

MORINGACEAE Martinov

- Drumstick Tree Family

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Trees or shrubs; glabrous or puberulent; roots tuberous [massive, fibrous, or shrubs canelike with underground tubers], (producing glucosinolates and isothiocyanates, especially in roots and leaves; strongly odoriferous). **Stems** erect to pendent; unbranched [branched]. **Leaves** (drought-deciduous) alternate, (imparipinnate), compound; stipules present (glandular); petiole present; leaflets opposite, blade margins entire. **Inflorescences** axillary, paniculate, with (2–)3–4(–5) orders of branching; bracts (and bracteoles) usually present (glandular). **Pedicels** present. **Flowers** strongly zygomorphic [nearly actinomorphic]; perianth and androecium perigynous; sepals 5, distinct; petals 5 (bannerlike petal borne abaxially), distinct; stamens 5, opposite petals (inserted on rim of hypanthium); staminodes [3–]5, similar to filaments, alternate with stamens; anthers monotheal, bisporangiate; ovary 3-carpellate, 1-locular, (on gynophore); placentation probably marginal (sometimes interpreted as medial); ovules anatropous; style 1 (hollow, with a gaping stigmatic aperture). **Fruits** capsular, valvate, laxly dehiscent, fibrous. **Seeds** 10–35, brown, globular, winged or not; cotyledons oily.

Genus 1, species 13 (1 in the flora): introduced; sw Asia, sw, ne Africa, Indian Ocean Islands (Madagascar); introduced also pantropically.

Moringaceae are closely related to Caricaceae, with which they share glandular appendages at the apex of the petiole.

The bark of Moringaceae is conspicuous with bundles of phloem, schizogenous gum ducts are present in the pith and also on trauma in the bark, and exudes a straw- or pinkish-colored gum. The wood is white or yellowish and the plants are fibrous to mostly parenchymatous.

SELECTED REFERENCES Olson, M. E. 2002. Intergeneric relationships within the Caricaceae-Moringaceae clade (Brassicales), and potential morphological synapomorphies of the clade and its families. *Int. J. Pl. Sci.* 163: 51–65. Olson, M. E. 2002b. Combining data from DNA sequences and morphology for a phylogeny of Moringaceae. *Syst. Bot.* 27: 55–73. Olson, M. E. 2003. Developmental origins of floral bilateral symmetry in Moringaceae. *Amer. J. Bot.* 90: 49–71. Verdcourt, B. 1985. A synopsis of the Moringaceae. *Kew Bull.* 40: 1–23.

1. MORINGA Adanson, Fam. Pl. 2: 318, 579. 1763 • [Tamil *murungai*, twisted pod, alluding to young fruit] I

Trees or shrubs, [massive pachycauls, baobab-like with water-storing trunk], slender-trunked. **Leaves:** stipules with nectaries at growing tip; rachis articulation with stalked glands; [1-pinnate](2-)3-4(-5)-pinnate; leaflet blade membranous [subcoriaceous], [lanceolate, oblanceolate, linear] round or oval, venation sometimes conspicuous abaxially, apex glandular, surfaces [pubescent] puberulent or glabrous. **Flowers:** parts usually with hairs forming a barrier distal to the nectariferous hypanthium; 1 sporangium initiated in anther ontogeny. **Capsules** 2-valved, often constricted between seeds. **Seeds** [1]2-3 cm, winged [not winged], sometimes with spongy seed coat, shed by gravity. $x = 11$.

Species 13 (1 in the flora): introduced; Asia (Bangladesh, India, Oman, Pakistan, Saudi Arabia, Yemen), sw, ne Africa, Indian Ocean Islands (Madagascar); introduced also pantropically.

Little is known about breeding systems in *Moringa*; *M. longituba* Engler appears incapable of self-pollination, and flowers with sterile anthers have been reported in *M. concanensis* Nimmo ex Dalzell & Gibson. All species are used medicinally locally; *M. stenopetala* (Baker f.) Cufodontis is used as a leaf vegetable in northwestern Kenya and southwestern Ethiopia.

1. **Moringa oleifera** Lamarck in J. Lamarck et al., Encycl. 1: 398. 1785 • Drumstick or horseradish or Ben tree F I



Guilandina moringa Linnaeus, Sp. Pl. 1: 381. 1753; *Hyperanthera moringa* (Linnaeus) Vahl

Plants 1-10 m, to 40 cm diam. **Roots** tuberous when young, woody with age. **Bark** pale gray or tan, smooth or finely rugose. **Stems** often canelike, becoming pendent with age,

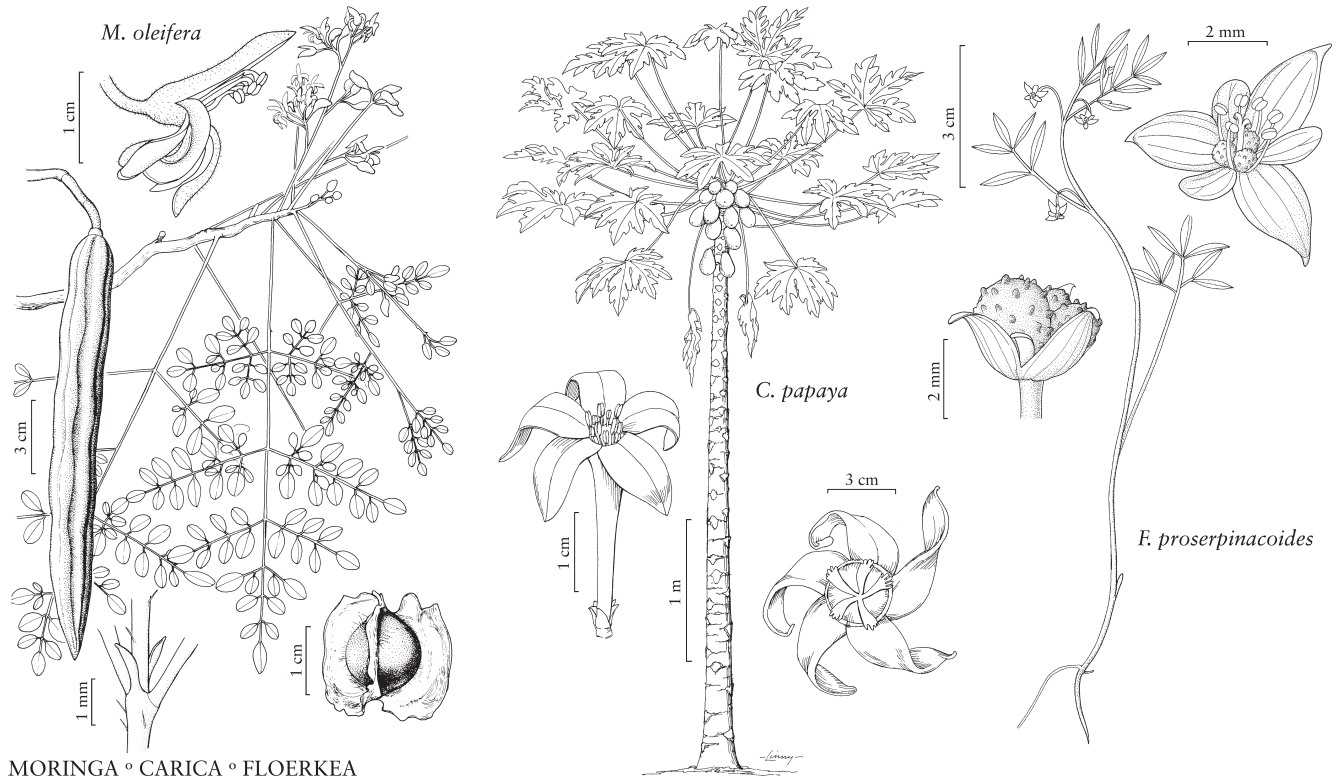
glabrous or finely puberulent. **Leaves** with pungent odor of horseradish; 30-60 cm, leaflets distributed on 4-8 pairs of pinnae; pinnae largest near base of leaf, 2 or 3 pinnate; leaflets 75-150, distalmost pairs represented by pairs of single leaflets along main rachis; blades bright to dark green, (0.5-)1-2(-3) × (0.3-)0.5-1.5(-2) mm, base rounded to cuneate, apex rounded to emarginate, glands 3-5 mm (smaller at blade apex). **Panicles** (5-)10-25(-35) cm, each flower subtended by glandular bract. **Pedicels** 5-10(-20) mm; bracteoles 2. **Flowers** sweet-scented, 2-3 cm; sepals 10-20 × 3-4 mm, proximal ones usually reflexed, usually puberulent, distalmost pair usually largest, ± erect, enclosing banner petal, or ± reflexed; petals cream, 1-2 cm, distalmost banner petal ± erect, others usually ± reflexed; filaments

and staminodes 7-10 mm, basally pubescent, adherent distally proximal to banner petal and anthers in a 3-tiered presentation; receptacle cup-shaped, 3-4 mm; gynophore 2-3 mm, appressed to banner petal; ovary 3-5 mm, with 3 ridges. **Capsules** tan, 10-30(-55) × 1.5-3 cm, apex beaked, 3 (or 4)-angled; valves silvery inside. **Seeds** pale to dark brown, globular, 3-winged; cotyledons exuding oil when compressed.

Flowering when leafless at end of dry season, fruiting as leaves emerge. Roadways, disturbed areas; 0-1000 m; introduced; Ariz., Calif., Fla.; Asia (India); introduced widely elsewhere.

Moringa oleifera is probably native to lowland dry tropical forests of northwestern India; recent collection information is lacking. It is cultivated in tropical countries as an ornamental and agricultural crop. It is occasionally reported as re-seeding along roadways and in other disturbed areas; there are no reports of *M. oleifera* invading intact habitats.

Moringa oleifera is often mistaken for a papilionoid legume or for a member of the Bignoniaceae. It is easily distinguished from both by stalked glands at the leaf base and at rachis articulations and by its pungent horseradish odor. The three-valved fruits with three-winged seeds also readily distinguish *M. oleifera* from both of those families. All parts of the plant are of economic importance: leaves are highly nutritious, flowers are edible, seeds contain large quantities of



high-quality oil, and presscake remaining after oil extraction contains one of the most powerful plant-derived flocculants known, used for clarifying turbid water. Roots are used as a horseradishlike condiment. *Moringa oleifera* is extremely fast growing (to 7 m in

first year from seed), with fruit yields ca. 10 tons/ha/yr.

Moringa pterygosperma Gaertner is a commonly cited synonym of *M. oleifera*. However, the name is illegitimate as it is based on *Guilandia moringa*.