Grevillea robusta

A. Cunn. ex R. Br.

Proteaceae

Grevillea

LOCAL NAMES

Burmese (khadaw hmi); English (silk oak,southern silky oak,silver oak,silky oak,silk-oak grevillea,grevillea,river oak); French (chêne d'Australie,Grevillée robuste); German (Australische seideneiche); Hawaian (oka-kilika,haiku-keokeo); Indonesian (salamandar); Javanese (salamandar); Ndebele (kangiyo); Nepali (Kangiyo); Spanish (agravilla,roble australiano,helecho,roble plateado,grevilea,roble de seda); Swahili (mgrivea,mukima); Tamil (savukkumaram); Thai (son-india); Trade name (Grevillea); Urdu (bekkar,bahekar); Vietnamese (tr[ax]i ban,tr[ax]I b[af]n,ng[aa]n hoa)

BOTANIC DESCRIPTION

Grevillea robusta is a deciduous medium-sized to large tree 12-25 (max. 40) m tall; crown conical, dense, with branches projecting upwards. Bole straight, branchless for up to 15 m, up to 80 (max. 120) cm in diameter, usually without buttresses; bark fissured, sometimes pustulate, dark grey to dark brown, inner bark reddish-brown.

Leaves alternate, fernlike, pinnately (almost bipinnately) compound, 15-30 cm long, exstipulate; 11-21 pairs side axes (pinnae), 4-9 cm long, deeply divided into narrow, long, pointed lobes 6-12 mm wide, upper surfaces shiny dark green and hairless, underneath silky with whitish or ash-coloured hairs.

Flowers showy, yellowish, numerous, paired, on long slender stalks 1-2 cm, composed of 4 narrow yellow or orange sepals 12 mm long. Flower clusters 7.5-15 cm long, unbranched, arising mostly from the trunk, in a terminal or axillary simple or branched raceme, protandrous, petals 4, united into a tube that is mostly recurved under the broadened apex (limb); stamens 4, sessile in the concave limb; disk annular or semi-annular, sometimes bilobed; ovary superior, 1-locular with 2 ovules, style curved and protruding from a slit in the perianth tube, the apex free from the limb, eventually straight, persistent.

Fruits podlike, broad, slightly flattened (boat shaped), 2 cm long, black with long slender stalk and long, threadlike, curved style; 1 or 2 seeds, 10-13 mm long, elliptical, brown, flattened with wing all around a coriaceous to woody follicle, usually oblique and opening along the ventral margin.

The name commemorates Charles F. Greville (1749-1809), one of the founders of the Royal Horticultural Society of London.

BIOLOGY

The tree first flowers when about 6 years old. In its natural range, flowering occurs over a few weeks in October-November, but when planted in equatorial latitudes, flowering is sporadic throughout the year or absent, as in Jakarta. The flowers are bisexual, and pollen is shed before the stigma becomes receptive. Pollinating agents include honeybees, birds and arboreal marsupials (Phalangeridae), which collect nectar and pollen from flowers. The period from fertilization to fruit maturity is about 2 months. Fruit opens during hot, dry weather, releasing the seeds, which can be carried considerable distances by wind. In Java, G. robusta has mature fruit from September to January. Seed dispersal is by wind.

Trees in 3-year-old provennace trial in Malava, Kenya (Anthony Simons)

Shade trees: Shade trees planted along the edge of a field of maize in Embu, Kenya. Trees have been pruned to reduce competition with the crop. (Chris Harwood)

Field boundary trees: Row of trees along the edge of a farmer's field, near Meru, Kenya. The trees have been pruned and pollarded repeatedly to produce firewood and poles, and will eventually be harvested as saw logs. (Chris Harwood)

ECOLOGY
G. robusta occurs naturally in 2 distinct habitats: riverine rainforest in association with either Castanospermum australe or Casuarina cunninghamiana; or in vine forest dominated by Araucaria cunninghamii. Rainfall distribution has a summer maximum in the natural range, but G. robusta also grows well in climates with a winter maximum or a bimodal rainfall regime. In temperate areas, it can survive moderate winter frosts. It is not resistant to persistent strong winds. In its natural range, the species is semi-deciduous, shedding most of its leaves in the dry season, and can stand up to 6 months of drought.

BIOPHYSICAL LIMITS
Altitude: 0-2300 m, Mean annual temperature: 14-23 to 25-31 deg. C, Mean annual rainfall: 600-1700 mm

Soil type: Establishes well in riverine habitats, on alluvial soils that are free of waterlogging and mildly acid to neutral. Loam soil is preferred. It also occurs on clay loam and sand.

DOCUMENTED SPECIES DISTRIBUTION

Native: Australia

Exotic: China, Eritrea, Ethiopia, India, Indonesia, Jamaica, Kenya, Laos, Malawi, Malaysia, Mauritius, Nepal, Pakistan, Philippines, South Africa, Sri Lanka, Tanzania, Uganda, US, Vietnam, Zambia, Zimbabwe

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: The golden flowers are attractive to bees, making it an important honey plant.
G. robusta honey is dark amber, of high density with a pronounced flavour.

Fuel: G. robusta is popular for firewood and charcoal. It is also used to fuel locomotives and river steamers, power boilers and small industries. The calorific value of sapwood is about 4800 kcal/kg, while that of heartwood is 4950 kcal/kg.

Fibre: Mean fibre length is about 1.5 mm and width about 26 µm; the wood is suitable for pulping.

Timber: Grevillea yields a medium-weight hardwood with a density of 540-720 kg/cubic m at 15% moisture content. The timber has economic potential. Heartwood is pale pink-brown, turning to yellow-brown or red-brown on exposure; moderately clearly differentiated from the cream-coloured to pale pink sapwood; grain straight to wavy; texture medium to coarse and uneven; wood lustrous; prominent silver grain on radial surface.

Shrinkage upon seasoning is low to moderate; seasoning properties are rated from good to poor; wood air-dries slowly. It has a tendency to warp and check; therefore, thick material should be air-dried slowly followed by a mild kiln schedule to avoid honeycombing. The wood is hard, of low strength, but elastic, can be peeled and sliced satisfactorily, is moderately durable to non-durable and shows an absorption of creosote of 128 kg/cubic m when treated by open-tank method and 321 kg/cubic m with pressure treatment. The wood is susceptible to marine borer, pinhole borer and termite attack. It is easy to work with hand and machine tools, but cutting at an angle of 10 degrees is required to obtain a good finish on quarter-sawn faces. The wood is used in making railroad ties, plywood, panelling, air-freight cases and furniture, parquetry, turnery, boat building, interior trim, cabinet work, parquet flooring, boxes, toys and novelties.

Gum or resin: By virtue of their solubility, viscosity and relatively high resistance to hydrolysis, G. robusta gums may have some industrial applications.

Poison: The flower buds, fruit and seeds are cyanogenic. Through contact with the leaves, sensitive persons may develop contact dermatitis due to tridecylresorcinol, a chemical compound related to the allergen toxicodendron.

SERVICES
Shade or shelter: This is a well known shade tree in coffee and tea plantations. Its spreading branching system makes it ideal for windbreaks or shelterbelts against wind-induced mechanical damage, high rates of transpiration and surface evaporation.

Reclamation: G. robusta is a pioneering colonizer of disturbed sites.

Soil improver: G. robusta provides abundant quantities of leaf mulch, which may accumulate to a depth of 30-40 cm. This thick layer protects the soil and maintains soil temperature. The leaves and twigs are apparently rich in aluminium.

Ornamental: Its majestic height, attractive shape and beautiful foliage make G. robusta an ideal tree for landscaping of private and public gardens. The cut leaves are used in flower arrangements, and young plants are grown as indoor pot plants in Europe.

Intercropping: A deep rooting system causes little interference with shallow-rooted crops, and it can be successfully intercropped with banana, tomato and other agricultural crops.

TREE MANAGEMENT
Moderate to fast growing. When climate and soil are suitable and weed competition is not severe, annual height and diameter increments of at least 2 m and 2 cm, respectively, are usually achieved for the 1st few years in row planting on farms. Annual height increments of 3 m have been observed at the most favourable sites. G. robusta regrows well after complete defoliation following pruning and pollarding, which can be carried out repeatedly to yield wood and to regulate shading and competition with adjacent crops. It is characterized by root suckering, hence it is a good candidate for management under coppice rotation; it responds well to pollarding, lopping and pruning. A plant density of 800-1200 trees/ha is recommended for plantations. Some control of competing vegetation is required for the 1st 1-2 years after planting. Seedlings are normally planted at a spacing of 2.5-3 x 3-4 m. The relatively open canopy of G. robusta makes it less suitable for areas with erosional hazard. It also easily regenerates naturally, especially in agricultural fields. For firewood production, rotations of 10-20 years are applied and annual volume increments of 5-15 cubic m/ha may be expected. A growth reduction after 20 years is reported. The species is known to produce substances toxic to its own seedlings.

GERMPLASM MANAGEMENT
Collection of seeds from mature trees is very difficult because the seeds are borne on thin and inaccesible branches at great heights and are easily lost during collection. Seed storage behaviour is orthodox; whole seed have 28.5% mc; 60-70% germination following 2 years of hermetic storage at -7 deg. C with 10% mc; 35% germination following 12 months of open storage. Seeds were maintained for 4 years in commercial storage conditions; viability was maintained for 2 years in hermetic air-dry storage at 3 deg. C. There are between 24 000 and 105 000 seeds/kg.

PESTS AND DISEASES
In humid regions, G. robusta is vulnerable to attack by fungal diseases such as Corticium salmoniclor. Fungi such as Amphichaeta grevilleae, Cercospora spp. and Phyllostica spp. have been observed to cause considerable damage to leaves and stems of young plants in Sri Lanka, particularly if they are overwatered in the nursery. Under lowland conditions in the Caribbean, it is severely attacked by the scale insect Asterolecanium pustulans. Attack by termites can be a problem when planted on dry sites in Africa. In Peninsular Malaysia, the big white ant Termes gestroi destroyed experimental trees. The wood is susceptible to marine borer and pinhole borer. Sapwood is susceptible to Lyctus.

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