

Santalum album

sandalwood, East Indian sandalwood

LOCAL NAMES

Bengali (chandan,sufaid-chandan,peetchandan,srikhanda); Burmese (santagu); English (sandal,cendana,sandal tree,East Indian sandalwood,white Indian sandalwood,sandalwood); French (Santal blanc); German (Weisser Sandel(holz)baum); Gujarati (sukhad,sukhet); Hindi (chandal,srikhanda,chandan,talia-parnam,sandal,safed-chandan,sriganda); Indonesian (chandan,chendana,cendana); Italian (Sandalo bianco); Sanskrit (ananditam,chandana,taliaparnam); Spanish (Sandalo blanco); Tamil (kulavuri,sandanam,santhanam,srigandam,ulocidam); Trade name (East Indian sandalwood,sandalwood)

BOTANIC DESCRIPTION

Santalum album is a small evergreen tree that grows to 4 m in Australia, but in India it is much larger and can grow to a height of 20 m; girth of up to 2.4 m, with slender drooping branchlets. Bark is tight, dark brown, reddish, dark grey or nearly black, smooth in young trees, rough with deep vertical cracks in older trees, red inside.

Leaves thin, usually opposite, ovate or ovate elliptical, 3-8 x 3-5 cm, glabrous and shining green above, glaucous and slightly paler beneath; tip rounded or pointed; stalk grooved, 5-15 cm long; venation noticeably reticulate.

Flowers purplish-brown, small, straw coloured, reddish, green or violet, about 4-6 mm long, up to 6 in small terminal or axillary clusters, unscented in axillary or terminal, paniculate cymes.

Fruit a globose, fleshy drupe; red, purple to black when ripe, about 1 cm in diameter, with hard ribbed endocarp and crowned with a scar, almost stalkless, smooth, single seeded.

The generic name is derived from the Greek 'santalón' meaning 'sandalwood', and the species name from the Latin 'albus' meaning 'white', in allusion to the bark.

BIOLOGY

Flower panicles appear from March to April in India, and fruits ripen in the cold season; in Australia flowers appear in December to January and also June to August, and mature fruit is available from June to September. The species is spread rapidly through seed dispersal by birds, which feed on the outer fleshy pericarp. Viable seed production occurs when the tree is 5 years old.

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A painting of the leaves, flowers and fruits. (Köhler's Medicinal Plants.)

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ECOLOGY

S. album is indigenous to the tropical belt of the Indian peninsula, eastern Indonesia and northern Australia. There is still debate as to whether *S. album* is endemic to Australia or was introduced by fishermen or birds from eastern Indonesia centuries ago. The main distribution is in the drier tropical regions of India and the Indonesian islands of Timor and Sumba. The principal sandal tracts are most parts of Karnataka and adjoining districts of Maharashtra, Tamil Nadu and Andhra Pradesh in India. The species is mostly found in dry deciduous and scrub forests in this region. The vegetation type is a typical monsoon vine thicket growing on pure sand. It has been recorded on coastal sand dunes immediately above the normal high water mark and close to the mangroves. It also grows on low lateritic cliffs above the beach. It is a partial parasite that attaches to the roots of other trees, it needs 'nurse' species in the area of planting out. Host plants that fix nitrogen and provide light shade are preferred. *Senna siamea* is good for this, and a most probable natural host is *Drypetes lasiogyne*, observed to be the most prolific species in the vicinity of *S. album*. It does not tolerate frost or waterlogging, but is drought-hardy and is a light demander in sapling and later stages. Prolonged drought and fire kill trees.

BIOPHYSICAL LIMITS

Altitude: 600-1 200 m, Mean annual temperature: 2-38 deg. C, Mean annual rainfall: 450-3 000 mm

Soil type: *S. album* grows in a wide range of soils but is most common in sandy or rocky red soil zones. The species is not found on black soil but luxuriant growth is noticeable in moist soils such as garden loam and well-drained deep alluvium. It also grows on ferruginous loam overlying metamorphic rocks, chiefly gneiss is considered the best and trees avoid calcareous situations. On shallow stony and gravelly soils, growth is poor. It is not exacting to soil depth. On Timor it grows on very stony, grey clay and red loam soils derived from coral parent material, well-drained and having a pH of 8-9. In India it usually grows on free draining red loams with a pH of 6-6.5, and occasionally on sandy soils associated with laterites.

DOCUMENTED SPECIES DISTRIBUTION

Native: Australia, India, Indonesia

Exotic: Kenya



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.

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PRODUCTS

Food: Fruits are edible.

Fodder: Trees are sometimes lopped for fodder; the foliage of *S. album* is palatable to grazing animals such as rabbits, sheep, goats, cattle, pigs, horses and camels.

Fuel: The wood has been used as a fuel but is generally considered too valuable for this purpose.

Timber: *S. album* is mainly grown for its timber, which weighs 870 kg/cubic m, is durable and strong. Its close grained heartwood is used for ornamental and carving work.

Tannin or dyestuff: The bark contains about 12-14% tannin and has good potential in the tanning industry. Seeds yield an oil that can be used in the manufacture of paint.

Essential oil: A valuable oil, 'the sandal oil', is distilled from the heartwood (yield varies from 4-10%) and is used in perfumery, soap making and medicines. The roots contain maximum quantity of oil and hence are more valuable.

Other products: Powder from the heartwood is used to make incense sticks, burnt as perfumes in houses and temples, or is ground into a paste and used as a cosmetic.

SERVICES

Shade or shelter: Branches grow densely and are capable of intercepting high wind velocity, thus protecting crops.

Soil improver: Leaves make good green manure.

Ornamental: Sandal tree is planted in house gardens as an ornamental.

Boundary or barrier or support: Trees can be planted along hedges and field boundaries.

Intercropping: *S. album* can be profitably raised along with other trees near or on the farm, thereby providing farmers with additional income.

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TREE MANAGEMENT

The yield of the heartwood varies according to age and locality. As a rule of thumb, each tree adds 1 kg of heartwood to its weight each year after the age of 15 years. On deep rich soils in moist areas, trees grow luxuriantly but the heartwood formation is slow and the oil content is low, while the slower-growing trees on difficult sites at elevations between 600-900 m and in rainfall zones of 500-1 000 mm develop maximum heartwood with high oil content. Girth increments for *S. album* in India are 1-1.3 cm/year in natural stands and up to 5 cm annually in cultivated areas. Between-tree variation in heartwood content and oil yields is high, indicating considerable scope for selection and breeding. Seedlings require protection from wild animals and cattle; nurse bushes provide such protection, and also protect them from excessive heat of the sun, which can kill the tender seedlings in the hot summer months. It is desirable not to clean-weed all round the sandal seedlings, as the roots form haustorial connections with adjoining weed growth. Spacing adopted for raising pure plantations is 3 x 3 - 5 x 5 m. Plantations should strictly be protected from fire. Trees attain exploitable stage (over 15 cm diameter at breast height) in about 30 years, yielding about 50 kg of heartwood, and attain 25 cm dbh in 40 years; such a well-grown tree, including the roots, can yield over 250 kg of scented heartwood. Young sandal trees coppice well. Whole tree harvesting is employed, and both living and dead trees are utilized.

GERMPLASM MANAGEMENT

Good seed is reported from trees over 20 years of age. Seed storage behaviour is orthodox; no loss in viability after 2 years storage at room temperature (seed longevity declines rapidly at room temperature); viability is reduced from 90-15% after 3 years storage at 7 deg. C with 30-45% r.h. Seeds tolerate desiccation to 2% mc, and no loss in viability is observed after 16 months hermetic storage at 4 deg. C with 3-10% mc. On average there are 4 300-6 800 seeds/kg.

PESTS AND DISEASES

Spike disease that shortens the internodes, reduces the leaf size, kills haustoria, blocks vascular tissue and eventually kills trees, is a serious pathogen in India. Nursery pests include pathogenic fungi, *Fusarium* and *Phytophthora* and nematodes. A wide range of insect pests is reported on this species in India.

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FURTHER READING

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SUGGESTED CITATION

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