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Pterocarpus indicus Willd.

Taxonomy and nomenclature

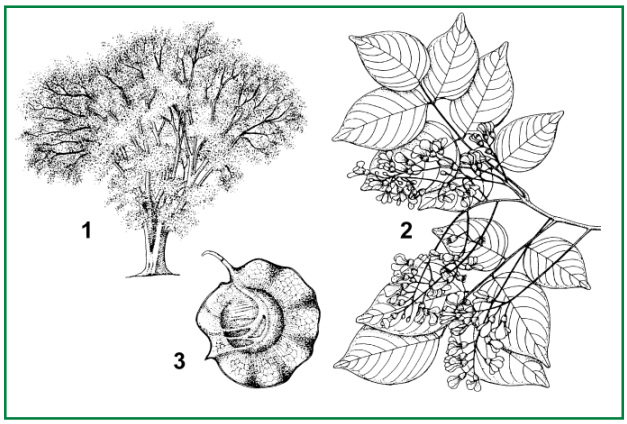
Family: Fabaceae (Papilionoideae)

Synonyms : *Pterocarpus wallichii* Wight & Arn; *P. zollingeri* Miq.; *P. papuanus* F.v.Mueller, *P. vidalinus* Rolfe.

Vernacular/common names: red sandalwood, Malay paduak (Eng.); amboine, santal rouge (Fr.); sonokembang (Indonesia); angsang, sena (Malaysia and Singapore); pradoo (Thai.); narra, amboyna, rosewood, Burmese rosewood (trade names).

In the Philippines the names prickly narra and smooth narra are used for forma *echinatus* and forma *indicus* respectively.

Two forms are recognized, *P. indicus* forma *echinatus* (Pers.) Rojo, and *P. indicus* forma *indicus*.



1. Tree habit; 2. flowering twig; 3. pod. From: Plant Resources of South-East Asia No. 5:1

Distribution and habitat

Natural distribution in SE Asia - Pacific, from southern Burma through SE Asia to the Philippines and other Pacific islands. Introduced into cultivation widely in the tropics. A widespread tree found in lowland primary and some secondary forest, mainly along tidal creeks and rocky shores. It is a pioneer species that performs best in the open. Grows on a variety of soil types from fertile farm soil to rocky soil. Normally found up to 600 m altitude but seems to thrive up to 1300 m. Frequently grown as ornamental in parks and along roads.

Populations have declined because of overexploitation, sometimes illegal exploitation of the narra timber as well as from increasing general habitat loss.

The Vietnam population has been extinct for some 300 years. An extensive forest survey in Sri Lanka has failed to find the species and information on populations in India, Indonesia and the Philippines indicates that the species is seriously threatened. Exploitation of the few known stands in Peninsular Malaysia may have caused its extinction there and what are believed to be the largest remaining populations, in New Guinea, are being heavily exploited.

Uses

All species of *Pterocarpus* produce highly valued timber. The timber of *P. indicus* is moderately hard and is used for fine furniture, flooring, cabinet work and musical instruments. It is nitrogen-fixing and recommended for use in agroforestry systems and as a shade tree for coffee and other crops.

Botanical description

Usually deciduous tree, up to 30-40 m tall. Bole up to 2 m in diameter, usually of poor form, short, twisted and deeply fluted, often with pronounced buttresses. The wood exudes a dark red sap called 'kino' or 'dragon's blood'. Leaves compound with 5-11 alternate, glabrous leaflets. Flowers in 6-13 cm long terminal or axillary panicles. Flowers bisexual, bright yellow and fragrant.

Fruit and seed description

Fruit: a modified indehiscent pod with large wing (i.e. samara). It is circular, light brown, 4-6 cm diameter, with a 1-2.5 cm broad wing surrounding the 2-3 cm diameter, 5-8 mm thick central seed case. The surface structure of the central seed case varies from smooth in forma *indicus* to densely covered with bristles in forma *echinatus*. Intermediate forms can be found. There are 1-2 seeds/ fruit.

Seed: 6-8 mm long, bean-shaped with brown papery testa.

Flowering and fruiting habit

Flowers often appear before the new leaves but flowering continues after leaf flushing. During the flowering period, flowering takes place in several short bursts each of only 1 days' duration. Flower opening is triggered by water, and individual flower bursts normally occur the day after a heavy rain. Pollination by bees and other insects. Usually only 1-3 flowers

from an inflorescence develop into fruits. Most trees flower and fruit every year but there are always some trees in a population with no or very limited flowering.

Fruit development takes 3-4 months. Although flowering is extended over a long season in tropical areas, fruit maturity occurs remarkably simultaneous. Since fruits are persistent on the tree for some time after maturity, collection time is not very critical. However, strong wind may release and displace many fruits after maturation. Insect attack can also be a problem in some populations.

Harvest

Fruits can be collected from the ground after natural fall, or after shaking or pruning low fruit bearing branches. Collection from taller trees normally involves climbing; the fruits may be released by shaking individual branches. Climbing is often made difficult by the presence of aggressive ants.

Processing and handling

If seeds are to be extracted manually, the fruits should not be dewinged before as it is difficult to orient oneself with dewinged fruits. However, dewinging may be necessary to reduce bulk. Removal of wings and bristles can be done by hammer mills or brushing machines with hard brushes. The dewinged fruits can then be stored until sowing.

Seed extraction should not be done until shortly before sowing since extraction often implies damage to seed which may interfere with their storability. The extraction is done manually with secateurs although it is a very slow process. The seed case in the middle of the fruit is cut at the opposite end of the seeds' radicles. This can only be seen on the entire fruit. The radicle end of the seed(s) is always pointing towards the small angle between the pedicel and the pod apex.

Storage and viability

Seeds are orthodox and can be stored at low temperature and moisture content for several years. Fruits that have been dewinged before storage are less prone to regain moisture and harbour fungi. Extracted seeds can be stored, preferably in CO_2, but if they are damaged during manual extraction, it can reduce their storability.

Dormancy and pretreatment

The seeds are not dormant and need no pretreatment but the pericarp poses a physical restraint to germination. Extracted seeds are susceptible to damage as they have only very thin seed coat and should preferably be sown immediately after extraction.

Sowing and germination

Seeds can be sown directly in pots or in germination beds and transferred to pots after about one month. Germination is epigeal. Germination percentage is low for non-extracted seeds because of the physical restraints of the pericarp and because many fruits are empty. A cutting test of a representative sample can show how many seeds per fruit can be expected. It can take as much as three months before germination is complete.

Because of the slow germination rate vegetative propagation is often used. Propagation by cuttings is the preferred method especially for ornamental planting. The species is unique in the sense that the capacity for rooting of stem cuttings is not lost with age. Actually, cuttings of 6 cm or more in diameter will root better than cuttings of a smaller diameter and young leaf-bearing stems will not root at all.

Phytosanitary problems

The fungus *Promopsis* can infect seeds. Other fungi can cause root and stem disease of young seedlings.

Selected readings

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