

LOCAL NAMES

Burmese (thit kado); Creole (sèd); English (cigar-box tree, cedar wood, cedar, Brazilian mahogany, American cedar, Central American cedar, cigar box cedar, cigar box cedrela, Honduras cedar, Jamaican cedar, Mexican boxwood, stinking mahogany, red cedar, Mexican cedar, Spanish cedar, West Indian cedar); French (acajou pays, Acajou à planches, acajou senti, acajou á muebles, cèdre, cedrela, acajou amer, Acajou femelle, acajou rouge); German (cedrela, westindische zedar, Westindische Scheinzeder, Zigarrenkistchenholz); Indonesian (suren); Italian (cedro acajou); Spanish (cèdre, cèdre espagnol, cedro macho, acajú, cedro hembra del país, redcedar, culche, cedro vermelho, cedro real, cedro hembra, cedro mexicano, cedro, cedro español, cedro dulce, cedro del país, cedro colorado, cedro blanco, cedro amargo, cedro oloroso); Swahili (mwerezi); Thai (yom-hom)

BOTANIC DESCRIPTION

Cedrela odorata is a monoecious, deciduous, medium-sized to large tree up to 40 m tall (up to 60 m in South America); bole straight, cylindrical, branchless for up to 25 m, to 120 (max. 300) cm in diameter; buttresses absent or small and up to 2 m high; bark surface rough and fissured, reddish brown especially near the base of the bole, greyish higher up; inner bark pink or purplish-red; branchlets finely to conspicuously lenticellate.

Leaves alternate, paripinnate with (min. 5) 6-12 (max. 15) pairs of leaflets; leaflets opposite to alternate, entire, ovate to oblong-lanceolate, 5-16 cm long, usually glabrous, base oblique; apex acute to shortly acuminate.

Inflorescence in terminal panicles. Flowers unisexual, but with well-developed vestiges of the opposite sex, actinomorphic, pentamerous, greenish-white, subsessile, 6-9 mm long, smelling of garlic. Calyx cup-shaped, split on 1 side, shallowly to deeply toothed; petals free, imbricate and adnate for 1/3 of their length, forming into a long, columnar androgynophore by a medium carina (therefore preventing their spreading in open flowers), white or cream tinged red near the margin. Stamens 5, free, but adnate to the androgynophore below; anthers dorsifixed, opening by longitudinal slits; ovary 5-locular, pubescent; each locule with 10-14 ovules; style short, stigma discoid.

Fruit a pendulous, reddish-brown capsule with 5 thin, woody valves, oblong-ellipsoid, to obovoid (min. 1.5) 2-3.5 (max. 4) cm long. Seed a sharply angled or winged columella.

The genus *Cedrela* is included in the tribe Cedreleae of the subfamily Swietenioideae, as is the genus *Toona*. All the Eastern species of *Cedrela* have been transferred to *Toona*. *Cedrela* differs from *Toona* by its prominent androgynophore with adnate petals and filaments, the cuplike calyx, the bigger and woodier capsule, and seedlings having entire leaflets. The specific name, 'odorata' is Latin for sweet-smelling, fragrant.

BIOLOGY

First flowering can be expected after 10-15 years. Flowering is annual, but good seed crops occur every 1-2 years. Seeds of *C. odorata* in the Philippines ripen in March-June.



C. odorata, Natural regeneration in coffee, Tabarcia, Costa Rica. (David Boshier)



Habit at Hana Hwy Maui, Hawaii (Forest & Kim Starr)



Habit at Hana Hwy Maui, Hawaii (Forest & Kim Starr)

ECOLOGY

In its natural area of distribution, *C. odorata* is found in both primary and secondary evergreen to semi-deciduous lowland or lower montane rainforest. It demands light and does not tolerate waterlogging or flooding. Widely distributed in wet forests of low elevations in tropical America. Native apparently throughout West Indies in Greater Antilles and Lesser Antilles to Trinidad and Tobago, the range spread by cultivation. Also native in continental tropical America from Mexico to Ecuador, Peru, Brazil and French Guyana. Trees are best planted in regions with very fertile soils and with perfect drainage that results in the good aeration of the soil required by the root system. Drought for part of the year does not adversely affect the health of the tree. In its natural habitat, removing trees around the seed tree and gradually opening up the canopy in the forest can encourage regeneration. In research plots in Papua New Guinea, the latter method has been shown to encourage growth; however, it increases the risk of insect attack. Because of the valuable wood, the native trees of this species are now found only in scattered, remote areas in Puerto Rico, chiefly in the moist limestone and lower cordillera forest regions.

BIOPHYSICAL LIMITS

Altitude: 0-1900 m, Mean annual temperature: 22-26 deg. C, Mean annual rainfall: 1000-3700 mm

Soil type: *C. odorata* is not demanding of soil nutrients, tolerating soils high in calcium; it prefers fertile, free draining, weakly acidic soil but tolerates heavy soil.

DOCUMENTED SPECIES DISTRIBUTION

Native: Argentina, Brazil, Cuba, Dominican Republic, Ecuador, French Guiana, Haiti, Honduras, Jamaica, Mexico, Peru, Trinidad and Tobago

Exotic: Costa Rica, Fiji, Indonesia, Kenya, Madagascar, Malaysia, Nigeria, Philippines, Samoa, Singapore, Solomon Islands, South Africa, Tanzania, Thailand, Uganda, United States of America



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

Apiculture: Flowers are visited by bees as a source of nectar for honey production.

Fuel: A good firewood species.

Fibre: In Papua New Guinea, the bark has been used for twine. Kraft pulping tests give a low yield of 54%, with a Kappa number of 71 and low brightness.

Timber: *C. odorata* is a lightweight and comparatively soft wood. The heartwood is pale creamy immediately after sawing, turning pinkish-brown upon exposure, and is clearly demarcated from the narrow band of sapwood. Heartwood is rated as moderately durable and moderately resistant to termites, but the sapwood is susceptible to staining and powder post beetles and is not durable. The density is 410-525 kg/cubic m at 12% mc.

The grain is usually interlocked, sometimes straight or woolly, indicating the presence of tension wood; texture moderately fine to moderately coarse; the grain pattern is attractive in flat sown boards. Freshly cut wood has a distinct onionlike odour, which disappears after 2-3 days. It is easy to work, saws, bores, turns and sands without problems and produces a good finish; it is easy to glue. However, growth stresses may cause severe end splitting of logs and warping and splitting during saw milling. Tests in Samoa showed that the timber can be rotary peeled without pretreatment with good results, producing attractively patterned veneer; veneer slicing also gave good results. The wood is difficult to treat with preservatives, even by a pressure treatment.

A premier timber for furniture, decorative veneer, musical instruments, wooden novelties and doors. The best known use of cedar timber is for cigar boxes, but it is also used for light construction, mouldings, cabinets, furniture, panelling, boxes, exterior joinery, weather boards, louvred doors, boat building (especially racing boats), canoes, musical instruments, turnery, matchboxes, household implements, face veneer and plywood. Lower grades are suitable for crates, fencing and animal pens. The repellent smell of the wood to insects makes it particularly suitable for the manufacture of clothing chests and wardrobes.

Medicine: Root and trunk bark is used to reduce fever and pain; the trunk is harvested to prepare a decoction for abortion; seeds are believed to have vermifugal properties.

SERVICES

Shade or shelter: As the trees have many low branches and a spreading crown, they are used for shade and as a windbreak in courtyard gardens and in cocoa and coffee plantations.

Ornamental: *C. odorata* is sometimes planted as an ornamental along roads and in parks, for example, in peninsular Malaysia, Papua New Guinea and Singapore.

Intercropping: *C. odorata* is highly susceptible to *Hypsipyla* attack; therefore it is recommended that trees be planted in mixed plantations, for example with *Leucaena leucocephala*, *Cordia* spp., or *Anthocephalus chinensis* or under the light shade of trees such as *Eucalyptus delgupta*.

TREE MANAGEMENT

Pruning is not required when *C.odorata* is grown as a stand, but trees affected by *Hypsipyla* attack may need pruning to remove multiple leaders formed. Early weeding is essential. *C. odorata* is a fast-growing, light demanding species. Under natural conditions, it is a long-lived pioneer that tolerates shade only temporarily. In enrichment planting, it is important to ensure sufficient overhead light. As the root system is superficial, there is some risk of wind damage and therefore thinning should be executed carefully. In Fiji, *C. odorata* proved to be very vulnerable to being blown over by wind.

In mixed stands, it is realistic to raise only 10-20 high-quality trees/ha. Well-formed, straight stems are usual except in trees grown in open places. The tree does not coppice. During the 1st 9 years in trial plantations of *C. odorata* in Java, the mean annual increment was 17 cubic m/ha at 650 m altitude and 28 cubic m/ha at 800 m altitude. A 40-year-old plantation in Nigeria yielded a timber volume of 445 cubic m/ha. *C. odorata* shows potential for plantations, as it is fast growing and produces multipurpose timber. Trials in mixed plantations similar to those conducted with *Toona* species should be implemented.

GERMPLASM MANAGEMENT

Seed storage behaviour is orthodox. Viability is maintained in hermetic storage at cool temperatures with 6-9.5% mc; seeds can be stored for about 2 years if kept in dry, cool (2-4 deg. C) and airtight containers. Well-dried seeds (6-9.5% mc) stored in paper bags, show no decrease in germination after 3 months, irrespective of the temperature during storage, ranging from -30 to 30 deg. C. Germination of seed kept in closed glass bottles at 4-6 deg. C is 82% after 2 months and 78% after 14 months. There are about 40 000 - 60 000 dry seeds/kg without wings or 31 000-48 000 seeds/kg with wings.

PESTS AND DISEASES

The most serious pest of *C. odorata* is the shoot borer (*Hypsipyla robusta*), which is a pest for many trees of the family Meliaceae. The main damage is caused by the larvae, which destroy the succulent terminal shoots by boring into the tip and tunnelling in the juvenile stem of saplings and seedlings. Resprouting of the plants followed by repeated attacks of the insect generally results in the development of numerous side branches and consequently in badly formed trees with multiple leaders, unsuitable for timber production. In India and Australia, *Hypsipyla* larvae have ruined the complete seed crop. The Solomon Islands are still free from the pest. There is some evidence that *Hypsipyla* attack is reduced by planting the tree under shade, possibly because this suppresses the lateral shoots, which provide the best conditions for the multiplication of the borer, or possibly because predators of the insect prefer shaded conditions. Vigorous trees tend to exude sufficient gum to entrap the invading larvae. Even repeated attacks on vigorous trees do not seem to cause any real damage. In South America, *C. odorata* is highly susceptible to *Hypsipyla grandella*, but it becomes resistant when grafted on *Toona ciliata*. In Papua New Guinea, the termite *Coptotermes elisae* has attacked the species.

Damping-off recorded in Philippines nurseries is mainly due to *Pythium ultimum* and to a lesser extent to *Rhizoctonia* spp. and *Fusarium* spp. Fungi including *Armillaria mellea* may cause damage to the roots of young trees during the 1st few years, but this has not yet been recorded in Southeast Asia. In Haiti, an unidentified aphid-borne virus causes leaves of young seedlings to shrivel with mosaic-type symptoms. Die-back has been observed but is possibly an indication that climatic or soil conditions are not optimal and that the root system is suffering from insufficient aeration. Die-back of previously healthy 1-2-year-old stands is a common phenomenon in Central America and the Caribbean, characterized by poor crowns going out of leaf at frequent intervals, dead-looking bark and die-back from the top.

FURTHER READING

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).

Lemmens RHMJ, Soerianegara I, Wong WC (eds.). 1995. Plant Resources of South-east Asia. No 5(2). Timber trees: minor commercial timbers. Backhuys Publishers, Leiden.

Little EL, Wadsworth FH. 1964. Common trees of Puerto Rico and the Virgin Islands. Agricultural Handbook. No. 249. US Department of Agriculture. Washington DC.

Streets RJ. 1962. Exotic forest trees in the British Commonwealth. Clarendon Press, Oxford.

Timyan J. 1996. Bwa Yo: important trees of Haiti. South-East Consortium for International Development. Washington D.C.

Torre A, de la;López C, Yglesias E, Cornelius JP. 2008. Genetic AFLP diversity of nine *Cedrela odorata* populations in Madre de Dios, Southern Peruvian Amazon: Forest Ecology and Management. 255:334-339.

Wadsworth FH. 1997. Forest production for tropical America. Agricultural Handbook 710. United States Department of Agriculture.

SUGGESTED CITATION

Orwa C, A Mutua, Kindt R, Jamnadass R, S Anthony. 2009 Agroforestry Database: a tree reference and selection guide version 4.0 (<http://www.worldagroforestry.org/sites/treedbs/treedatabases.asp>)