 2-5 months, depending on the cultivar and temperature. Fruiting is often biennial; some cultivars, in addition to the main fruiting seasons, set a few fruits throughout the year. The fruits are eaten and dispersed by bats, hornbills, porcupines, monkeys, elephants and humans.

ECOLOGY
The mango thrives in both the subtropics and the tropics. In the subtropics, the cold months ensure excellent floral induction, but late frosts are a major risk; tender parts of the tree are killed by frost. In the tropics, the mango grows anywhere up to 1200 m elevation, but for fruit production a prominent dry season lasting more than 3 months is necessary. A flowering flush is produced during the dry season, but—contrary to the subtropics—flowering is erratic and a yield-limiting factor. At elevations above 600 m in the tropics, the climate becomes too cool for the commercial cultivars, the optimum temperature being about 24-27 deg. C.

The trees are drought tolerant but do not seem to suffer from occasional flooding. Frequently found in coastal areas. Trees shade out grasses because of their thick crowns.

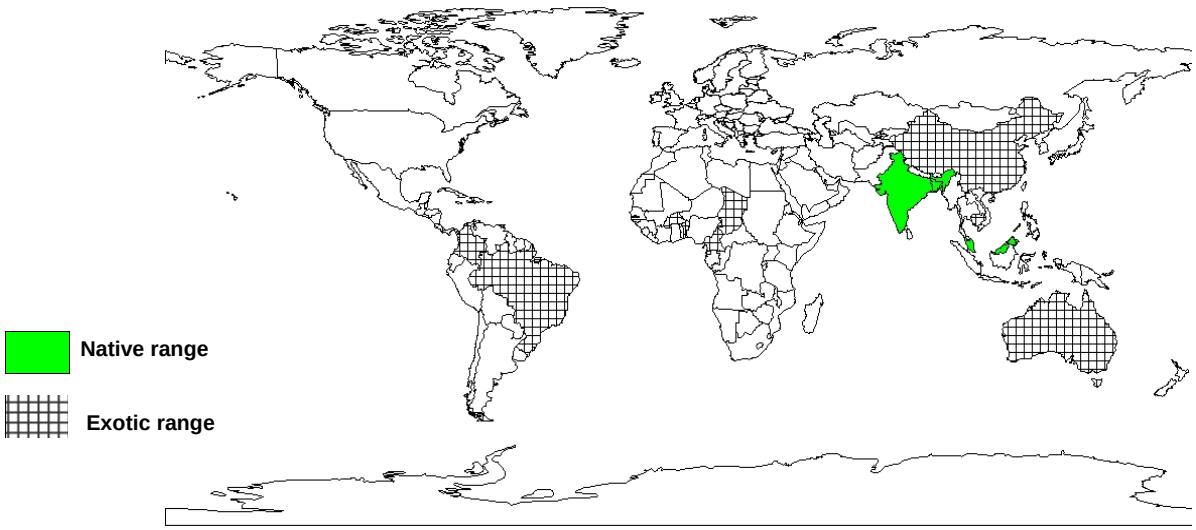
BIOPHYSICAL LIMITS
Altitude: 0-1200 m, Mean annual temperature: 19-35 deg. C, Mean annual rainfall: 300-2 500 mm

Soil type: Mango trees thrive in well-drained soils with pH ranging from 5.5 to 7.5 and are fairly tolerant of alkalinity. For good growth, they need a deep soil to accommodate the extensive root system.

DOCUMENTED SPECIES DISTRIBUTION

Native: Bangladesh, India, Malaysia, Myanmar

Exotic: Antigua and Barbuda, Australia, Barbados, Benin, Brazil, Burkina Faso, Cambodia, Cameroon, Chad, China, Colombia, Cote d'Ivoire, Cuba, Dominica, Dominican Republic, Eritrea, Ethiopia, Fiji, French Guiana, Gambia, Ghana, Grenada, Guatemala, Guinea, Guyana, Haiti, Honduras, Indonesia, Jamaica, Kenya, Laos, Liberia, Mali, Mauritania, Mexico, Nepal, New Zealand, Nicaragua, Niger, Nigeria, Pakistan, Panama, Papua New Guinea, Philippines, Puerto Rico, Samoa, Sao Tome et Principe, Senegal, Sierra Leone, Solomon Islands, Somalia, St Lucia, St Vincent and the Grenadines, Sudan, Surinam, Tanzania, Thailand, Togo, Tonga, Trinidad and Tobago, Uganda, Venezuela, Vietnam, Virgin Islands (US), 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: Mango is cultivated for the fruit, which can be eaten in 3 distinct ways, depending largely on the cultivar: unripe (mature green, very popular in Thailand and the Philippines), ripe (the common way to enjoy mango throughout the world), and processed (at various stages of maturity, in the form of pickles or chutneys, dried slices, canned slices in syrup, juice and puree or paste). The fruit is surrounded by golden, juicy flesh, rich in vitamins A and C. The green fruit is also used to flavour fish and meat dishes in the same way as tamarind and other sour fruits. In India, the kernels are important as a famine food, but the astringency has to be removed by boiling, roasting and soaking them for a long time. Young leaves are cooked as a vegetable.

Fodder: Mango leaves are occasionally fed to cattle, but large quantities can cause death. Seed kernels are a byproduct of processing; they can be used as feed for cattle and poultry.

Apiculture: M. indica is an important honey plant, secreting large quantities of nectar.

Fuel: With a calorific value of 4200 kcal/kg, the wood makes excellent charcoal and firewood.

Timber: Heartwood is pale yellowish-brown to reddish-brown, darkening on exposure, not clearly demarcated from the pale yellowish-brown sapwood. Grain somewhat wavy, texture moderately coarse; freshly cut wood is scentless. The wood is used for many purposes, including indoor construction, meat-chopping blocks, furniture, carpentry, flooring, boxes, crates and boat building (canoes and dugouts).

Tannin or dyestuff: Bark is the source of a yellowish-brown dye used for silk.

Poison: In sensitive individuals, ingestion of the fruit or skin contact with the juice may cause a rash like that of poison ivy.

Medicine: Charred and pulverized leaves make a plaster to remove warts and also act as a styptic. Seeds are used to treat stubborn colds and coughs, obstinate diarrhoea and bleeding piles. The bark is astringent, homeostatic and antirheumatic.

SERVICES
Shade or shelter: Its umbrella-shaped crown makes the mango tree a suitable shade for people and their livestock; it also acts as a firebreak.

Soil improver: Mango leaves improve soil fertility when used as mulch for crops.

Intercropping: Young mango is often interplanted with other fruits and vegetables, and the tree is a valued component of the traditional homegarden agroforestry system.

TREE MANAGEMENT
Irrigation in the 1st years after planting promotes flushing (and suppresses flowering), so that tree size increases quickly. Irrigation also widens the scope for intercropping, for example, with papaya, banana, pineapple or vegetables, during the establishment phase. When the trees are big enough to produce a substantial crop, irrigation is stopped, or at least interrupted long enough to impose quiescence leading to flower initiation. Trees of most cultivars have a dense canopy, and with a little weeding the orchard floor can be kept clean.

To ensure good, balanced and productive growth, the mango seedlings should be pruned. The main stem of the hardy trees is allowed to grow to 1 m before being topped to give well-distributed branches. In fruiting trees, pruning is confined to the removal of dead wood and branches broken or weakened by pests and diseases.

GERMPLASM MANAGEMENT
Seed storage behaviour is recalcitrant; there is complete loss in viability within 7 days in open storage at 30 deg. C. Viability can be maintained for 120 days with subimbibed seeds stored at 15 deg. C; no loss in viability of excised embryonic axes on fast desiccation to 11.8% mc. Seeds are damaged by chilling to temperatures below 3-6 deg. C. They require no pretreatment, but nicking enhances germination. Fresh seeds germinate at temperatures between 5 and 40 deg. C, with germination being most rapid between 25 and 40 deg. C. The germination rate of fresh stones is generally over 80%, with the normal rate ranging from 60 to 90%. Sowing complete fruit or stones with the pulp attached delays germination by up to 7 weeks, and germination rate is only 30-50%. Mature mango seeds have a high mc and cannot withstand desiccation; desiccation below 30% mc will kill them. Wet storage of stones at 15 deg. C is possible, but germinating seeds develop roots about 5 cm long and shoots about 8 cm long after 6 months. There are up to 50 seeds/kg.

PESTS AND DISEASES
Anthracnose (Glomerella cingulata, conidial stage Colletotrichum gloeosporioides) distorts and turns developing leaves black and disfigures developing fruit. The fungal infection may spread to fresh young growth. It can be controlled with bimonthly applications of copper spray or captan as a growth flush begins and until the flowers open; spraying is resumed when the fruit begins to form. The flower panicles, young fruit and leaves are subject to powdery mildew (Oidium mangiferae), especially in rainy weather or frequent fog. A spray of powdered kelp at bud break will often control it. Sodium bicarbonate and fungicide sprays are also effective. Other diseases include the flower malformation caused by Fusarium moniliforme and spread by mites, and bacterial canker, which is becoming a pressing disease problem.

A mealybug, Rastrococcus invadens, has recently invaded Africa, where it causes serious damage to mango and other crops. In the greenhouse, thrips often turn leaves rusty brown. Malathion is the conventional spray for insect pests; sulphur works on mites. A long-horn beetle (Rhytidodera simulans) bores into the trunk and thick branches; branches may be killed but the whole tree retains its viability. The larvae of the mango weevil (Cryptorrhynchus mangiferae) feed on the pulp and damage the fruit.

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