**Morus spp.**

**Scientific name**
Morus spp. L. (M. alba, L., M. nigra L. and M. rubra L.)

Most of the cultivated varieties are white mulberry (Morus alba L.), black mulberry (M. nigra L.), Indian mulberry (M. indica) and in North America the American or red mulberry (M. rubra L.). Hybrid forms exist between Morus alba and M. rubra and others. There are many other species: Korean mulberry (Morus australis), Himalayan mulberry (M. laevigata).

**Family/tribe**
Family: Moraceae.

**Common names**
mulberry, common mulberry, silkworm mulberry (English); morera o mora (Spanish); morera (Portuguese); morier (French).

**Morphological description**
The common mulberry is a handsome deciduous tree, 10–25 m tall, of rugged, picturesque appearance, forming a dense, spreading head of branches usually wider than the height of the tree, springing from a short, rough trunk. The form of the tree can vary from pyramidal to drooping. The simple, alternate, stipulate, petiolate, light green leaves are constant at the base but very variable in form, even on the same tree; some are unlobed while others may be almost palmate. Flowers are unisexual, borne in the axils of leaves or on spurs on separate spikes, or catkins, which are small, more or less cylindrical and trees may be monoecious or dioecious. Fruits are collective, fleshly, white, lavender, deep red to black.

**Distribution**
Native to: Asia.
Other: It has now spread from the temperate areas of northwest and central Asia, Europe and North America, through the tropics of Asia, Africa and Latin America, to the southern hemisphere (southern Africa and South America). There are mulberries used in environments, from sea level to altitudes of 4,000 m, and from the humid tropics to semi-arid lands. In the Near East with 250 mm of annual rainfall and southwest of the USA, mulberry is also produced under irrigation.

**Uses/applications**
Mulberry leaves have been used as the feed for the silk worm. There is evidence that sericulture started about 5,000 years ago and hence the domestication of mulberry. The main use of mulberry globally is as feed for the silk worm, as feed for the silk worm, but depending on the location, it is also appreciated for its fruit (consumed fresh, in jam or as preserves); as a delicious vegetable (young leaves and stems), for its medicinal properties in infusions (mulberry leaf tea), for landscaping and as animal feed. There are several places where mulberry is utilised traditionally as a feed in mixed forage diets for ruminants. The berries, called sorosis, have been used in traditional fabric dyeing. Purple and red are common colours produced with mulberry. It is traditionally used to dye wool.

Mulberry is well suited for use as a fodder where it can be grown opportunistically around house compounds, on spare pieces of land and along field edges. Integration of fish, livestock, and crop production in China has been redefined for over 2,000 years. The system recycles resources, reduces organic pollution (livestock and poultry manure is good organic fertilizers for fish farming), and combines fish farming with mulberry cultivation for raising silkworms. The silkworm pupae are used as fish feed, and the worm faeces and wastewater from silk processing as pond fertilizers. Pond silt is used as fertilizer for fodder crops, which can in turn be used to feed livestock, poultry, and fish.

**Feeding value**

**Nutritive value**
One of the main features of mulberry as forage is its high palatability. Small ruminants avidly consume the fresh leaves and the young stems first, even if they have never been exposed to it before. Then, if the branches are offered unchopped, they might tear off and eat the bark. Cattle consume the whole biomass if it is finely chopped. Animals initially prefer mulberry to other forages when they are offered simultaneously, and even dig through a pile of various forages to look for mulberry.

**Palatability/acceptability**
There have been no report to toxicity and only too few cases of bloating with cattle in Japan.

**Toxicity**

**Production potential**

**Dry matter**
There is a report of ad libitum dry matter intake of 4.18% of liveweight (average of three lactating goats), which is much higher than in other tree fodder, the dry matter intake of mulberry leaves of 3.44% of body weight in sheep under experimental conditions. Goals can produce between 15,000-25,000 kg of mulberry leaves in mulberry based feeding systems. In a comparative study, high daily dry matter intake of mulberry leaves were seen in sheep in goats (3.55 vs. 2.74 kg DM/100kg body weight). In Costa Rica, live weights of bulls belonging to the Romosinuo breed (a criollo type) fed elephant grass, increased to over 900 kg/day when mulberry was offered as a supplement at 1.7% of their body weight on a DM basis. Growing Zeus x Baven Swiss steers were fed increasing levels of mulberry as supplement to a sorghum slage diet. Although the growing rates with the highest mulberry diet level are not impressive (199 g/day), most likely due to the poor quality of the slage, this shows the high nutritive value of the supplement. Other small herbivores, like guinea pigs, guanacos and shrews, could also be fed mulberry leaves. In fact, wild green iguanas (iguana iguana) came to feed on recently established mulberry fields in Costa Rica. A combination of mulberry and Trichantera gigantea leaves, as the protein source, and blocks made of molasses, cassava root meal and rice bran, as the energy source, gave better reproduction and growth performance than a diet of commercial concentrates and grass supplemented Angora rabbits, receiving pelleted diets, with mulberry leaves ad libitum and obtained intakes of mulberry equivalent to 29.38% of the total intake. This level significantly reduces feed cost. Fed mulberry leaves as the sole ration for adult rabbits. They found daily intakes of 68.5g for dry matter, 11.2g for crude protein and 175 kcal for digestible energy (equivalent to 28.3% of digestible energy per kg). The digestibility values were 34% for crude protein, 53% for crude fibre and 64% for dry matter. The authors concluded that mulberry leaves provided enough nutrients for maintenance. Shade-dried M. indica leaf meal in the mash of laying hens has been found to improve egg yolks colour and to increase egg size and production with the inclusion up to 6%) in laying hens.

**Animal production**
The diploid M. alba (2n = 2x = 28) is the species most widely spread, and polyploid varieties, which originated in various research stations in Asia, show greater leaf yields and quality. In general, polyploid varieties have thicker and larger leaves with darker green colour, and produce more leaves. Triploid varieties have been found especially among Morus bombycina Kozi. M. cathayana Hemsl. has tetraploid, pentaploid and hexaploid varieties. Both M. avernaria Roch., indigenous to India, and M. nilakaka Makino, originally from Japan and Korea, are known to be hexaploid. M. bommini Kozi is a tetraploid being endangered due to cross contamination with M. acutifolia Griff. M. nigra L. is decaploid (2n = 308), the largest number of chromosomes among phanerogams. They are wind pollinated and some cultivars yield fruit without any pollination. Cross-pollination is not necessary. Male catkins are generally longer than female ones and are loosely arranged; after shedding pollen they die and drop off. The juicy drupelets formed by the individual flowers on the catkin combine to form a sorosis, the characteristic mulberry fruit.

**Genetics/breeding**
Fruits are picked or shaken on sheets when ripe. Mulberry seeds should be removed from the ripe fruit as soon as ready by squashing with plenty of water to separate seed from pulp. The seed can be dried and planted as they will germinate. They have been planted only to a limited extent in America, mostly on the Pacific Coast. The mulberry makes a good town tree, which will grow well in a tub.

**Other comments**
Selected references


Internet links

Cultivars | Country/date released | Details
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'Black Persian' | USA | Large black fruit, over 25 mm long and almost as wide. Resistant to blight.
'Collier' | USA | Medium-sized, purplish-black fruit, 30 mm long and 10 mm in diameter. Flavor sweet, with just a trace of tartness. Quality very good, on par with 'Illinois Everbearing'. Ripens over a long period. Tree of medium size, spreading, relatively hardy, very productive.
'Downing' | USA | The original 'Downing' was a M. alba var. multiflora plant grown from seed sown about 1846. The fruit was black with excellent flavor and ripened from June to September.
'K.M.' | India | West Bengal selection which gives 50% more leaves than local types, and is popular in Mysore for grafting purposes.
'Pakistan' | USA | Originated in Islamabad, Pakistan. Extremely large ruby-red fruit 65-90 mm long and 10 mm in diameter. Flesh firmer than most other named cultivars. Sweet with a fine balance of flavors. Quality excellent. Tree spreading with large heart-shaped leaves. Recommended for the warmer areas.
'Russian' | USA | Introduced into Europe from China about 1,500 years ago. Fruit reddish-black, of good quality when completely ripe. Tree bushy, to 10 m tall, very hardy and drought resistant. Used as a rootstock. Planted widely for windbreaks and wildlife food.
'Shangri-La' | USA | Originated in Naples, Fla. Large, black fruit. Good mulberry for warmer areas but hardy. Tree has very large, heart-shaped leaves.

Promising accessions

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Coppiced plants in Cuba.
Foliage and fruits.
Goat grazing coppiced plants.
Coppiced plants growing with trees of Erythrina sp. In Costa Rica.
Growing with a leguminous groundcover.
High palatability value is suitable for ral and semi-arid areas.