

Pongamia pinnata (L.) Pierre



Syn.: *Pongamia glabra* Vent.

Derris indica Bennet

Fabaceae

Pongam, Indian beech

Source: James A. Duke. 1983. Handbook of Energy Crops. unpublished.

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Uses

The pongam tree is cultivated for two purposes: (1) as an ornamental in gardens and along avenues and roadsides, for its fragrant Wisteria-like flowers, and (2) as a host plant for lac insects. It is appreciated as an ornamental throughout coastal India and all of Polynesia. Well-decomposed flowers are used by gardeners as compost for plants requiring rich nutrients. In the Philippines the bark is used for making strings and ropes. The bark also yields a black gum that is used to treat wounds caused by poisonous fish. In wet areas of the tropics the leaves serve as green manure and as fodder. The black malodorous roots contain a potent fish-stupefying principle. In primitive areas of Malaysia and India root extracts are applied to abscesses; other plant parts, especially crushed seeds and leaves are regarded as having antiseptic properties. The seeds contain pongam oil, a bitter, red brown, thick, non-drying, nonedible oil, 27–36% by weight, which is used for tanning leather, soap, as a liniment to treat scabies, herpes, and rheumatism and as an illuminating oil (Burkill, 1966). Also used for lubrication and indigenous medicine. Pongam oil showed inhibitory effects on *Bacillus anthracis*, *Bacillus mycoides*, *Bacillus pulilus*, *Escherichia coli*, *Pseudomonas mangiferae*, *Salmonella typhi*, *Sarcina lutea*, *Staphylococcus albus*, *Staphylococcus aureus*, and *Xanthomonas campestris*, but did not inhibit *Shigella* sp. (Chaurasia and Jain, 1978). The oil has a high content of triglycerides, and its disagreeable taste and odor are due to bitter flavonoid constituents, pongamiin and karanjin. The wood is yellowish white, coarse, hard, and beautifully grained, but is not durable. Use of the wood is limited to cabinetmaking, cart wheels, posts, and fuel (Allen and Allen, 1981). Both the oil and residues are toxic. Still the presscake is described as a "useful poultry feed." Seeds are used to poison fish. Still it is recommended as a shade tree for pastures and windbreak for tea. The leaves are said to be a valuable lactagogue fodder, especially in arid regions. It is sometimes intercropped with pasture, the pasture grasses said to grow well in its shade (NAS, 1980a). Dried pongam leaves are used in stored grains to repel insects. Leaves often plowed green manure, thought to reduce nematode infestations. Its into ground as spreading roots make it valuable for checking erosion and stabilizing dunes. Twigs are used as a chewstick for cleaning the teeth. The ash of the wood is used in dyeing.

Folk Medicine

According to Hartwell (1967–1971), the fruits and sprouts are used in folk remedies for abdominal tumors in India, the seeds for keloid tumors in Sri Lanka, and a powder derived from the plant for tumors in Vietnam. In Sanskrit India, seeds were used for skin ailments. Today the oil is used as a liniment for rheumatism. Leaves are active against *Micrococcus*; their juice is used for colds, coughs, diarrhea, dyspepsia, flatulence, gonorrhea, and leprosy. Roots are used for cleaning gums, teeth, and ulcers. Bark is used internally for bleeding piles. Juices from the plant, as well as the oil, are antiseptic. It is said to be an excellent remedy for itch, herpes, and pityriasis versicolor. Powdered seeds are valued as

a febrifuge, tonic and in bronchitis and whooping cough. Flowers are used for diabetes. Bark has been used for beriberi. Juice of the root is used for cleansing foul ulcers and closing fistulous sores. Young shoots have been recommended for rheumatism. Ayurvedic medicine described the root and bark as alexipharmic, anthelmintic, and useful in abdominal enlargement, ascites, biliousness, diseases of the eye, skin, and vagina, itch, piles, splenomegaly, tumors, ulcers, and wounds; the sprouts, considered alexeteric, anthelmintic, aperitif, and stomachic, for inflammation, piles and skin diseases; the leaves, anthelmintic, digestive, and laxative, for inflammations, piles and wounds; the flowers for biliousness and diabetes; the fruit and seed for keratitis, piles, urinary discharges, and diseases of the brain, eye, head, and skin, the oil for biliousness, eye ailments, itch, leucoderma, rheumatism, skin diseases, worms, and wounds. Yunani use the ash to strengthen the teeth, the seed, carminative and depurative, for chest complaints, chronic fevers, earache, hydrocele, and lumbago; the oil, styptic and vermifuge, for fever, hepatalgia, leprosy, lumbago, piles, scabies, and ulcers.

Chemistry

Reported to contain alkaloids demethoxy-kanugin, gamatay, glabrin, glabrosaponin, kaempferol, kanjone, kanugin, karangin, neoglabrin, pinnatin, pongamol, pongapin, quercitin, saponin, β -sitosterol, and tannin. Air-dry kernels have 19.0% moisture, 27.5% fatty oil, 17.4% protein, 6.6% starch, 7.3% crude fiber, and 2.4% ash. Fatty acid composition: palmitic, 3.7–7.9%, stearic 2.4–8.9, arachidic 2.2–4.7, behenic 4.2–5.3, lignoceric 1.1–3.5, oleic, 44.5–71.3, linoleic 10.8–18.3, and eicosenoic 9.5–12.4%. Destructive distillation of the wood yields, on a dry weight basis: charcoal 31.0%, pyroigneous acid 36.69, acid 4.3%, ester 3.4%, acetone 1.9%, methanol 1.1%, tar 9.0%, pitch and losses 4.4%, and gas 0.12 cu m/kg. Manurial values of leaves and twigs are respectively: nitrogen 1.16, 0.71; phosphorus (P_2O_5), 0.14, 0.11; potash (K_2O), 0.49, 0.62; and lime (CaO), 1.54, 1.58%. Such manure reduces the incidence of *Meloidogyne javanica*.

Description

Fast growing, glabrous, deciduous, tree to ca 25 m tall, branches drooping; trunk diameter to 60 cm; bark smooth, gray. Leaves imparipinnate, shiny; young leaves pinkish red, mature leaves glossy, deep green; leaflets 5–9, the terminal leaflet larger than the others; stipels none; stipules caducous. Flowers fragrant, white to pinkish, paired along rachis in axillary, pendent, long racemes or panicles; calyx campanulate or cup-shaped, truncate, short-dentate, lowermost lobe sometimes longer; standard suborbicular, broad, usually with 2 inflexed, basal ears, thinly silky-haired outside; wings oblique, long, somewhat adherent to the obtuse keel; keel petals coherent at apex; stamens monadelphous, vexillary stamen free at the base but joined with others into a closed tube; ovary subsessile to short-stalked, pubescent; ovules 2, rarely 3; style filiform, upper half incurved, glabrous; stigma small, terminal. Pod short stalked, oblique-oblong, flat, smooth, thickly leathery to subwoody, indehiscent, 1-seeded; seed thick, reniform (Allen and Allen, 1981).

Germplasm

Reported from the Hindustani Center of Diversity, pongam, or cvs thereof, is reported to tolerate drought, frost, heat, limestone, salinity, sand, and shade. ($2n = 22$)

Distribution

An Indomalaysian species, a medium-sized subevergreen tree, common on alluvial and coastal situations from India to Fiji, from sealevel to 1200 m. Now found in Australia, Florida, Hawaii, India, Malaysia, Oceania, Philippines, and Seychelles, for example.

Ecology

Probably ranges from Tropical Dry to Moist through Subtropical Dry to Moist Forest Life Zones. Withstanding temperatures slightly below 0°C to 50°C and annual rainfall of 5–25 dm, the tree grows wild on sandy and rocky soils, including oolitic limestone, but will grow in most soil types, even with its roots in salt water.

Cultivation

Seeds, remaining viable for sometime, require no special scarification. Direct sowing is usually successful. Seedlings transplant easily from the nursery after about a year. Root suckers are rather plentiful as well. It is a rapid-growing coppice species that can be cloned.

Harvesting

Pods are collected and shells removed by hand. Grown in 30-year rotations for fuel in West Bengal.

Yields and Economics

Trees of ten reach adult height in 4 or 5 years, bearing at the age of 4–7 years. A single tree is said to yield 9–90 kg seed per tree, indicating a yield potential of 900–9000 kg seed/ha, 25% of which might be rendered as oil (assuming 100 trees/ha). In general, Indian mills extract 24–27.5% oil, village crushers, 18–22% oil.

Energy

Wherever it is grown, the wood (calorific value 4,600 kcal/kg) is burned for cooking fuel (NAS, 1980a). The thick oil from the seeds is used for illumination, as a kerosene substitute, and lubrication. It would seem that with upgraded germplasm one could target for 2 MT oil and 5 MT firewood per hectare per year on a renewable basis. The oil has been tried as fuel in diesel engines, showing a good thermal efficiency (C.S.I.R., 1948–1976).

Biotic Factors

Two rhizobial strains produced nodules on 18 species of 12 different genera in the cowpea miscellany. The strains, culturally and physiologically typical of slow-growing rhizobia, elicited ineffective responses on *Clitoria ternatea* and *Stizolobium utile*. One was ineffective on *Lespedeza stipulacea* and *Samanea saman*. Browne (1968) lists: Viruses. Sandal Spike Virus. Fungi. *Fusicladium pongamiae*, *Ganoderma lucidum*, *Phyllachora pongamiae*, *Ravenelia hobsoni*, *Ravenelia stictica*. Angiospermae. *Cuscuta reflexa*, *Loranthus* sp. (?). Acarina. *Eriophyes cheriani*. Diptera. *Microdiplosis pongamiae*, *Myricomyia pongamiae*. Hemiptera. *Coptosoma cribrarium*, *Drosicha stebbingi*, *Drosichiella tamarinda*. Lepidoptera. *Acrocercops anthracuris*, *Amphion floridensis*, *Cydia balanoptycha*, *Cydia perfricta*, *Eresia jumbah*, *Indarbela tetraonis*, *Jamides celeno*, *Phyllonorycter virgulata*. Orthoptera. *Schistocerca gregaria*. Thysanoptera. *Megalurothrips distalis*.

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[Complete list of references for Duke, Handbook of Energy Crops](#)

Last update January 8, 1998 by aw