

Hopea odorata Roxb.

Family: Dipterocarpaceae

Vernacular names: Malaysia: merawan siput jantan (general), chengal pasir, chengal mas, chengal kampung, chengal pulau (Peninsular Malaysia); Vietnam: sao den; Cambodia: kok, mosau, thmar; Laos: kh'en; Thailand: takhian-thong, takhian-yai

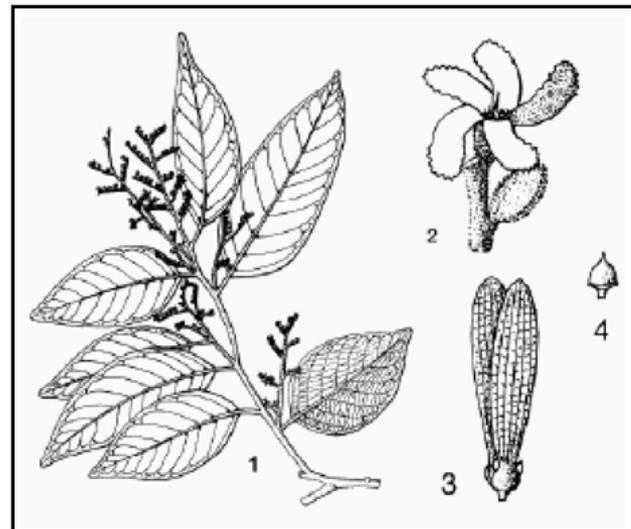
Distribution and habitat: Distributed from Andaman Islands, Myanmar, Thailand and Indo-China to the northern part of Peninsular Malaysia. It is found mostly in lowland tropical forests on deep, rich soils up to 300 m altitude and rarely far away from streams. The Indian Andaman population, however, occurs in moist evergreen forest at higher altitudes away from streams. Best growth is obtained in areas with annual rainfall more than 1200 mm and mean annual temperature of 25°–27°C. It can grow in a wide range of habitats and is easy to handle as a plantation species.



Natural distribution of *H. odorata* is restricted to Peninsular Malaysia, Thailand, Indochina, Myanmar and Andaman Islands

Uses: The timber is a strong light hardwood that is used for construction, furniture, veneer and a number of other uses. It has a density of 0.5–0.98 g/cm³ at 15% moisture content. It is suitable for rehabilitation of degraded lands and is also widely planted as an ornamental and shade tree. The bark is rich in tannin suitable for tanning leather; it produces resin, though of inferior quality (rock dammar).

Description: Evergreen tree up to 45 m tall with diameter of 120 cm and prominent buttress. Leaves are simple and alternate, 10–20 cm long with slightly unequal base. Inflorescence is a branched panicle, terminal or axillary. Flowers are small, unisexual, with 5 pinkish petals with hairs on both sides.



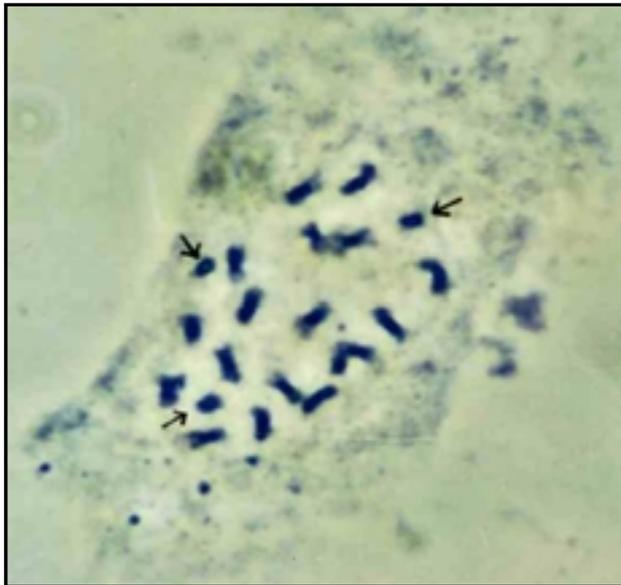
1: Flowering branch; 2: flower; 3: fruit with calyx lobes (wings); 4: fruit with calyx removed. [From: Plant Resources of South-East Asia No. 5(1)]

Reproductive biology: As with any other dipterocarp species, mass flowering and fruiting of *H. odorata* is irregular and may occur once in 2 to 3 years. Trees reach reproductive maturity at the age of 8–10 years. Fruits are formed 1.5 months after flowering. The fruits mature in 2 to 3 months. Some *H. odorata* fruits are polyembryonic; one fruit may produce up to seven plantlets. Apomixis in *H. odorata* has been inferred from embryological studies. Isozyme and DNA profiles of *H. odorata* seedlings revealed genetic variation between multiple seedlings from single seeds indicating sexual and asexual reproduction in this species. Pollen can be dispersed as far as 700 m by small insects. *H. odorata* has been reported to be a diploid with $2n = 2x = 14$ and also a near triploid with $2n = 3x = 20, 21$ or 22 . However, no convincing evidence to indicate that *Hopea* would contain two disjunct basic chromosome numbers, i.e. $x = 7$ and $x = 11$ has been reported. The occasional numbers $2n = 20$ and 22 are believed to be aneusomatic variants, not diploid numbers in Malaysian *H. odorata*.

Conservation status and tree improvement: In Vietnam, a long period of selective logging has reduced the size of stands to small groups of trees or isolated individuals. In Peninsular Malaysia, it is found as refugia populations in South Perak, South Terengganu and North Kelantan only.

H. odorata seeds are recalcitrant. Because of the problems with seed storage, vegetative propagation with cuttings is often used to establish plantation trials. In Thailand, an *ex situ* conservation project for forest species including *H. odorata* was initiated in 1989 by the Royal Forestry Department and Danida Forest Seed Centre; however, monoculture conservation stands proved poor in vigour and vulnerable to diseases and

pests. On the contrary, in Peninsular Malaysia plantation trials using seedlings and cuttings have been successful and do not suffer from serious diseases or pests. Currently, there are no genetic improvement programmes for this species.



Chromosomes of *H. odorata* (arrows showing possible homologous chromosomes)

Research on genetic conservation: *H. odorata* has undergone severe disturbances in Malaysia where its natural habitats have been drastically reduced or converted to other land uses. However, the existing populations/seed sources in the country have sufficient genetic diversity to support a selective breeding programme. All remnant populations should be evaluated for growth performances in different sites with emphasis to be given to populations with high genetic diversity. The *H. odorata* populations sampled in genetic diversity studies seem to be the only available seed sources for the species in Malaysia. Hence, immediate conservation measures are needed for these populations before any further genetic erosion takes place.

Agencies active in genetic conservation of *H. odorata*: Forest Research Institute Malaysia; Forest Department of Peninsular Malaysia; Universiti Putra Malaysia; Universiti Kebangsaan Malaysia; Royal Forest Department of Thailand, Bogor Agriculture University (Indonesia); Research Centre for Biotechnology (LIPI, Cibinong, Indonesia); Forest Science Institute of Vietnam.

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