

# ***Gmelina arborea* an Indigenous Plant with high Medicinal value: A Review**

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## **Abstract**

*The drupes that fall during the rainy season promote *Gmelina arborea* natural reproduction. Seed germination requires both heat and moisture. Artificial reproduction uses seeds or cuttings to develop plants. Healthy *Gmelina arborea* Roxb. offspring require certain circumstances. They have fertile soil with good drainage. This sun-loving plant hates shade. It prefers an annual rainfall of between 750 and 4500 millimeters. Poorly drained, sandy, or dry soils stunt growth. Despite contemporary medicine's advances, unique natural product-based treatments are still required. 70 000 plants are therapeutic. Ayurveda uses over 2,000 plants to treat diseases. Only a few commercially important medicinal plants are not grown in the US. Ayurveda and other ancient Indian medical practices use around 1200 medicinal plant species. We can discover new treatments for many ailments by studying the medicinal properties of plants that have been around for generations. It is now possible to create novel plant-based drugs. It's a lovely, fast-growing bloom. The pharmacological consequences of commercial medication formulations must be investigated by finding active compounds.*

**Keywords:** *Herbal, Pharmacology, Medicinal, *Gmelina arborea*, Morphological Character*

## **Introduction**

Herbal medicine has grown in popularity recently. They value the product's natural origins and few adverse effects. Nature has a cure for everything, and it's free. Around 80% of the world's population uses herbal supplements. Herbal remedies have been utilized for centuries. Despite modern medicine's incredible advances, it is vital to develop new natural medical products. 70,000 plants are healing<sup>1</sup>. Ayurveda uses over 2,000 plants to treat illnesses. Rarely are medicinal herbs grown in the US. Ayurveda and other traditional Indian medical practices use around 1200 Indian medicinal herbs<sup>2</sup>. Examining plants for their medicinal potential and historical use can lead to the creation of new medications for many ailments. Thus, new plant-based drugs can be created. Beautiful, fast-growing plant. This method is the most often used, easiest, and most effective. Leave the green and black *Gmelina arborea* Roxb. fruits behind when collecting mature brown ones. After four to five days of stacking or burying, they're

washed. *Gmelina arborea* Roxb. They respect its wood and healing powers. It is widely used in the tropics<sup>3</sup>. The Amazon basin in Brazil was the first to colonise *G. arborea*, while Costa Rica was the first in Central America. Eventually it reached Venezuela, Honduras, Ivory Coast, Panama, In India, it is found between 8° to 27° N and 72° to 96° E in states like Kerala<sup>4</sup>.

*G. arborea* can grow to 35 m and 3 m in diameter. In nature, the tree produces several stems with a huge canopy. This tree's roots are frequently used in Ayurvedic and Unani therapies and by local practitioners in India. The IUCN considers it a "Least Concern" species. However, the medical industry (500–1000 metric tonnes per year). The tree is destroyed to obtain the root bark, which is then sold as a whole. Nobody can deny that habitat quality and quantity are diminishing<sup>5</sup>.

*Gmelina* was originally in the Verbenaceae. Linnaeus first described it in 1753 using an Indian specimen. The genus is named after Johann Georg Gmelin (1709–1755), a botanist and chemist. Hooker described the species in 1885, after Roxburgh described it in 1832. (1924) Rees (1810), Lam (1919), Greaves (1981), Moldenke (1984) and Munnir (1984). The Lamiaceae genus was reclassified in 2012. The name comes from the Latin 'arbour' (tree). An overview of its taxonomy and description was included in the revision. 36 is the chromosome 2n number<sup>6</sup>.

*Gmelina arborea* thrives in evergreen and dry deciduous forests with annual rainfall of 750–5000 mm. Annual mean temperature is 21–28°C. The species is native to 5-30N and 70-110E. Candidates include deep loamy, clay loamy, calcareous, and moist soils. The pH is 5.0-8.0. Acidic, thin, and severely leached soils limit its growth<sup>7</sup>. It is frequently planted in many countries due to its adaptability, coppicing ability, and early reproductive potential. In natural woodlands, it is often found scattered and mixed with other species. Pseudoteak; Malayan, African, and Melina. African peasant; Yemane Yun nan shi zi rvore boca de leo<sup>8</sup>.

Gambar, Gmelinea, Melina, this animal is called "so-maeo" in the Dominican Republic and the Philippines. Kasmari; Kasmiri-mara; Khambhari; Kumbil; Kumhar; Kummadi; Perungumpil; Sewan; Shewan; Shivan; Shivani; Shriparmi; Umi-Thekku, Gomari BSI 2020.

## Geographical Distribution

*Gmelina arborea* is native to Assam and northern Bengal, as well as Bihar and Orissa. Gamhar is found in West Bengal's mix forests. It is an important plantation species for medicinal and timber purposes. The root of this plant is the most medicinal. So the factory is gone. During the wet season, *Gmelina arborea* Roxb. starts reproducing spontaneously. Warmth and moisture are required for seed germination. Artificial reproduction involves seed or vegetative propagation distribution<sup>9</sup>. Agroclimatic parameters must be met to produce healthy *Gmelina arborea* Roxb progeny. They include nutrient-dense soil with good drainage. This plant despises shade. It thrives in 750-4500 mm rainfall areas. Dry, sandy, or nutrient-deficient soils, as well as poorly draining soils, might stunt its growth. Its growth and output are strongly reliant on these requirements being met<sup>10</sup>.

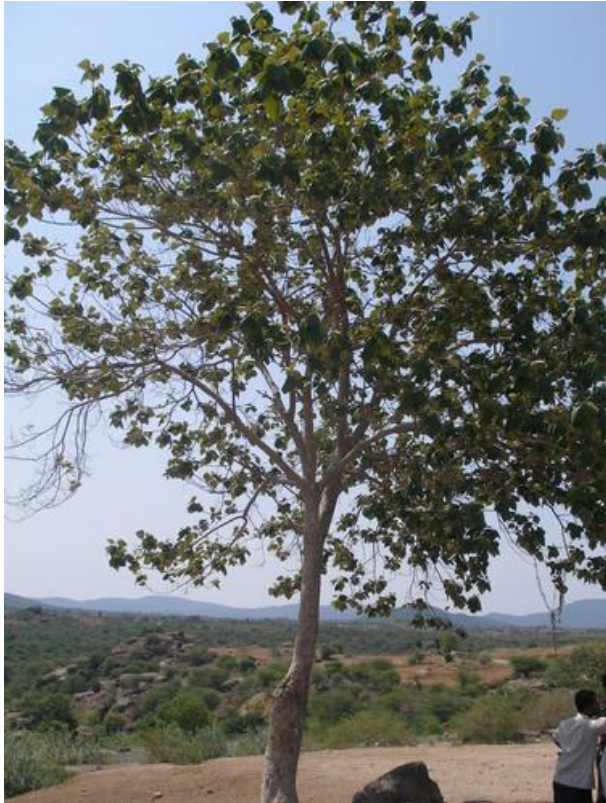


**Fig: 1 Geographical distribution of *Gmelina arborea***

### **Morphological Characteristics:**

- ❖ Household characteristics Most of the species found here are native to India. Ivy and ferns Some xerophytic plants are thorny. They frequently stink. A 4-angled stem is rare. Leaves can be simple pinnate or palmate or complex. Inflorescences are racemes, panicles, spikes, and dichasial cymes<sup>11</sup>.
- ❖ Pentamerous, hypogynous, and bisexual flowers Involucres are the bracts in Lantana.
- ❖ Calyx sepals are usually four to five, but can be up to eight or even gamosepalous. The calyx is a rock.
- ❖ A five-petalled gamopetalous hybrid. They used to have two, but now they have five. Long or short limb aestivation imbricates the tube<sup>12</sup>.
- ❖ Adroecium has four epipetalous didynamous stamens (rarely 2 or 5). Their position is similar to the corolla lobes.
- ❖ Two carpels, but can have four if needed. The ovary superior has two or four chambers, each holding one or two ovules.
- ❖ Pyrenes occur in the fruit and seeds.
- ❖ This type of seed is called ex albuminous seed. The floral formula is: This velvety tomentose deciduous tree's juvenile sections reach 18 metres. The bark is corky yellow-grey. Branch pubescence is whitish mealy. They are 10-20 cm long, glabrous above and stellately fulvous-tomentose below 57.5 cm length glandular cylindrical puberulous pedicels Each flower has three cymes on the panicle's branches. bracts 8mm angular and cylindrical

buds The calyx is coated in fulvous hairs. Yellow 5-lobed 2-lipped corolla 3.8cm long. 1cm long, two oblong lobes Lips<sup>13</sup>. That's about 2.5cm longer than the rounded lateral lobes of the lower lip. It's a golden brown colour. Drupes are a tropical berry. An oblong-obovoid seeded 2-2.5cm length (green unripe, orange ripe).





**Fig: 1,2,3,4,5,6 Shows Morphology Characteristic of Gmelina arborea**

### **Chemical Composition**

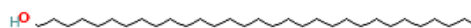
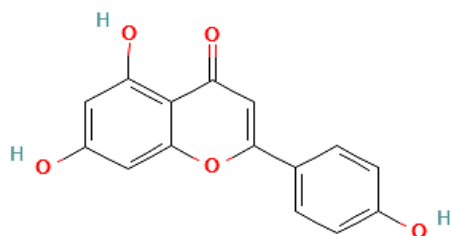
*G. arborea* has a number of chemical components. Offor (2014) investigated *G. arborea* leaves' nutritional phytoconstituents. *G. arborea* bark contains flavonoids, saponins, terpenoids, and cardiac glycosides. tannins 0.060.00 mg, saponins 3.85 mg, glycosides 1.77 mg<sup>14</sup>, flavonoids 0.06 mg, alkaloids 0.06 mg, phenols 0.32 mg, steroids 0.09 mg (mg/100gm). proximate analysis (percentage) of the leaves: 15.05 – 0.07 – 0.07, 20.05 – 0.07 – 0.07, 47.1–1.04.

For extraction, utilised petroleum ether,  $\text{CHCl}_3$ , and EtOH. The alcoholic extract was denatured using petroleum ether, Et<sub>2</sub>O, and  $\text{CHCl}_3$  as extraction solvents. In addition to tetrahydroxy flavone, the Et<sub>2</sub>O extract yielded another chemical, luteolin, after recrystallization from alcohol. These compounds were found in *Gmelina arborea*<sup>15</sup>. Also, flavone glycosides were found to be present. The leaves of *Gmelina arborea* included apigenin, luteolin, quercetin, hen triacontanol, and sitosterol, all of which were crystallised. They found flavone glycosides. They discovered a long-chain ester in *G. arborea* roots and heartwood (1971). Spectroscopy and synthesis revealed cluytyl ferulate. No cluytyl ferulate has been found in nature yet<sup>16</sup>.

In 1975, discovered gummadiol in heartwood. It's gummadiol, a structural isomer of arboreols. Gummadiol's hydroxyl group is hemi-acetal when treated with methanol and hydrochloric acid. Using 1H and 13C NMR to structure an isolated chemical. Six new lignans were found in *Gmelina arborea* heartwood extracted in methanol. hydroxymethyl-4,4' hydroxy tetrahydrofuran, methylene dioxy benzyl, hydroxy methylene dioxy benzyl, and epigummadiol

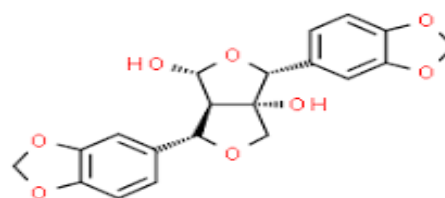
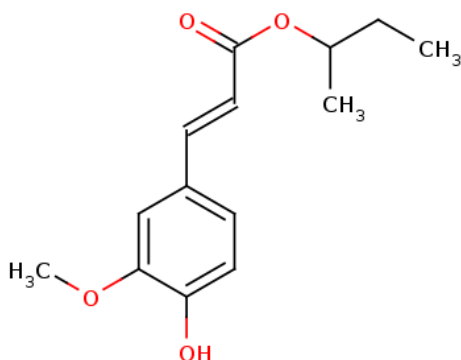
were all synthesised from 1,4-dihydroxysesamin (gummadiol).  $^1\text{H}$ ,  $^{13}\text{C}$ , and mass spectrometry (MS) were used to investigate this group of compounds<sup>17</sup>.

One of these is arborone (I), and the other is 7-oxodihydrogmelinol (II). Paulownin acetate and epieudesmin are two recognised furofuran lignans, found kaempferol, apigenin, and luteolin glycosides in *G. arborea* and *G. asiatica*.



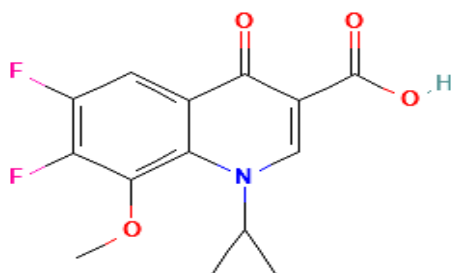
**A) Apigenin**

**B) Hentriacontanol**

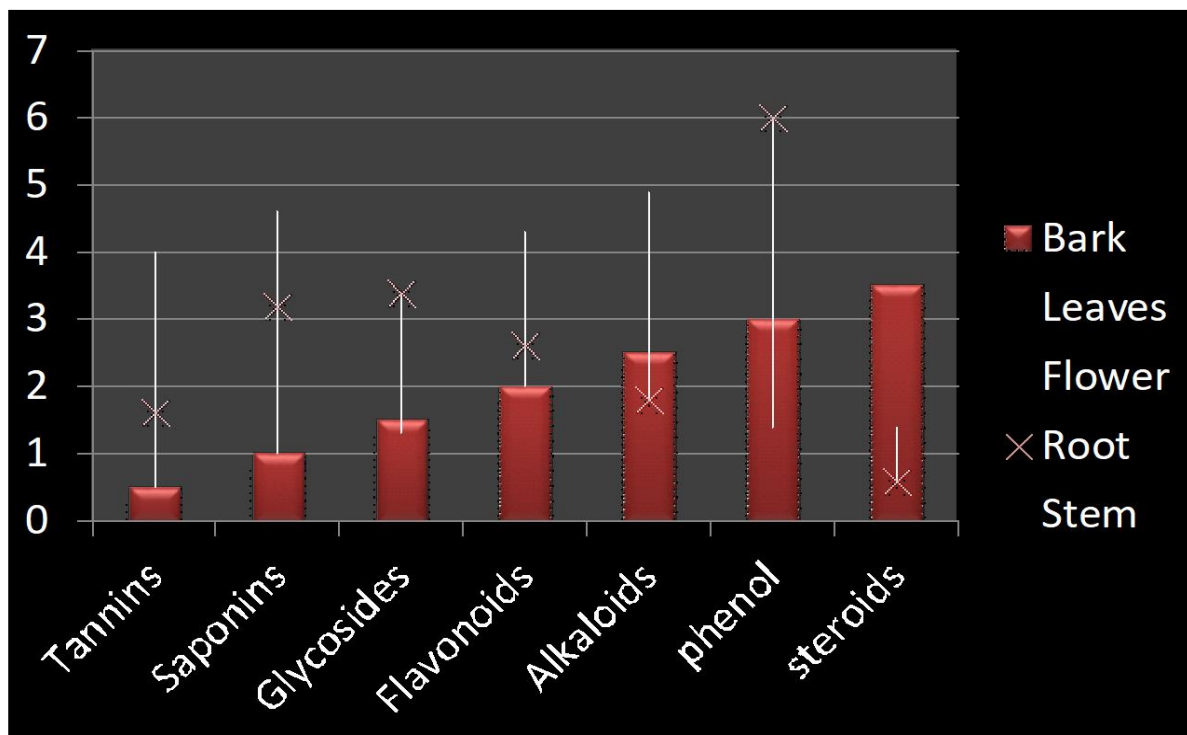


**c) 2- Butyl ferulate**

**d) Gummadiol**



**e) 7-oxodihydrogmelinol**



**Fig: 6 Bar Chart Represent Chemical Composition of plant *G. Aborea***

From *Gmelina arborea* Linn heartwood, 3,7-dioxabicyclooctanes are the parent chemical of arboreol. Aside from that, there was isoaborool<sup>18</sup>. The first lignans were made from gmelanone, 3,6-dioxabicyclo [3, 2, 1]-octane. R1 = OH) and isoarboreol (II). *Gmelina arborea* contains -sitosterol (IV) and -pauownin (V).

Krishna et al discovered a bromine-containing lignan in *Gmelina arborea* (1977). NMR and other spectral approaches determined the isolated chemical's structure .

Phytochemicals	Ethanol extract	Ethyl acetate extract	n-butanol extract	Petroleum ether extract
Alkaloids	+	-	+	+
Carbohydrates	+	-	-	+
Cardiac glycosides	+	+	+	+
Anthraquinone glycosides	+	-	+	+
Gums and mucilages	+	+	+	-
Proteins and amino acids	-	+	-	+
Tannins	+	-	+	-
Phenolic compounds	+	-	+	-
Steroids and sterols	+	+	+	+
Triterpenoids	-	-	+	+
Saponins	-	-	+	+
Flavonoids	+	-	+	-

+: Present; -: Absent

## Pharmacology Properties

### Toxicity study:

In mouse trials, the extract was well tolerated at the tested dosages, with no signs of liver, kidney, or hepatotoxicity. Thus, oral acute and repeated dosage toxicities showed that *Gmelina arborea* aqueous extract is non-toxic. The results of this study may be useful in future preclinical and clinical studies on *Gmelina arborea*<sup>19</sup>.

### Antioxidant Study:

The antioxidant and cytotoxic effects of *G. arborea* are attributed to the presence of certain bioactive secondary metabolites components in each extract, as well as the quantity of phenolic contents in each extract<sup>20</sup>. The results showed that most *G. arborea* leaf extracts exhibited high antioxidant activity, iron chelation, reduction power, and cytotoxicity. *G. arborea* leaf extracts had many of these qualities. These in vitro studies show that plant extracts are a rich source of natural antioxidants that may slow the progression of oxidative stresses<sup>21</sup>.

### Anti-diabetic Activity:

The extracts had many times the potency of the control (normal saline water) and standard treatment (Glibenclamide) in lowering blood sugar levels (Glibenclamide). Compared to a normal control, ethanol and n-butanol extracts are more effective at lowering blood sugar. These effects are equivalent to Glibenclamide<sup>22</sup>. Although different components were extracted in different solvents based on their polarity, ethanol extract was found to be more successful than other solvent extracts. The action exhibited by this extract is significant and supports its use in traditional diabetic treatment. Alcohol and n-butanol are the most effective anti-diabetic substances. An ANOVA and z-test revealed that all data were statistically significant (F value > F crit) at 1% ( $p > 0.01$ ; or 0,00417). The ethnopharmacological use of *G. arborea*'s bark extract as an anti-diabetic is justified. This impact may be investigated further for the treatment of diabetic diseases. More research is needed to pinpoint the antidiabetic benefits of the chemical components<sup>23-25</sup>.

### Anti microbial Activity:

The antibacterial activity of *Gmelina arborea* leaf extract was demonstrated against *Staphylococcus aureus* and *E. coli* with a zone of inhibition of 9.730.64mm at 1000mg/kg. All extract groups had a significant ( $p < 0.05$ ) difference in fecal decreases at 2/3 hours compared to the untreated group, but no change compared to the standard medication ( $p > 0.05$ ). This study found that *Gmelina arborea* methanol leaf extract contains antidiarrheal and antibacterial components<sup>26</sup>.

### Anti-diuretic Activity:

Each one of the four extracts was given 300 mg/kg orally to assess diuretic efficacy. The salt and potassium levels, urine volume, and pH levels were also measured. The diuretic activity was assessed by measuring the  $\text{Na}^+/\text{K}^+$  ratio and the diuretic index after 5 hours<sup>27</sup>.  $\text{Na}^+$  and



K<sup>+</sup> content (mmol/l/5h) of animal urine One can induce diuresis by boosting regional blood flow or early vasodilatation, or by blocking tubular reabsorption of water and anions. Its recognised anti-hypertensive efficacy is based on increased salt and water excretion.

### **Cardioprotective Activity:**

The results show that both Ksheerapaka and water extracts protect against free radicals and oxidative stress while preserving endogenous antioxidant levels. They also helped maintain the structural integrity of the heart cells, avoiding enzyme leakage into the serum. Discussion: Hrudya dravyas benefit the mind and heart<sup>28</sup>. Examples of subactivities of Hrudya Karma are Lekhana and Tarpana. Flavonoids, Glycosides, Tannins, and Triterpenoids are responsible for this action. Cardioprotective medicines have anticoagulant, vasodilator, and heart stimulant modes of action.

### **Anti-pyretic & Analgesic:**

An ethanolic and aqueous extraction of *Gmelina arborea* Roxb. peel at 420mg/kg body weight reduced hyperthermia 1 hour after treatment, comparable to paracetamol at 50mg/kg body weight. Three hours after injection, chloroform and toluene extract had only moderate impact on temperature lowering<sup>29</sup>. Although aqueous and ethanolic extract (test compounds) had higher analgesic effect than diclofenac sodium at 25mg/kg, it appears that the test compounds primarily inhibit the peripheral pain mechanism.

### **Some Other Activity**

This extract displayed modest antiviral activity against Ranikhet virus cell culture and no cytotoxic action against CA-9KB (ED<sub>50</sub> > 20µg/ml). Dry stem bark has antiviral activity against Ranikhet virus cell cultures<sup>30</sup>.

The ethanolic extract of stem bark and wood had hypoglycemic effect in albino rats at a dose of 250mg/kg. In a quantitative toxicity test on mice, aqueous extract has a maximum tolerated dose (Igm/kg).

The dried stem ethanolic extract demonstrated antimalarial activity (IC<sub>50</sub> = 36µg/ml), but the root (IC<sub>50</sub> = 85µg/ml) and root bark (IC<sub>50</sub> = 36µg/ml) had low antimalarial activity.

Wood decoction had modest nematocidal effect on *Toxocara canis* when tested at 10mg/ml. A multi-component formulation containing *G. arborea* shows hypolipidemic activity. This study found that intragastric (50 mg/kg) therapy of rats lowered blood fl-lipoprotein and apoprotein levels<sup>31-35</sup>.

Several *G. arborea* shade-dried root extracts demonstrated angiotensin converting enzyme inhibiting action. The extracts had weak inhibitory action at 0.33 mg/liter, while the aqueous extract was ineffective<sup>36</sup>.

A 50% ethanolic extract of dried stem bark showed significant anti-inflammatory effect when given intraperitoneally to male and female rats at 500mg/kg.

Antifungal activity of *Trametes versicolor* and *Fomitopsis palustris* against Malaysian *G. arborea* heartwood was evaluated. The highest potent lignans against both fungi were found in ethyl acetate soluble fractions. Suggested impact: lignan piperonyl nucleus and five chemical synergism<sup>37-40</sup>.

Liver slice cultures were treated with aqueous bark and fruit extracts, then parqueted with hydrogen peroxide. Both parquet and hydrogen peroxide were cytotoxic when tested on liver slice cultures. Combining cytotoxic medicines with bark and fruit extracts reduced lactate dehydrogenase release. Antioxidant enzymes superoxide dismutase, catalase, and glutathione reductase were elevated in response to these pro-oxidants<sup>41</sup>. Plant extracts and pro-oxidants hindered enzyme activity. The extracts showed antioxidant activity in in vitro experiments. Its bark and fruit extracts protected liver slice culture cells from oxidative stress-induced cell damage. The effects of fruits on rabbits were studied using electrophoresis of serum fractions, body weight, and physical behaviour. The treatment raised T- and Y-globin fractions, body weight, and alertness in physical behaviour<sup>42</sup>. It enhanced wound healing concentration, skin breathing strength, granuloma breaking strength and granuloma weight (200 mg/kg).

## Conclusion

Ancient Indian medical literature suggests *Gmelina arborea* has medicinal benefit, which is supported by this morphological review. Some of its pharmacological actions include healing, cytotoxicity, cardioprotection, antibacterial, antioxidant, antipyretic, analgesic, and antidiabetic. Identifying the compounds responsible for distinct activities in commercial pharmaceutical formulations is required to widen their pharmacological implications. This review indicates the value of *Gmelina arborea* Roxb. (gambhari) as a classical medicinal herb. This fast-growing multipurpose medicinal plant must be propagated and cultivated on a large scale using established techniques to exclude adulterants and replacements. Clinical trials are required to confirm and expand on the pharmacological qualities shown in animal investigations. However, the diuretic efficacy of the components is unknown. More research is needed to separate and identify the compounds in fruit extracts that have medicinal qualities.

## Future scope

Plants can be used to extract semi-synthetic compounds for the cosmetic, fragrance, and food industries. Plant-based health products have always been popular. So medicinal plants are important in economic growth. Demand is projected to increase. *Gmelina arborea* is a well-known lumber species worldwide.

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