

Gmelina arborea

yemane, gumhar

Roxb.

Verbenaceae

LOCAL NAMES

Bengali (gamari,gumbar,gumhar,gomari,gamar); Burmese (mai saw,yemari,yemane,yemani); English (white teak,yemane,Malay beechwood,Kashmir tree,Candahar tree,beechwood,goomar teak,gmelina); French (melina,gmelina,peuplier d Afrique); German (Gumar-Teak); Gujarati (shewan); Hindi (gomari,gumhar,gambhar,sewan,kambhari); Nepali (gamari,khamari,gambari,gumhari); Sanskrit (bhadraparni,gambhari,gandhari,shriparni,kasmari); Spanish (melina,gmelina); Tamil (perungumpil,gumadi,kumadi,umi-thekku); Thai (so,so-maeo); Trade name (yemane,gumhar); Vietnamese (nghi [ees]n d[aa]s,t,[ox]l th[o]j)

BOTANIC DESCRIPTION

Gmelina arborea is an unarmed, moderately sized to large deciduous tree with a straight trunk. It is wide spreading with numerous branches forming a large shady crown, attains a height of 30 m or more and a diameter of up to 4.5 m. Bark smooth, pale ashy-grey or grey to yellow with black patches and conspicuous corky circular lenticels. Inside surface of bark rapidly turns brown on exposure and exfoliates into thick woody plates or scurfy flakes. Blaze pale orange and mottled with a darker orange colour.

Leaves opposite-decussate, mostly rather soft and limp; petioles cylindrical, 5-15 cm long, puberulent or glabrous; leaf blades broadly ovate, 10-25 cm x 7-20 cm wide, apically long acuminate or caudate, entire on mature plants but strongly toothed or lobed on young plants, usually cordate or truncate basally, with a short cuneate attenuation into the petiole, densely tomentose above when young, becoming glabrous above when mature, permanently densely fulvulous-tomentellous with stellate hairs beneath, glanduliferous just above the petiole on the basal attenuation.

Flowers abundant, scented, reddish, brown or yellow, in terminal and axillary 1- to-3-flowered cymes on the panicle branches, which are about 8-40 cm long. Flower 2.5-5 cm in diameter; bracts 8 mm long, linear lanceolate; calyx broadly campanulate, about 5 mm long, densely fulvous-tomentose externally, the rim with 5 small, triangular, acute teeth; corolla large, showy, varying from yellow to orange or brilliant orange to reddish- or brownish-yellow, dull yellow-brown, tubular below, obliquely funnel-form at the throat, the tube densely pubescent externally, the limb 2-lipped, the upper lip often orange-pink, deeply divided into 2 oblong, obtuse, backwardly curled lobules, the lower lip often lemon yellow, up to twice as long as the upper and 3-lobed.

Fruit a drupe, 1.8-2.5 cm long, obovoid, seated on the enlarged calyx, glossy and yellow when ripe; exocarp succulent and aromatic; endocarp bony and usually 2-celled. Seeds 1-3, lenticular, exalbuminous.

The genus was named after J.C. Gmelin, an 18th-century German botanist. The specific name means tree-like, from the Latin 'arbor' (tree).

BIOLOGY

Seed years recorded from various locations show that the tree seeds well every year. There are 2 peak periods for floral bud burst, which may vary from year to year, and with the local climatic conditions. The first flowers are borne 3-4 years after planting and, in nature, self-pollination is discouraged by the floral morphology. However, in controlled self-pollination, flowers develop into fruits. Many types of insects visit the flower showing that the flowers may be insect-pollinated. Birds and bats, attracted by the smell of fruits, are the main seed dispersal agents. Mature fruits are produced 1 week after flowering peak and fruiting may be spread over a 2-month period. In India, the species flowers from February to March and fruits ripen from the end of April to June.



G. arborea plus tree, Turralba, Costa Rica. (David Boshier)



G. arborea, farmer reforestation, Nicoya peninsular, Costa Rica. (David Boshier)



G. arborea flower. (David Boshier)

ECOLOGY

The species occurs in a variety of forest habitats, including tropical semi-evergreen, sub-montane, very moist teak forests, deciduous, sal and dry teak forests. It also occurs in *Syzygium* parkland and low alluvial savannah woodland. The tree is a light demander, although it can stand some shade. It is moderately frost hardy and recovers quickly from frost injuries.

G. arborea occurs in the western Himalayas. Its choice of site is wide, but it shows a preference for moist fertile valleys with sandy loam soil; in west Bengal, this species grows best on high silt deposits near rivers. It does not thrive where the drainage is poor, while on dry, sandy or otherwise poor soil it remains stunted and is apt to assume little more than a shrubby form because of repeated dying back through drought.

BIOPHYSICAL LIMITS

Altitude: 0-1200 m, Mean annual temperature: 20-28 deg. C, Mean annual rainfall: 750-4500 mm

Soil type: Preference for moist, fertile, freely drained soils; acid soils, calcareous soils and laterite soils.

DOCUMENTED SPECIES DISTRIBUTION

Native: Bangladesh, Cambodia, China, India, Japan, Laos, Myanmar, Nepal, Pakistan, Sri Lanka, Thailand, Vietnam

Exotic: Brazil, Cote d'Ivoire, Ethiopia, Gambia, Ghana, Kenya, Malawi, Malaysia, Nigeria, Sierra Leone, Sudan, Tanzania, Uganda, Zambia



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

Food: The fruit of *G. arborea* is edible.

Fodder: Leaves are regarded as good fodder and cattle eat the fruit.

Fuel: *G. arborea* is planted mostly for firewood, which has a calorific value of 4800 kcal/kg. For firewood, a spacing of 2 x 2 m is recommended. Plantations of *G. arborea* have been established for tobacco curing.

Apiculture: Flowers produce abundant nectar, which produces high-quality honey.

Fibre: The wood produces good-quality pulp. Unmixed semi-chemical pulp is suitable only for carton board or low-grade writing paper, but kraft pulp of yemane wood is suitable for higher grades of writing paper. It is also utilized for particle board.

Timber: When 1st cut, the wood is yellowish- to reddish-white, turning light russet or yellowish-brown with a density of 400-560 kg/cubic m. The wood seasons well without degrading, but it is slow to dry both in the open and in a kiln.

Where it is indigenous, it is regarded as a valuable general-purpose wood because of its dimensional stability. The natural durability of the wood is about 15 years. Uses include the manufacture of furniture, plywood core stock, mine props, matches and timber for light construction.

Tannin or dyestuff: Both wood ash and fruit yield a very persistent yellow dye.

Medicine: Bark, leaves and roots contain traces of alkaloids and are used medicinally in its native range, such as in Hindu medicine. For example, both fruit and bark have medicinal properties against bilious fever.

Other products: Recommended for silkworm culture.

SERVICES

Reclamation: *G. arborea* is a highly light-demanding species and regenerates naturally only in the open and on the edge of forests. It is an ideal choice for large-scale afforestation programmes.

Ornamental: *G. arborea* is sometimes planted as an avenue tree.

Intercropping: Planting *G. arborea* with crops like maize and cassava has been found beneficial in increasing the simultaneous production of wood and food. When intercropped with maize and cassava, it performs better under closely stocked stands of cassava, yams and maize. Cassava, however, suppresses re-growth of stumped trees and should, therefore, be planted 3 months later. Spacing for optimum yields of both crops was 2.5 x 2.5 m for *Gmelina* and 1 x 1 m for both yams and maize. *Gmelina* forms an integral component of a taungya system where it is intercropped with peanut, cashewnut, tobacco, maize and beans. Some limitations are that it casts heavy shade, and nothing will grow under a dense 2 x 2 m stand; it forms a leaf carpet beneath trees, creating a mild fire hazard in times of prolonged drought; and the palatability of the foliage is a drawback to establishing woodlots near villages. Valuable in coffee and cocoa plantations to protect young trees and to suppress invasive grasses.

Other services: After 18 months of growth, the tree's low, dense canopy provides effective weed control.

TREE MANAGEMENT

G. arborea has suitable characteristics for agroforestry, with fast growth, ease of establishment, and relative freedom from pests outside its natural range (it can be browsed repeatedly without damage). It is an especially promising fuelwood species because it can be established easily, regenerates well from both sprouts and seeds, and is fast growing. Trees coppice well with vigorous shoot growth. Although able to compete with weeds more successfully than many other species, it responds positively to weeding and also benefits from irrigation.

GERMPLASM MANAGEMENT

Viable seeds should be collected from standing trees of superior phenotype. Seed storage behaviour is orthodox; viability can be maintained for several years in hermetic storage at 3 deg. C with 7-10% mc. On average, there are 1400 seeds/kg.

PESTS AND DISEASES

Where it is introduced, it has few disease problems, although some sporadic cases have been reported. Nursery pathogens include *Pythium splendens*, which causes wilting in 1-2 month old seedlings; *Fusarium oxysporum*, a damping-off fungus that causes high seedling mortality; and *Rhizoctonia solani*, a root-collar disease on 4-month-old seedlings. Anthracnose disease caused by *Colletotrichum* sp. is also reported. Plantation diseases observed include leaf spot caused by *Colletotrichum gloeosporioides*; vascular necrosis and chlorosis by *Pestalosphaeria elacidis* and *Khuskia oryzae*; heart rot and root rot caused by *Ganoderma* spp.; and stem and branch canker (machete disease) caused by *Ceratocystis fimbriata*. A bark disease (worm disease) that can girdle the base of the tree and cause die-back of branches in 2-year-old plantations is spread by *Griphosphaeria gmelinae*. In Indonesia one of the insects consistently associated with the species is a carpenter worm *Prionoxystus* sp. which bores into stems of saplings feeds from within and weakens them.

Serious plantation pests are the larvae of *Dihammus cervinus*, which bores longitudinal galleries on the cambial layer of the saplings, and the larvae of *Calopepla leayana* and *Glenea indiana*. *Ozola minor*, which attacks out-planted seedlings, and a leaf-cutting ant (*Atta* spp.) cause severe defoliation.

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