

Sclerocarya birrea ssp. caffra

marula

(Sond.) J.O. Kokwaro.

Anacardiaceae

LOCAL NAMES

Afrikaans (maroela); Arabic (el hamaidai, homeid); Bemba (musebe); English (marula); Hausa (dania); Lozi (muyombo, muongo, mulula); Nyanja (msewe, mgamu); Swahili (mng'ong'o, mng'ongo, morula, mgongo); Tigrigna (abengul); Tongan (muongo); Trade name (marula); Tswana (morula); Zulu (umGanu)

BOTANIC DESCRIPTION

Sclerocarya birrea ssp. caffra is a medium to large tree, usually 9 m tall, but trees up to 18 m have been recorded; it is single stemmed with a dense, spreading crown and deciduous foliage; the bark is grey and usually peels off in flat, round disks, exposing the underlying light yellow tissue; young twigs are thick and digitaliform with spirally arranged composite leaves at their ends; it has a thick, relatively short taproot reaching depths of 2.4 m, lateral roots branch at the upper 60 cm of soil; mycorrhizae (root fungus) are found on the fine roots.

Leaves 18-25 x 8-15 cm, composite, containing 2-23 leaflets, averaging 11; leaflets oblong elliptic with petioles ranging from very short to 20 mm in length.

Although male and female flowers occasionally occur on the same tree, it is considered dioecious. Male flowers are borne in groups of 3s on racemes below new leaves, dark red when young, turning pink or white when open. The female flowers are blood red but change colour from purple to white after opening. They occur below the leaves on long peduncles and consist of 4 curling petals, numerous infertile stamens and a long, shiny ovary.

Fruit borne in clusters of up to 3 at the end of the twigs and always on the new growth. Fruit a round or oval drupe, usually wider than it is long, with a diameter of 30-40 mm. The shape and number of nuts per stone determine the final shape of the fruit. Marula fruit has a thick, soft leathery exocarp with tiny, round or oval spots, enclosing a juicy, mucilaginous flesh that adheres tightly to the stone and can be removed only by sucking. The flesh tastes tart, sweet and refreshing, although the fruit has a slight turpentine-like aroma and can give off a very unpleasant smell when decaying. Each fruit contains an exceedingly hard seed, which is covered by fibrous matter. It is usually trilobular, but sometimes only bilobular. Each seed locule contains a single, light nut filling the entire cavity, which is sealed by a round, hard disk that protects the embryo until germination.

The name 'sclerocarya' is derived from two Greek words, 'skleros' and 'karyon', meaning 'hard' and 'nut', respectively, and refers to the hard stone of the fruit. 'Birrea' comes from 'birr', the common name for the tree in Senegal, and *caffra* from 'Kaffaria' (Eastern Cape, South Africa).

BIOLOGY

Most *S. birrea ssp. caffra* trees are dioecious, and the monoecious ones are predominantly male. The fruit is abscised when ripening commences so that final ripening takes place on the ground. In South Africa flowering occurs from September to November, and fruiting from January to March. Like many riverine species, it is dispersed by water streams and shows adaptation to water dispersal by having air spaces in the fruits.



S. birrea seeds after extraction (James Were)



S. birrea bark. (Roeland Kindt)



Variation in fruit colour. (Jumanne Maghembe)

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ECOLOGY

S. birrea ssp. *caffra* occurs in wooded grassland, riverine woodland and bushland and frequently on or associated with hills. It prefers a warm, frost-free climate but is also found at high altitudes where temperatures may drop below freezing point for a very short period in winter. The tree is frost sensitive and moderately drought resistant. Occasionally found in clear stands. *S. birrea* ssp. *caffra* is known to be highly salt tolerant: in Israel it grows vigorously when irrigated with salty water.

BIOPHYSICAL LIMITS

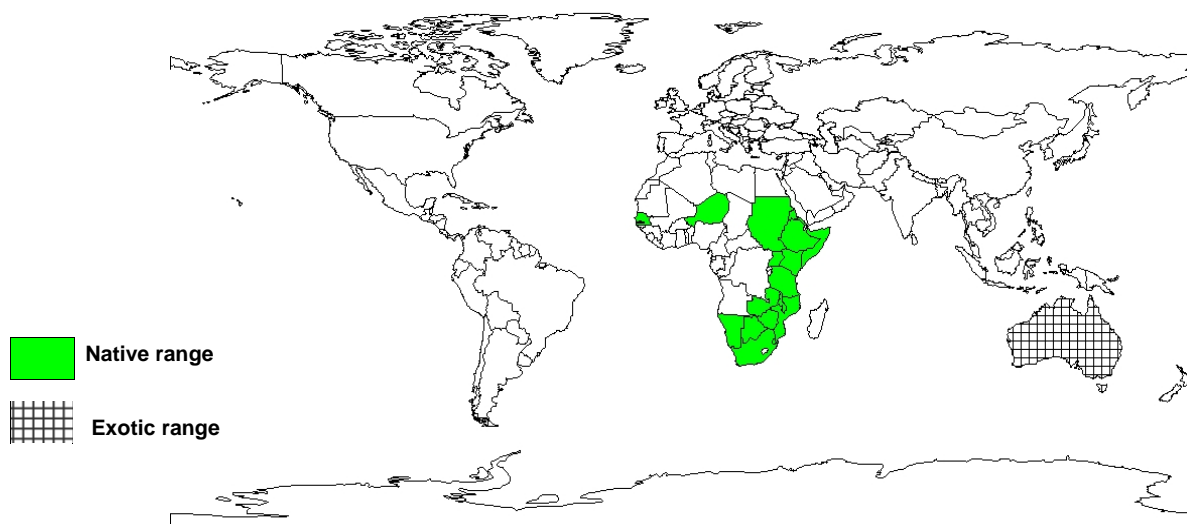
Altitude: 0-1 500 m, Mean annual rainfall: 0-1370 mm, Mean annual temperature: 19-35 deg.C

Soil type: Few specific requirements; on sandy or stony soils and on lateritic crusts.

DOCUMENTED SPECIES DISTRIBUTION

Native: Botswana, Democratic Republic of Congo, Eritrea, Ethiopia, Gambia, Kenya, Malawi, Mozambique, Namibia, Niger, Senegal, Somalia, South Africa, Sudan, Swaziland, Tanzania, Uganda, Zambia, Zimbabwe

Exotic: Australia, Israel



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: All parts of the fruit of *S. birrea ssp. caffra* are edible. The vitamin C content of the fruit is 54 mg/100 g, which is 2-3 times that of the orange. The seeds are high in fat (56-61%), protein (28-31%), citric acid (2.02 %), malic acids and sugar, phosphorus, magnesium, copper, zinc, thiamine and nicotinic acid. The pulp can be consumed raw or boiled into a thick, black consistency and used for sweetening porridge. The fruit is an excellent conserve and makes a delicious amber-coloured jelly. The flavour of *S. birrea ssp. caffra* has been described as pleasant, sour-sweet, guavali-like and tart.

The nuts, described as a delicacy, are commonly used to supplement the diet during winter or drought periods in countries such as Tanzania and Zambia, as the oil in the seed is rich in protein. Protein contents of 54-70% have been reported for de-fatted nuts. They are mixed with vegetables or meat or may be pounded and made into a cake before consumption.

Fodder: The fruits are eaten by cattle and goats and a wide variety of game animals, including elephants, which often behave drunkenly when the fruits ferment in their stomachs. Although the leaves are said to be slightly poisonous, in times of drought when there is no grazing, livestock owners will lop branches off the tree to use the leaves as fodder.

Fibre: A relatively good quality rope can be made from the inner bark.

Timber: Wood is light reddish-brown to whitish with no definite heartwood, soft and light (air-dry 560 kg/m³). As trees attain large diameters, the wood is preferred for mortars, pestles, bowls and various local crafts, saddles, furniture and heavy crates. In South Africa, commercial utilization of the wood was halted in 1962 when the tree was officially declared a protected species throughout the country.

Gum/resin: The gum that exudes from the tree is rich in tannin and is sometimes used in making ink by dissolving it in water and mixing in soot.

Tannin or dyestuff: Bark contains 20.5% tannin and some alkaloids.

Lipids: The nuts yield an oil with a quality and fatty acid composition comparable to olive oil but with a stability that is 10 times greater. A non-drying oil that burns like a candle comprises 56% of the seed. The walnut-like stone contains up to 6% edible oil (1 t of fruit yields 60 l of oil), which is occasionally sold on the local market. The oil from the seeds has preservative properties and, if dried and stored in a cool place, meat treated with it is said to keep up to 1 year. Zulu women of South Africa use the extracted oil as a cosmetic.

Alcohol: A popular, fermented alcoholic beverage is prepared from the ripe fruit. The yeast occurring naturally in the fruit is normally used for spontaneous fermentation. This beverage, commonly known as marula beer, has approximately twice as much ascorbic acid as orange juice and thus is an excellent anti-scorbutic. The juice is also used to manufacture liqueur.

Poison: There are claims that the fruit may be used as an insecticide as well as a germicide. Among the Zulu, the fruit is used as an acaricide.

Medicine: Bark of *S. birrea ssp. caffra* is used to treat a variety of ailments, notably fever, boils and diarrhoea. Together with butter, it is applied as an ointment for headache and pains of the eyes. It is claimed that blood circulation is aided by a steam bath of extracts of *S. birrea ssp. caffra* mixed with extracts from other plants and roots. Steam from the bark is also used to treat eye disorders. Bark decoction, when mixed with other medicinal plants, treats various infections such as malaria, syphilis, leprosy, hydrophy, dysentery, hepatitis and rheumatism, and is a laxative. It is also used internally and externally as a prophylactic against gangrenous rectitis. Leaves, bark and roots are used externally (as a rub) for snakebite, and internally (as a beverage) for toothache. It has occasionally been used in veterinary medicine.

Other products: The tree is a host to the edible mopane caterpillar.

SERVICES

Shade or shelter: *S. birrea ssp. caffra* can be used most successfully as a shade tree in the garden or park and to line streets.

Boundary or barrier or support: Cuttings and truncheons strike readily and *S. birrea ssp. caffra* can be used to make a live fence.

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TREE MANAGEMENT

Truncheons 100-150 mm in diameter and 2 m long can be planted. One of the fastest growing trees in South Africa with a growth rate of up to 1.5 m/year. Coppicing is a suitable practice.

GERMPLASM MANAGEMENT

Orthodox seed storage behaviour, although viability is lost in 1 month in open storage. Seeds store well in air-dry storage at cool temperatures. There are approximately 400 seeds/kg.

PESTS AND DISEASES

Psyllid mites are the major pest problem affecting both wild trees and nursery stock. Severe infections have been observed on wild trees but the harvests do not seem to be significantly affected. Aphids, white flies and thrips can also become endemic in the nursery, but spraying with dichlorophos or malathion can control them. Wood, if not treated, is susceptible to borer and termite attack.

S. birrea ssp. *caffra* is liable to sap-stain fungi and other more harmful fungal attacks. Normally the wood of the tree is pinkish-white to light red, sapwood and heartwood being much alike; through fungi and beetle attacks, it is liable to blue discoloration. Powdery mildew can be prevalent under humid conditions and can quickly spread to all seedlings in a nursery net house. Control is achieved by spraying with copper oxychloride.

FURTHER READING

Beentje HJ. 1994. Kenya trees, shrubs and lianas. National Museums of Kenya.

Bein E. 1996. Useful trees and shrubs in Eritrea. Regional Soil Conservation Unit (RSCU), Nairobi, Kenya.

Chirwa PW, Akinnifesi FK. 2008. Ecology and biology of *Uapaca kirkiana*, *Strychnos cocculoides* and *Sclerocarya birrea* in Southern Africa: In: Akinnifesi FK, Leakey RRB, Ajayi OC, Sileshi G, Tchoundjeu Z, Matakala P, Kwesiga FR. 2008. Indigenous fruit trees in the tropics: domestication, utilization and commercialization. Wallingford: CAB International. p. 322-340.

Coates-Palgrave K. 1988. Trees of southern Africa. C.S. Struik Publishers Cape Town.

Dale IR, Greenway PJ. 1961. Kenya trees and shrubs. Buchanan's Kenya Estates Ltd.

Goldsmith B, Guter DT. 1981. The indigenous timbers of Zimbabwe. Forestry Commission

Hong TD, Linington S, Ellis RH. 1996. Seed storage behaviour: a compendium. Handbooks for Genebanks: No. 4. IPGRI.

Katende AB et al. 1995. Useful trees and shrubs for Uganda. Identification, Propagation and Management for Agricultural and Pastoral Communities. Regional Soil Conservation Unit (RSCU), Swedish International Development Authority (SIDA).

Leakey RRB. 1997. Potential for novel food products from agroforestry trees. Institute of Terrestrial Ecology. Scotland, UK.

Maghembe JA et al. 1994. Improvement of indigenous fruit trees of the Miombo woodlands of southern Africa. Proceedings of a conference held on 23-27 January 1994 Mangochi, Malawi.

Mbuya LP et al. 1994. Useful trees and shrubs for Tanzania: Identification, Propagation and Management for Agricultural and Pastoral Communities. Regional Soil Conservation Unit (RSCU), Swedish International Development Authority (SIDA).

Nagy S, Shaw PE, Wardowski WF (eds.). 1991. Fruits of tropical and subtropical origin: composition, properties and uses. Florida Science Source, Inc. Lake Alfred, Florida.

Peter CR. 1988. Notes on the distribution and relative abundance of *Sclerocarya birrea* (A. Rich.) Hochst. (Anacardiaceae). Monogr. Syst. Bot. Missouri Bot. Gard. 25:403-410.

Storrs AEG. 1995. Know your trees: some common trees found in Zambia. Regional Soil Conservation Unit (RSCU).

Venter F, Venter J-A. 1996. Making the most of Indigenous trees. Briza Publications.

Vogt K. 1995. A field guide to the identification, propagation and uses of common trees and shrubs of dryland Sudan. SOS Sahel International (UK).

von Maydell HJ. 1986. Trees and shrubs of the Sahel - their characteristics and uses. GTZ 6MBH, Eschborn.

SUGGESTED CITATION

Orwa C, Mutua A, Kindt R, Jamnadass R, Simons A. 2009. Agroforestry Database: a tree reference and selection guide version 4.0 (<http://www.worldagroforestry.org/af/treedb/>)