



Cananga odorata
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Cananga odorata (LAM.) HOOK. F. & THOMS., 1855

syn.: Canangium fruticosum CRAIB; Canangium odoratum (LAM.)
BAILL. ex KING; Canangium scortechinii KING;
Unona leptopetala DC.; Unona odorata (LAM.) BLUME;
Uvaria odorata LAM.

Ylang-ylang-Baum,
Ilang-ilang, Ylang-ylang

Family: Annonaceae

Bahasa Indonesia: Kernanga

Burmese: Sagasein, kadatngan, kadatnyan

Malay: Bungan sandat (Bali), chenanga,
kananga, kenanga utan

Tagalog: Ilang-ilang, alang-ilang

Thai: Fereng, kradang nga Thai



Fig. 1: Cananga odorata branchlet with flowers, Bot. Garden Singapore.

picture: Ulla M. Lang

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Fig. 2: Approximate native range of *Cananga odorata* native range

Cananga odorata, widely known as Ylang-ylang, is a fast-growing, medium-sized tree indigenous to lowland and lower montane tropical forests of the Indo-Pacific region. It is cultivated throughout the tropics and subtropics in gardens for its exceptionally fragrant flowers, from which are distilled essential oils used in perfumes, soaps, shampoos and other cosmetic products, foods, and aromatherapy. The Comoro Islands and Madagascar are major producers of ylang-ylang oil, accounting for an estimated 80 % of global production. In addition to its value as an ornamental and source of ylang-ylang oil, it is valued in its Indo-Pacific range for its medicinal uses, the essential oil and other parts of the plant being used in traditional systems of medicine to treat a variety of ailments.

Distribution

While the center of origin of *C. odorata* is not precisely known, the species is generally thought to be indigenous to the Indo-Malayan region, including southern Myan-

mar (Burma), Malaysia, Indonesia, the Philippines, northern Australia, and Malesia [4]. It has been introduced and cultivated throughout the tropics and subtropics usually as an ornamental tree in gardens. It has become naturalized in southern India and in many island countries of the Indian and Pacific Oceans from Madagascar to Sri Lanka and from the Mariana and Caroline Islands to Fiji and New Caledonia eastwards to French Polynesia, as well as in southern China and Taiwan [4]. It was also introduced to the Caribbean region, including Cuba, Hispaniola, Puerto Rico, the Virgin Islands, and Guadeloupe, where it is reported to be naturalized. More recently, ylang-ylang has been introduced to Central America and tropical countries of South America [12]. Many of the introductions in the Pacific and Indian Ocean regions apparently pre-dated the arrival of Europeans, although further introductions to India (in 1797, from Sumatra), some regions of Polynesia, and tropical America were associated with European and North American colonization and commerce [11, 12, 14]. In the Pacific islands, it grows from sea level to 800 m elevation, and up to 1200 m at lower equatorial latitudes.



Morphology

Ylang-ylang is a medium-sized evergreen tree, typically 10–20 m in height but occasionally up to 40 m in natural forests in its native Indo-Pacific range. It produces a single main trunk and an uneven spreading crown of drooping branches and twigs bearing leaves in two rows. It is easily recognized by its odd-shaped, very fragrant yellow or greenish-yellow flowers and distinctive aggregate fruit consisting of 8–15 clustered green or black berries.

Leaves and young shoots

The leaves are dark shiny green above, duller, lighter, and slightly pubescent beneath, simple, alternate, ovate-oblong to broadly elliptic, 9–21 cm in length and 4–9 cm wide, with wavy margins, a rounded and usually unequal base, and finely acuminate apex. As with most other members of the family *Annonaceae*, the leaves are arranged on a single plane along twigs. Petioles are light green, 6–15 mm long. The leaf midrib is prominent, with 7–12 pairs of lateral veins at an angle of 45° to the midrib. The twigs are light green when young, becoming brown, and have a slightly spicy taste.

Flowers, fruits and seeds

The highly fragrant, drooping flowers are approximately 7.5 cm long and borne in groups of 4–12 together in hanging axillary, umbellate clusters scattered along the older parts of twigs at leaf bases or from the branches behind the leaves. Pedicels are 1–2.5 cm long, elongated in fruit. The calyx has three broad, pointed, hairy yellow-green lobes (sepals) 0.6 cm long, spreading and slightly turned back, and six slightly thickened, straplike, twisted, pointed, slightly hairy petals usually 4–6 cm long (sometimes up to 8 cm). The petals are arranged in two series of three each, the outer ones usually 8–12 mm wide, the inner ones 5–7 mm wide. Green when young, the petals turn yellow and finally yellowish-brown and drooping, with a reddish-brown blot at the base of the three inner petals when mature.

The flowers have numerous stamens less than 3 mm long that are pointed and becoming reddish tinged at the apex, crowded into a triangular mass along with 8–15 separate green pistils that are less than 6 mm long and whose stigmas are also crowded together [12, 18].

Pollinators include nocturnal moths and relatively small beetles of the families *Nitidulidae*, *Chrysomelidae* and *Curculionidae* [8, 9].



Fig. 3: Branch with flowers.



Fig. 4: Flowers

picture: C. Elevitch

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Fig. 5: Mature fruits

picture: C. Elevitch



picture: Ulla M. Lang

Ylang-ylang flowers from cultivated trees of an early age, usually during the second year of growth, or when trees have attained a height of 2 m. Wild trees generally begin flowering somewhat later, when they reach 9–12 m in height. In areas with relatively aseasonal temperature and rainfall patterns, as in the Philippines, mature trees may flower throughout the year, while younger trees or those grown in more seasonal regions such as in India generally flower twice each year, with flowering and fruiting associated with wetter months [14].

Several fruits develop from each flower. These compound fruits are comprised of 6–12 (occasionally up to 20) berries borne in axillary clusters. The fleshy, olive-like berries are ovoid or obovoid 1.5–2.3 cm long, glabrous, dark green to black when ripe, each containing 2–12 (usually 4–5) hard, flattened ovoid, pale brown, pitted seeds 6 mm or more in diameter, arranged in two rows, embedded in an oily nearly tasteless yellow pulp.

Seed weights are variable, with reported averages ranging from 14,000–21,000 per kilogram [11, 12, 14]. In its native habitat in lowland southeast Asia the fruits are eaten by small mammals such as squirrels, bats, monkeys and frugivorous birds, which disperse the small hard seeds.

Bark and wood

The bark is smooth when young, becoming fissured and rough, and variable in colour from light or dark brown to greyish or silvery. The inner bark is yellowish to light brown, with prominent bast fibres, and has a slightly bitter taste [3].

The wood is light, averaging 0.48–0.56 g/cm³ air-dry, pale greyish to yellowish in colour with a pinkish tinge. The sapwood and heartwood are not distinct. The grain is straight with a coarse texture. Growth rings are inconspicuous, and pores are usually very few and variable in size from moderately small to large, evenly distributed, isolated and in radial groups of 2–4 or more, open with simple perforation plates; soft tissue occurs mainly in very fine, inconspicuous lines between the broad, low, widely spaced rays between which are found two rows of pores. The wood is easy to work, soft and highly perishable. Shrinkage during seasoning from green to air-dry averages 1.5 % radial and 4 % tangential [3].

Rooting habit

Ylang-ylang produces a long taproot. For this reason it grows best on deep, well-drained soils. It does not produce buttresses or stilt roots.



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Fig. 6: *C. odorata* stem approx. 20 years old

Taxonomy, genetic differentiation, races and hybrids

In Sarawak (Malaysia) and Brunei-Darussalam on the island of Borneo, two forms are recognized, the wild (*kenanga hutan*) and the cultivated. The flowers of the cultivated form are generally more fragrant than those of the wild form, which may have very little, or even a sour, fragrance. Flowering in both the wild and cultivated forms occurs regularly but only the cultivated form reportedly produces flowers at very early ages (less than two years) [3]. Among the cultivated varieties two groups are distinguished: forma *macrophylla* STEENIS, which has branches perpendicular to the stem (rather than drooping) and large leaves up to 20 cm long and 10 cm wide, and forma *genuina* STEENIS, which has drooping branches and smaller leaves than those of forma *macrophylla*.

The flowers of the first group are the source of the distillate traded as cananga oil and, in the Pacific, is cultivated in Java, Fiji and Samoa.

Those of the second group, cultivated throughout the tropics, are the source of the distillate traded as ylang-ylang oil [14]. *C. odorata* var. *fruticosa* (CRAIB.) J. SINCL. is a dwarfed, cultivated form that grows only to 2 m in height. This variety often has more numerous and more curled petals than is typical for the species and is not known to set fruit [14].

Growth, development and yield

Early growth rates in ylang-ylang are moderately high for tropical tree species. In plantation trials conducted in the Philippines, tree heights averaged 1.3, 2.1, 3.8, 5.3 and 8.4 m at, respectively, 2, 3, 4, 5, and 7 years of age, with stem diameters at breast height (1.3 m) of 7 and 12 cm at 5 and 7 years [2]. Since ylang-ylang is a light-demanding species, trees in commercial plantations are typically established at a spacing of 6 by 6 m; closer spacing of trees can result in overcrowding and reduced productivity of flowers on lower branches [14].

A good tree can produce up to 5 kg of flowers per year from four years onwards, and up to 11 kg after 10 years. Although trees rarely yield more than 20 kg of flowers per year, individual trees with yields as high as 59 kg have been recorded in Borneo [3], and even higher (30–100 kg per tree) for certain varieties in Java, Fiji and Samoa [14]. When grown in plantations at 5 by 5 m spacing (approximately 400 trees per ha), a typical flower yield of 3,400 kg per hectare has been reported [6, 13].

Propagation and cultivation

The tree is usually propagated from seed, but can also be propagated by cuttings with varying degrees of success [13, 14]. Seeds should be collected from mature (black) fruits and separated from the surrounding oily flesh by wet sieving. The seeds are orthodox, remaining viable when dried and stored in airtight containers. Germination of fresh seed is reportedly erratic, while dried seeds stored for 6–12 months have higher germination rates. [11, 14]. Hot water treatment has been shown to stimulate germination [16]. Germination in ylang-ylang is hypogeal.

Direct seeding in the field is commonly used to establish plantings, which is advantageous in that it avoids taproot damage that can occur with transplantation of nursery-grown seedlings. Good results are usually obtained by sowing several seeds at a depth of 2–3 cm at each planting spot, which should be prepared prior to seeding by clearing weeds and cultivating to a depth of 50 cm, particularly in compacted soils, to allow for good taproot development [14].

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Alternatively, wild seedlings 10–20 cm tall are sometimes collected and grown in seedling containers for 2–3 months before out-planting [14]. For nursery production, a light, well drained potting medium is suggested. Seedlings between 20–30 cm in height are recommended for transplanting to the field [14]. Due to their susceptibility to competition, seedlings and transplants require careful tending during the first two years of growth.

Vegetative regrowth by coppicing is rapid in ylang-ylang trees damaged by severe winds or other disturbances. When grown in plantations, the tree is often heavily pruned or pollarded to maintain trees at a suitable height (typically 3 m) for collection of flowers. Even large trees will readily regrow after pruning, and trees are sometimes felled for their flowers [2, 6, 14].

Ecology

Within its native and introduced ranges, the tree is best adapted to humid lowland tropical and subtropical maritime climates on sites receiving between 700 and 5000 mm annual rainfall characterized by uniform or seasonal precipitation patterns and rainless periods up to two months [14]. In this region, it occurs in areas with mean annual temperatures between 18 and 28 °C, with mean maximum temperatures of 28–35 °C during the hottest month and mean minimum temperatures of 10–18 °C in the coldest month. The species cannot tolerate temperatures below about 5 °C [14]. It grows on a wide range of soil types of varying textures, from sands to clay loams and clays, and can withstand wide variations in soil pH, from 4.5–8.0, but does poorly on saline and alkaline soils. While it can tolerate brief periods of waterlogging and can grow on shallow, infertile soils, it does best on well-drained, volcanic or fertile sandy soils [14].

It is a component of tropical moist to seasonally dry forests in its native Indo-Pacific range. In Indonesia, ylang-ylang is found in mixed and teak forests [14]. In Indonesia, Papua New Guinea, the Philippines, northern Australia, and nearby tropical Pacific islands, ylang-ylang is an important food source for many species of fruit doves and collared pigeons. These include the Collared Imperial-pigeon (*Ducul mullerii*), Purple-tailed Imperial-pigeon (*Ducula rugigaster*), Zoe's Imperial-pigeon (*Ducula zoeae*), Superb Fruit-dove (*Ptilinopus superbus*), Pink-spotted Fruit-dove (*Ptilinopus perlatus*), Coroneted Fruit-dove (*Ptilinopus coronulatus*), Orange-bellied Fruit-dove (*Ptilinopus iozonus*), and the Wompoo Fruit-dove (*Ptilinopus magnificus*) [10].

In many regions where it has been introduced as an ornamental tree or in plantations or agroforestry systems, it has become naturalized. As pioneer species, it regenerates easily from seed in open areas, where it becomes quickly established.

In Guam, for example, it is found in secondary forests near roadways with other introduced species such as *Leucaena leucocephala*, *Spathodea campanulata*, and *Areca catechu* [14]. In Sri Lanka, it is locally naturalized in moist secondary forests in the lowlands [7]. Despite its naturalization in many regions, it is rarely considered a pest and is not considered an invasive species according to the Pacific Ecosystems at Risk project [19].

The tree grows best in full sunlight, although it can tolerate moderate shade, as in traditional agroforestry systems in the Pacific islands. When grown in denser, mixed stands in competition with other species, height growth is rapid, accompanied by self-pruning of its lower branches [14].

Pathology

There is little published information on pests and diseases of ylang-ylang, with none reported from the Pacific islands [14]. However, there are some reports of damage to trees by stem borers, flower-eating beetles, and other insects causing leaf wilting [16]. In India, the parasitic plant *Dendrophthoa falcate* (L.f.) ETTINGSH. is reported to be a potential though not serious problem in ylang-ylang plantations [6].

The limbs of ylang-ylang are brittle and highly susceptible to wind damage, although it rapidly regrows following damage by heavy winds. Heavy rains or prolonged dry spells are very damaging to the flowers.

Uses

The tree is widely planted as an ornamental in homegardens, especially in many islands of the Pacific. In Malaysia it is used as a street tree. In agroforestry systems in the Pacific island of Pohnpei it is used as an understory trellis tree for yam (*Dioscorea* spp.) [14].

The tree is valued chiefly for its flowers, which yield ylang-ylang oil which is used in the manufacture of numerous beauty products such as perfumes, soaps, shampoos and hair oils. One of the principal products is Macassar oil, coconut oil scented with ylang-ylang, which has a good though restricted market in many parts of the world. The flowers themselves are valued in Borneo and elsewhere for their scent, the dried flowers being sold in markets and are worn in women's hair and laid between cloth to impart an agreeable scent. In Samoa and other Pacific islands, the flowers are used to make garlands and headdresses, and their beautiful fragrance is celebrated in songs [1, 14].

Flowers attain their peak fragrance 15–20 days after opening, when they have changed colour from green to yellow [14].



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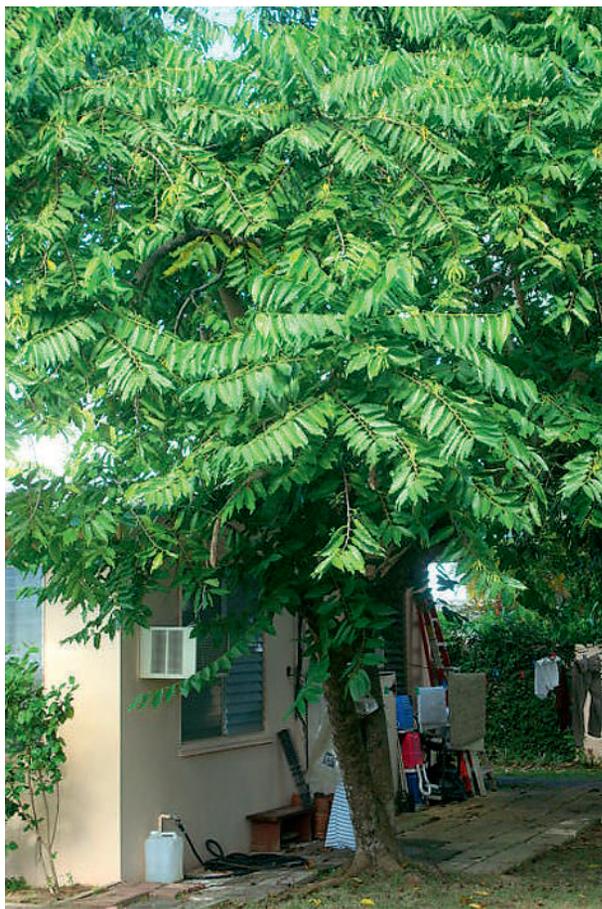


Fig. 7: *C. odorata* housegarden planting in Puerto Rico
(picture: G. & J. McMurray).

It is recommended that flower collections should be done at night or in the early morning hours, when their scent is strongest. When processed for their essential oil, this should be done immediately after harvest. The most common and recommended method is steam distillation, although distillation in water is sometimes used, but with mixed results. The first part of the distillate recovered consists mainly of the more readily volatile and oxygenated ester constituents and traces of terpenes. This represents 50–60 % of the total oil recovered and is the best quality ylang-ylang oil. Prolonged distillation yields mainly sesquiterpenes and a product of lower quality known commercially as cananga oil [6]. Volatile oil yields by steam distillation usually average 1–2 kg per 100 kg of flowers, depending on the quality of the flowers, their handling, and the distillation technology used [13, 14]. The quality of the natural oil produced is somewhat variable, and synthetic versions are currently produced which have, to some extent, substituted for natural ylang-ylang oil in the French perfume industry. During the early

decades of the 20th century, commercial production of natural ylang-ylang oil was concentrated in the Philippines, Java, India and Madagascar, but since the 1950s commercial production for international markets has become concentrated in the Indian Ocean region, specifically in Madagascar and, especially the Comoros, where ylang-ylang oil is a very significant export product [6, 13, 14].

The wood of this tree is non-durable and subject to termite attack, and has very limited value for timber. It is sometimes used for wooden shoes, boxes and crates, tool handles, net-floats and lathe turnings [5, 21, 22]. Being very resonant, it is good for making drums. In Samoa, the Northern Mariana Islands and elsewhere in the Pacific, the wood is reportedly used for making canoes, furniture (in the Cook Islands), and for general construction (in Tonga and Samoa) [14, 15, 20, 21, 22]. Coarse ropes can be made from the fibrous bark [3, 14, 15, 22].

Ylang-ylang has a variety of medicinal properties and traditional therapeutic uses. In Tonga and Samoa, the bark is used to treat stomach ailments and as a laxative. In Java, the fresh flowers are pounded into a paste for use in the treatment of asthma, and the dried flowers are reportedly used for treating malaria [14]. Many parts of the tree are used in traditional medicine in India. The fresh flowers are reportedly prescribed as a carminative and in the treatment of asthma, and an infusion of the flowers is used after bathing or rubbed on the skin to prevent skin itching. Also in India, the essential oils from the flowers is used as an external application for treatment of headache, ophthalmia and gout. The leaves are considered useful for treating diarrhea in infants, and rubbed on the skin to relieve itching and boils. The fruits and seeds are used for treating fevers. The bark, rich in alkaloids, is sometimes given as a decoction for treatment of rheumatism, phlegm, ophthalmia, ulcers, fevers, and to improve complexion [17]. The essential oils are also used in aromatherapy and are thought to be beneficial for treating depression, distressed breathing, high blood pressure, anxiety, and as an aphrodisiac [14].

The ylang-ylang and cananga oil are sometimes added as a flavouring in beverages and foods, and are used extensively in hair oils and other cosmetic products.

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