

# *Terminalia catappa* L.

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## COMBRETACEAE (COMBRETUM FAMILY)

*Catappa domestica* Rumph. (Herbarium Amboinense 1:174-176, t. 68; 1741); *Terminalia badamia* sensu Tul. (Annales des Sciences Naturales, Botanique, ser. 4, 6: 92; 1856); *Terminalia rubrigemnis* Tul. (Annales des Sciences Naturales, Botanique, ser. 4, 6: 102; 1856)

Almendra, almendra de playa, badam, Barbados almond, Indian almond, ketapang, talisai, wild almond (Chudnoff 1984, Perrier de la Bathie 1954, Tulasne 1856)

*Terminalia catappa* is a tropical species that is widely distributed in the Indo-Malayan region, extending to the Philippines; it has been widely planted throughout the Tropics, often becoming naturalized (Chudnoff 1984). It is found primarily along the coastal lands forming part of the littoral woodland community.

The species is a fast-growing, medium-sized, deciduous tree that reaches 12 to 25 m in height and 60 to 70 cm d.b.h. (Perrier de la Bathie 1954). The bole is quite straight, asymmetrical, and frequently grooved in the basal third. The axis is monopodial; the branches arising at the end of each growth flux are sympodial and plagiotropic, forming a pagoda crown (Hallé and others 1978). The bark is thin (0.9 cm), dull, and grayish brown with vertical fissures. Internally, it is yellowish. It has a fibrous texture and a slightly bitter taste. Phyllotaxy is spiral; internode reduction leads to spur shoot formation at the branch end. Leaves are petiolate, simple, exstipulated, coriaceous, obovate or oblanceolate, with entire margin, acuminate apex, and attenuate base. There are numerous abaxial domatia. In some parts of the geographic range, the tree loses its leaves twice a year; they turn yellow and then red as they senesce (Tomlinson 1986). The tree grows in sandy, clay, or poor soils, although it reaches its best growth in sandy soils. The species grows well at elevations of 0 to 1200 m.

The sapwood is pale yellowish in green condition, and the heartwood is darker; in dry conditions the sapwood is yellowish brown, and the heartwood is brownish yellow or reddish. The wood oxidizes rapidly when exposed to air and light. It has straight or interlocked grain, medium to high luster, medium texture; it is odorless and tasteless. The wood is heavy (green weight 1000 to 1020 kg per m<sup>3</sup> with 50 to 61 percent moisture content; basic specific gravity is 0.48 to 0.62). The timber is of good quality and has good physical and mechani-

cal properties (Longwood 1971). Drying is rapid with a moderate amount of warping and little or no checking (Chudnoff 1984). Shrinkage, green to oven-dry, is: radial 4.5 percent, tangential 5.7 percent, volumetric 10.3 percent (Chudnoff 1984). The timber saws and machines easily but torn and fuzzy grain is common in planing, shaping, and turning; it sands to a fairly good surface (Chudnoff 1984). Natural durability varies with origin, but it is classified as perishable. Resistance to fungal attack is moderate, but it is very susceptible to dry-wood termite attack (Chudnoff 1984). Sapwood absorption of preservative oils is obtained using an open-tank treatment (Chudnoff 1984). The timber can be used in general light construction, furniture, cabinetwork, flooring, beams, decorative veneers, parquet, barrels, and railroad ties. *Terminalia catappa* is used primarily as an ornamental, shade, and salt-tolerant street tree, but the leaves provide food for the Tasar silkworm, and the seeds are edible like almonds with similar oils (Hutchinson 1969, Lawrence 1969, Mabberley 1997, Schery 1963). Fruits, roots, and bark are used as a source of myrobalan, a tannin used in blends for calf, goat, and sheepskin tanning (Mabberley 1997, Schery 1963).

Blooming occurs from November through March, with variations at the beginning and conclusion of the flowering period along the geographic range of the species. The tree is andromonoecious and the inflorescences arise from the axil of spur shoot leaves (Tomlinson 1986). Flowers are male or perfect, borne in axillary spikes; male flowers are distal while perfect flowers are proximal. Male flowers lack any conspicuous pistillode; perfect flowers include a well-developed ovary (Tomlinson 1986). Flowers are epigynous and shortly pedicellate. The calyx (in both types) is pentamerous, lobed, gamosepalous, tubular, creamy, whitish, or yellowish. In perfect flowers,

it is fused to the androecium and gynoecium in the basal third. The distal free third is cupuliform; calyx lobes are deltoid and pubescent in both surfaces. The androecium has 10 stamens distributed in two whorls; the external whorl alternates with the sepals while the inner verticil is opposite from the sepals. The gynoecium is unilocular, with two anatropous, bitegmic, crassinucellate ovules; placentation is suspended. Fruits ripen from January through April, although regional variations occur. The fruit is short pedicellate and almond shaped, 5 to 7 cm long, with a shallow lateral ridge. The exocarp is shiny and coriaceous; the mesocarp, fleshy and fibrous; and the endocarp, woody. The sea, bats, rodents, monkeys, and some large birds disperse the fruits.

The seed is enclosed by the fibrous endocarp. It is cylindrical-oblongate or cylindrical-elliptic and has a long funiculus. The seedcoat is dull and whitish and is formed by the testa and tegmen. The embryo contained in the walnut-like fruit has a good flavor resembling the hazelnut (*Corylus* spp.) (Schery 1963). The period of seed viability is unknown.

Germination is hypogeal and the seedling is cryptocotylar. Under greenhouse and nursery conditions, germination is gradual. The radicle emerges at 65 to 75 days. Seedling survival in the nursery is about 90 percent.

Fruits must be sown in boxes filled with sand, germination beds, or bancales. They require moderate shade and constant moisture. The seedlings must be transplanted to plastic bags before the first eophyll extends. Soil fertilization or application of foliar nutrients increases seedling growth and vigor. The seedlings can be transplanted 8 to 12 months after germination. Seedlings and saplings must be transferred to the field in adobe.

Leaf venation is eucamptodromous. The midrib is thick with a straight course, and projects abaxially; the secondary veins have an acute angle of divergence with respect to the midvein. The leaf is hypostomatic; stomata are anomocytic. The foliar ptyxis is conduplicate; leaf size and shape vary within a given tree or spur shoot. The abaxial surface bears domatia.

Stamen filaments are 2.0 to 2.5 mm long; they are filiform, glabrous, and whitish. The anthers are subglobose, small (0.3 to 0.4 mm long), extrorse, dorsifixed, and yellow; anther dehiscence is longitudinal. Pollen is abundant and liberated in monads. An annular nectariferous disc surrounds the style; its secretion is slightly sugary. The style is thin and glabrous; the stigma is truncate, glandular, hollow, and yellowish.

The mature seed is exospermic and lacks perisperm. The endosperm is nuclear and is absorbed during embryo development. The embryo is conspicuous, oblong, and whitish. It is straight and has contorted, foliar cotyledons. Although the ovary has two ovules, only a single ovule develops, is fertilized, and forms a seed.

After 8 to 9 days, the hypocotyl begins its development, the endocarp valves open, and the cotyledons emerge. Cotyledons are reniform, pedicellate, green, and foliaceous; as soon as they are outside they begin to grow and continue growing for several days. They remain attached to the seedling for more than 3 months; abscission takes place at the petiole base. The first flux of growth ends at 6 months and the first fan of plagiotropic lateral branches is produced.

