

## Jatropha curcas

pig nut, physic nut, fig nut

### LOCAL NAMES

Afrikaans (purgeerboontjie); Arabic (habel meluk,dand barri); Bengali (bagbherenda,erandagachh); Chinese (yu-lu-tzu); Creole (fey medsen,gran medsinye); Dutch (purgeernoot); English (curcas,Barbados nut,pig nut,physic nut,castor oil,purging nut,fig nut,wild oil nut,Chinese castor oil); Filipino (tubang-bakod); French (Noix de medicine,médecinier béni,médecinier,feuilles médecin,médecinier carthartique,grand médecinier,pignon d'Inde,pourguere); German (Purgiernussbaum); Hindi (bagbherenda,safedarand,jangliarandi); Indonesian (jarak budeg); Italian (Giatrofa catarcita,Ricino maggiore,fagiola d'India,Fava purgatrice); Luganda (kiryowa); Mandarin (yu-lu-tzu); Nepali (kadam); Portuguese (mundubi-assu,purgueira); Sanskrit (kananaerend,parvataranda,kananaeranda); Spanish (piñón purgante,piñón,piñón vóci,piñón lechero,piñón botija,pinon,pinol,piñón criollo); Swahili (mbono); Tamil (kadalamanakku,kattamanakku); Thai (sabudam); Trade name (fig nut,physic nut,pig nut)

### BOTANIC DESCRIPTION

*Jatropha curcas* is a perennial, monoecious shrub or small tree up to 6 m high; bark pale brown, papery, peeling; slash exudes a copious watery latex, soapy to touch but soon becoming brittle and brownish when dry; branches glabrous, ascending, stout.

Leaves alternate, palmate, petiolate, stipulate; stipules minute; petiole 2-20 cm long, blade 3-5 lobed, 12.5-18 x 11-16 cm, lobes acute or shortly acuminate at the apex, margins entire or undulating, leaf base deeply cordate, glabrous or pubescent only on the veins below, basal veins 7-9, prominent, venation reticulate.

Inflorescence a cyme formed terminally on branches and complex, possessing main and co-florescences with paracladia. The plant is monoecious and flowers are unisexual; occasionally hermaphroditic flowers occur; 10 stamens arranged in 2 distinct whorls of 5 each in a single column in the androecium and in close proximity to each other. In the gynaecium, the 3 slender styles are connate to about 2/3 of their length, dilating to a massive bifurcate stigma. Female flowers with sepals up to 18 mm long, persistent; ovary 3-locular, ellipsoid, 1.5-2 mm in diameter, style bifid.

Fruit an ellipsoid capsule 2.5-3 cm long, 2-3 cm in diameter, yellow, turning black. Seeds black, 2 per cell, ellipsoid, triangular-convex, 1.5-2 x 1-1.1 cm.

The meaning of the specific name 'curcas' is not known. It was first given 400 years ago to 'certain seeds' by the Portuguese doctor Garcia de Orto, who published a work on Indian medicinal and drug plants in 1563.

### BIOLOGY

Pollination is by insects. The rare hermaphroditic flowers can be self-pollinating. After pollination the trilocular ellipsoid fruit is formed. The exocarp remains fleshy until the seeds are mature. In Thailand, there are 2 flowering peaks, in November and May. In permanently humid equatorial regions, flowering occurs throughout the year. Fruit development needs 90 days from flowering until seeds mature.

Shrubs begin to produce at 4-5 months and reach full productivity at about 3 years. The female flowers are 4-5 times more numerous than the male ones.

L.

Euphorbiaceae



*Jatropha curcas* foliage (Joris de Wolf, Patrick Van Damme, Diego Van Meersschaut)



*Jatropha curcas* (Paul Latham)



*Jatropha curcas* (Paul Latham)

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### ECOLOGY

As a succulent that sheds its leaves during the dry season, *J. curcas* is best adapted to arid and semi-arid conditions. Most *Jatropha* spp. occur in the following seasonally dry areas: grassland-savannah and thorn forest scrub but, are completely lacking from the moist Amazon region. The current distribution of *J. curcas* shows that introduction has been most successful in drier regions of the tropics. It is very tolerant and thrives under a wide range of climatic and edaphic conditions. It is particularly hardy at medium altitude and in humid zones. It is not sensitive to day length.

*J. curcas* is a highly adaptable species, but its strength as a crop comes from its ability to grow on poor, dry sites. It is very drought tolerant and can withstand slight frost.

### BIOPHYSICAL LIMITS

Altitude: 0-500 m, Mean annual temperature: 20-28 deg. C, Mean annual rainfall: 300-1000 mm or more.

Soil type: Grows on well-drained soils with good aeration and is well adapted to marginal soils with low nutrient content. On heavy soils, root formation is reduced.

### DOCUMENTED SPECIES DISTRIBUTION

- Native: Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama
- Exotic: Angola, Antigua and Barbuda, Argentina, Bahamas, Barbados, Benin, Bolivia, Brazil, Burkina Faso, Cambodia, Cameroon, Cape Verde, Central African Republic, Chad, China, Colombia, Cote d'Ivoire, Cuba, Democratic Republic of Congo, Dominica, Dominican Republic, Ecuador, Egypt, Eritrea, Ethiopia, French Guiana, Gabon, Gambia, Ghana, Grenada, Guadeloupe, Guinea, Guinea-Bissau, Haiti, India, Indonesia, Jamaica, Japan, Kenya, Laos, Liberia, Madagascar, Malawi, Malaysia, Mali, Martinique, Mauritania, Montserrat, Mozambique, Myanmar, Namibia, Nepal, Netherlands Antilles, Nigeria, Peru, Philippines, Portugal, Puerto Rico, Sao Tome et Principe, Senegal, Sierra Leone, Somalia, South Africa, Sri Lanka, St Kitts and Nevis, St Lucia, St Vincent and the Grenadines, Tanzania, Thailand, Togo, Trinidad and Tobago, Uganda, United States of America, Venezuela, Vietnam, Virgin Islands (US), Zanzibar, 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.

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### **PRODUCTS**

**Food:** In Guinea, ashes from the roots and branches are used as cooking salt. Young leaves may be safely eaten when steamed or stewed. Cooked nuts are eaten in certain regions of Mexico

**Fuel:** *Jatropha* oil is an environmentally safe, cost-effective renewable source of non-conventional energy and a promising substitute for diesel, kerosene and other fuels. Physic nut oil was used in engines in Segou, Mali, during World War II. The oil burns without smoke and has been employed for street lighting near Rio de Janeiro.

Fruit hulls and seed shells can be used as a fuel. Dried seeds dipped into palm oil are used as torches, which will keep alight even in a strong wind. The wood was used as fuel, though of poor quality, in Cape Verde.

**Tannin or dyestuff:** Leaf juice stains red and marks linen an indelible black. The 37% tannin found in bark is said to yield a dark blue dye; latex also contains 10% tannin and can be used as marking ink. Ashes from the roots and branches are used in the dyeing industry, and pounded seeds in tanning in Ghana.

**Lipids:** The seeds yield up to 31-37% of a valuable oil. It is used to prepare varnish after calcination with iron oxides. Hardened physic nut oil could be a satisfactory substitute for tallow or hardened rice bran oil. In Europe it is used in wool spinning and textile manufacture. Along with burnt plantain ashes, oil is used in making hard homemade soap.

**Wax:** The bark contains a wax composed of a mixture of 'melissyl alcohol' and its melissimic acid ester.

**Poison:** Curcas oil contains a toxin, curcasin. The albumen of the kernel is a poison, toxalbumen cursin, most abundant in the embryo. Another poison, a croton resin, occurs in the seeds and causes redness and pustular eruptions of the skin. The plant is listed as a fish poison. Aqueous extracts of *J. curcas* leaves were effective in controlling *Sclerotium* spp., an *Azolla* fungal pathogen.

The seed oil, extracts of *J. curcas* seeds and phorbol esters from the oil have been used to control various pests, often with successful results. In Gabon, the seeds, ground and mixed with palm oil, are used to kill rats. The oil has purgative properties, but seeds are poisonous; even the remains from pressed seeds can be fatal.

**Medicine:** Seeds were formerly exported from the Cape Verde Islands to Portugal and the 'curcas', or purging oil, from them is a drastic purgative. They resemble groundnuts in flavour, and 15-20 seeds will cause griping, purging and vomiting for 30 minutes. It is reported from Gabon that 1-2 roasted seeds are sufficient to act as a purgative; larger doses may be dangerous. The seeds have been substituted for castor oil and are sometimes called 'larger castor oil'. The oil is widely used for skin diseases and to soothe pain such as that caused by rheumatism; it is an ingredient in the oily extract, known in Hausa as 'kufi', which is a rubifacient for rheumatism and for parasitic skin conditions. The oil is used to stimulate hair growth. The seeds are also used in the treatment of syphilis.

Juice or latex is applied directly to wounds and cuts as a styptic and astringent to clean teeth, gums, and to treat sores on the tongue and in the mouth. Branches are used as a chewing stick in Nigeria. Latex has antibiotic properties against *Candida albicans*, *Escherichia coli*, *Klebsiella pneumoniae*, *Staphylococcus aureus* and *Streptococcus pyogenes*. It also has coagulating effects on blood plasma. A methanol extract of physic nut leaves afforded moderate protection for cultured human lymphoblastoid cells against the cytopathic effects of the human immunodeficiency virus.

Preparations of the plant, including seeds, leaves and bark, fresh or as a decoction, are used in traditional medicine and for veterinary purposes. A leaf infusion is used as a diuretic, for bathing, to treat coughs, and as an enema in treating convulsions and fits. Leaves are also used to treat jaundice, fevers, rheumatic pains, guinea worm sores and poor development of the fetus in pregnant women. The leaves produce a sap that has haemostatic properties; it is used to dress wounds. In Ghana the ashes from the burnt leaves are applied by rectal injection for haemorrhoids. The root bark is used to relieve the spasms of infantile tetanus and is used for sores, dysentery and jaundice. The juice of the flowers has numerous medicinal qualities.

### **SERVICES**

**Erosion control:** In Cape Verde, *J. curcas* was recently planted in arid areas for soil-erosion control.

**Nitrogen fixing:**

**Soil improver:** Press cake cannot be used in animal feed because of its toxic properties, but it is valuable as organic manure due to a nitrogen content similar to that of seed cake from castor bean and chicken manure. The nitrogen content ranges from 3.2 to 3.8%, depending on the source. Tender branches and leaves are used as a green manure for coconut trees. All plant parts can be used as a green manure.

**Boundary or barrier or support:** Widely cultivated in the tropics as a living fence in fields and settlements. *J. curcas* is not browsed by cattle; it can grow without protection and can be used as a hedge to protect fields.

**Intercropping:** In Madagascar, the plant is used as a support for vanilla.

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### **TREE MANAGEMENT**

Seedlings are susceptible to competition from weeds during their early development. Therefore weed control, either mechanical or with herbicides, is required during the establishment phase. Satisfactory planting widths are 2 x 2 m, 2.5 x 2.5 m, and 3 x 3 m. This is equivalent to crop densities of 2500, 1600 and 1111 plants/ha, respectively. Under good rainfall conditions, nursery plants bear fruit after the 1st rainy season, while directly seeded plants bear for the 1st time after the 2nd rainy season. With vegetative propagation, the 1st seed yield is higher. At least 2-3 t of seeds/ha can be achieved in semi-arid areas.

Live fences can be established quickly by planting cuttings directly in the field. Pruning as a hedge is a frequent practice. *J. curcas* has a productive life of 40-50 years without necessitating replanting or tending.

### **GERMPLASM MANAGEMENT**

Seeds are oily and do not store for long. Seeds older than 15 months show viability below 50%. High levels of viability and low levels of germination shortly after harvest indicate innate (primary) dormancy.

### **PESTS AND DISEASES**

Some pests and diseases have been observed on *J. curcas* in Senegal; in Zimbabwe, powdery mildew damages leaves and flowers, *Alternaria* causes premature leaf fall, and golden flea beetles eat young leaves and shoots. In other countries pests and diseases do not cause severe problems although millipedes can cause total loss of young seedlings. *J. curcas* is a host for cassava viruses.

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### **FURTHER READING**

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