

Gmelina arborea: An indigenous multipurpose tree species

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Introduction

Gmelina arborea commonly known as white teak, gabar, or siwan belongs to Liminaceae family. It is indigenous, fast-growing deciduous tree species found across the world majorly in tropical countries like Brazil, Philippines, Gambia, Nigeria, India, China, Bangladesh, Sri Lanka, Myanmar, Cambodia, Laos, Thailand and Indonesia. The tree species owns equal importance for both medicinal and timber values. It is also a promising multipurpose tree for fuel, feed, and other household necessities. In recent days it is used in reclamation of wastelands, marginal lands, and social forestry programs.

In India, the species is distributed between latitude 8° to 27° N and longitude 72° to 96° E. It accounted for 0.47% of nation's agroforestry (ISFR 2013). Their population is significant in states like Kerala, Tamil Nadu, Andhra Pradesh, Karnataka, Jharkhand, West Bengal, Assam, Nagaland, Mizoram and Tripura with plantations raised majorly outside the forests. Under regular conditions *G. arborea* can grow up to 35 m tall and 3m in diameter. With multi-potent uses, the population of *Gmelina* is decreasing. The IUCN has identified it as a “Least Concern” species (de Kok., 2019).



Fig 1: a) *Gmelina arborea*



b) Worldwide distribution of *G. arborea*

(Source: <https://www.cabi.org/isc/datasheet/25465#toDistributionMaps>)

Ecology

Gmelina arborea is a popular tree species found in evergreen and dry deciduous forests associated with mean annual temperature of 21-28°C and annual rainfall of 750-5000 mm for optimum growth. Deep, loamy, clay loams, calcareous, and moist soils are best suited for its growth with pH range of 5.0 and 8.0 and clay or least drained soils are avoided for its cultivation. The species is extensively planted as an integral part of agroforestry systems in humid tropical regions. Due to its high adaptability for different ecological conditions and coppice ability for propagation it's been cultivated in many countries as commercial plantations.

Wood related aspects

G. arborea possesses native trees of high-quality wood. With favourable conditions, the the species can reach 20 m height in five years with remarkable growth. Form of the tree is fair to good, with 6-9m of clear bole. Some trees can reach 3m height within a year after planting. The tree attains more than 30m height with about 60cm dbh at maturity with 4.5-5 years. At the age of 12 years of planting, the yield of gamhar is recorded on average as low (84 m'lha) in poor sandy soils whereas it is quite higher (210 m'lha) in clay or lateritic soils, and highest (252 m'lha) in alluvial soils. Compared to other hardwood pulps, *G. arborea* produces average yield but of superior quality. Its wood can be utilized for carpentry, feed, plywood, shipbuilding, molding, furniture and interior woodworking (Wang 2004). Rotations for pulpwood and sawn wood are usually done for six and ten years respectively. Rotations of 5-10 years are common for fuel wood. The *Gmelina* wood is similar to soft woods and possesses coarse texture with white-pale yellow colored

heartwood and white sapwood. The heartwood of *Gmelina* is moderately durable and offers good dimensional stability. Fiber dimension and derived indices values of *Gmelina arborea* wood are mentioned in table 1.

Wood parameters (µm)	Measured value
Fiber length	783.70
Fiber Width	24.10
Cell Wall thickness	03.60
Lumen width	16.90
Runkel ratio	00.40
Flexibility coefficient	70.12
Slenderness ratio	38.80
Rigidity coefficient	00.30

Table 1: Fiber dimension and derived indices values of *Gmelina arborea* wood

(Source: Chaudhari *et al.*, 2015; Azzez *et al.*, 2016)

Plantation techniques

The plants can be regenerated both naturally (seed, coppice, root sucker) and artificially by methods namely, direct sowing, stump planting, entire transplanting and vegetative propagation.

a) Direct sowing: It is the easiest method to raise commercial plantation. Sowing is done in patches. Patches of 0.3×0.3×0.3 are hoed on 1.8m×1.8m field and are allowed to weather for a month and then filled with well-drained soil up to 7.5cm above the ground. During monsoon breaks, seeds are sown 1.0cm to 2.5cm deep at

the rate of four seeds per patch in line sowing with 0.9m apart.

b) Stump planting: The seedlings rose in the month of May become ready for stump planting in June. The stumps prepared from one year old seedlings are used for planting.

c) Entire transplanting: It is widely used in which seedlings are planted along with earthy material without trimming the roots. The entire transplanting is generally done at onset of rains when the young plants are of one month age or of 2.4 to 2.7m height as it gives 95% survival.

d) Vegetative propagation: Tropical Forest Research Institute, Jabalpur has developed be effective methods for mass propagation of the species through micropropagation or cuttings. The micropropagation method is standardized with MS basal medium + 1 μ M BA+ 4mg/l AgNO₃, for shoot multiplication and WPM basal medium + 10 μ M IBA for rhizogenesis. Among different types of cuttings and treatments employed, sprout cuttings treated with 5mM IBA is considered as an efficient procedure for cloning of the *G. arborea*.

Medicinal Uses

Therapeutic value of *G. arborea* is equally significant with its timber value. Root extracts of the species are important ingredient of "Dashmula" an Ayurvedic formulation to improve digestion, treat haemorrhoids, piles and heart diseases. Fruits and leaves are used to treat ulcer, anaemia, leprosy and other gastro-intestinal issues. It is also used as a nerve tonic in insanity and epilepsy. The leaves are also applied to snakebite and scorpion stings. The crushed juice of roasted fruit is applied dermally to treat itching and other skin allergies.

Pests and pathogens

The *G. arborea* species is susceptible to a variety of pests and pathogens from nursery to plantation stage. Some of the significant diseases include, Foot rot (*Fusarium oxysporum*), Poria root rot (*Poria rhizomorpha*), Stem rot (*Phoma nebulosa*), Root rot and collar rot (*Sclerotium rolfsii*), Leaf spots (*Pseudocercospora ranjita*, *Deptoheria gmelinae*, *Phoma tropica*, *Alternaria laterata*, *Macrophomina phaseolina*), Powdery mildew (*Phyllactinia suffulta* var. *Gmelina*), wilting (*Ceratocystis fimbriata*) and Stem canker (*Thyronectria pseudotricha* and *Hendersonula toruloidea*) has caused most significant failures of *G. arborea* plantations.

Among the insect pests, defoliators like *Calopepla leayana* and *Owla minor* considered to be significant pests along with a phanerogamic parasite *Loranthus scurrula* is found to severely affect *G. arborea* due to its thin bark. Apart from them, *Spilosoma* (*Diacrisia*) *maculosa*, *Lixus camerunus*, *Empacamenta calabrica*, *Zonoceros variegates* and *Achaea lienardi* are also recorded to cause huge damage to the *G. arborea* plantations.

Genetic resources for tree improvement

In order to develop improved germplasm with desired traits of interest genetic exploration is required. Assessment of morphological and genetic diversity in *G. arborea* is performed by using various tools of population genetics like ISSR, SSR, and RAPD nuclear ribosomal DNA molecular marker based on ITS region for better end results. However, there are many challenges to identify economically productive germplasm with resistance against pests and pathogens. Some cultivars of the *G. arborea* tree include,

i) *Gmelina arborea* var. *canescens*: This cultivar has subcoriaceous and grey-pubescent lamina features.

ii) *Gmelina arborea* var. *glaucescens*: This cultivar has glaucous and glabrous lamina features.

Conclusion

Gmelina arborea is as multipurpose tree. Due to its fast growing potential and adaptation

features, it is emerging as “agroforestry” species. It is cultivated along with other crops and is widely recommended for reclamation of degraded lands. As the species has high demand for various end uses, more efforts are required for its genetic improvement. Commercial plantations of *G. arborea* need to be encouraged by persuading farmers with applicability of silvicultural practices to harness splendid economic returns.

References

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