

Simmondsia chinensis

(Link) Schneider

Simmondsiaceae

LOCAL NAMES

English (coffeeberry, quinine plant, wild hazel, pig nut, jojoba, gray box bush, goat nut, deer nut, coffee bush)

BOTANIC DESCRIPTION

Simmondsia chinensis is a leafy, xerophytic, woody evergreen dioecious shrub or small multi-stemmed tree that grows to a height of 0.5–1 m in the wild, occasionally to 6 m tall with taproots to 12 m long.

Leaves opposite, oval or lanceolate, grey green or bluish-green, leathery, oblong, opposite, 2.5–3.5 cm long and contain special tissue with a high concentration of phenol compounds.

Flowers apetalous, dioecious; the male flowers are yellow, larger, and occur in clusters with 10–12 stamens per flower; female flowers small, usually solitary in the axils or in clusters at the nodes, pale green with 5 greenish sepals, soft and hairy.

Fruits green capsules, ovoid, usually dehiscent with 1-3 seeds.

Seed peanut-sized, dark brown, the endosperm scanty or absent

The first taxonomic description of this species appeared in 1822, when Johann Link named it as *Buxus chinensis* but later changed to *Simmondsia californica* in 1844 by Thomas Nuttall. In 1912, the Austrian botanist, Camillo Karl Schneider, renamed it as *Simmondsia chinensis*. Although earlier botanists placed jojoba in the family Buxaceae, many other botanists believe that it should be placed in its own family due to its morphological and anatomical distinctiveness.

BIOLOGY

Jojoba is a dioecious, wind-pollinated shrub. Flower buds form in the axils of leaves. Anthesis occurs in March to June when the soil and air temperature rise to above 15°C. Severe water stress prevents opening of flowers. Fruits ripen April to July and seeds fall to the ground in August (about 3-6 months after fertilization). Seed production is generally limited until the fourth year of growth.



Leaves (©J.S. Peterson. USDA NRCS NPDC. Quail Botanical Garden, San Diego Co., CA.)

ECOLOGY

The plant is drought resistant and to some extent also salt-resistant, ranging from warm temperate desert (with little or no frost) to thorn through tropical desert forest life zones. It grows best where the annual rainfall exceeds 300 mm, but does exist where less than 125 mm occur. It tolerates full sun and temperatures ranging from 0-47°C. Mature shrubs tolerate temperatures as low as -10°C, but seedlings are sensitive to light frosts just below freezing.

BIOPHYSICAL LIMITS

Altitude: 0-1500 m

Mean annual temperature: 12-35°C

Mean annual rainfall: 200-1100 mm

Soil type: Jojoba is usually restricted to well-drained, coarse, sandy or gravelly soils, well-aerated desert soils that are neutral to alkaline, with an abundance of phosphorus and pH of 7.3 to 8.2.

DOCUMENTED SPECIES DISTRIBUTION

Native: Mexico, United States of America

Exotic: Argentina, Australia, Brazil, Costa Rica, Egypt, Haiti, Israel, Paraguay, South Africa



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: Seeds are eaten raw or roasted by Indians. Since jojoba oil contains no cholesterol or triglycerides and is not broken down by normal metabolic pathways, it may become an important low-calorie oil for human consumption.

Fodder: The residual meal from oil extraction contains 30–35% protein and is acceptable as a livestock food after detoxification. It is an important browse plant, the foliage and young twigs being relished by cattle, goats and deer.

Lipids: Jojoba oil contained in seed is light yellow, unsaturated, of unusual stability, remarkably pure, and need not be refined for use as transformer oil or as a lubricant for high-speed machinery or machines operating at high temperatures. The stability of jojoba oil makes it attractive to the electronic and computer industries and it is also suitable for sulfurization to produce lubricating oil and a rubber-like material (factice) suitable for use in printing ink and linoleum. Other proposed uses include candles, plasticizers, detergents, fire retardants and leather industry.

Wax: Jojoba wax is a light yellow liquid at room temperature and does not become rancid or damaged by prolonged exposure to high temperatures. The wax and its derivatives have a wide range of industrial uses, mainly in cosmetics in which it is incorporated in formulations for skin care preparations such as lotions, moisturizers, massage oils, and soothing creams. It is also widely used in hair care products, such as shampoos, gels and mousses, and is a very good base for lipstick, makeup and nail products.

Poison: The plant contains a group of glycosides, known as food intake inhibitors with simmondsin [2-(cyano-methylene)-3-hydroxy-4,5-dimethoxycyclohexyl- β -glucoside] being the most important toxic factor, which is found in leaves, stems, roots as well as in jojoba meal after oil extraction. It is believed that the food intake reduction after intake of simmondsin is probably due to a specific inhibition of hunger.

Medicine: The oil can be used as an antifoam agent in antibiotics production and as a treatment for skin disorders. Jojoba oil from the seed has been used to promote hair growth and is effective in treating dandruff and psoriasis. The oil was used in folk remedies by the Indians in Mexico for cancer, kidney disorders, colds, dysuria, eyes, head, obesity, parturition, poison ivy, sorethroat, warts, and wounds.

Other products: The seed per 100 g contains: 4.3–4.6 g water, 14.9–15.1 g protein, 50.2–53.8 g fat, 24.6–29.1 g total carbohydrate, 3.5–4.2 g fiber, and 1.4–1.6 g ash. The two major flavonoid constituents of the leaves are isorhamnetin 3-rutinoside (narcissin) and isorhamnetin 3,7-dirhamnoside.

SERVICES

Reclamation: It is used for revegetation of arid areas as it can survive in harsh desert environments; this is so in Mexico and Israel.

Intercropping: It may be planted together with other crops that can survive the harsh arid conditions

TREE MANAGEMENT

Clearing, ploughing and leveling a site prior to seeding or planting seedlings enhances the establishment of jojoba plantation. Transplanted seedlings survive readily, if the roots are pruned. They should be planted in straight rows 4.5 m apart with 2 m between plants in a row (1,110 plants/ha). Any slow-growing or unproductive plants should be thinned.

Seedlings are frost sensitive and need 2-3 irrigations during the first summer and must be protected from browsing and be treated with contact herbicides. Fertilizer should be applied with the irrigation water, mainly nitrogen phosphate and potassium. Weeding is recommended after each irrigation time in the two first years of plantation establishment. Plants begin seed bearing in 4 years, reaching full production in 8-10 years.

GERMPLASM MANAGEMENT

In the wild, the only harvesting method has been hand collection from under the plants, since mature seeds fall from the bush. Under cultivation, harvesting of seeds is done from the ground under the bushes manually. Jojoba seed that has been dried to around 10% mc and protected from pest damage keeps viable for several years. The seed storage behaviour is orthodox. Seed weight varies in the range 650-5500 seeds/kg.

PESTS AND DISEASES

Diseases: On poorly drained soils, jojoba is susceptible to fungal wilts, including *Verticillium*, *Fusarium*, *Pithium* and *Phytophthora*. One fungus (*Sturnella simmondsiae* Bonar) occurs on the leaves, calyxes, and peduncles, but little damages the plant. *Phytophthora parasitica* and *Pythium aphanidermatum* may cause root rot in plantations. Cuttings are sensitive to *Alternaria tenuis*, seedlings to *Sclerotium bataticola* and *Fusarium oxysporum*. The symptoms of fusarium disease may include wilt and defoliation of leaves, which develop into desiccation and death of the plant. The infection may lie dormant and the disease can take hold in quite well developed plants 3-4 years after the infection.

Pests: A harmful pest, probably a micro-lepidopterous insect can destroy a large part of the wild crop by consuming the very young ovules. One spraying at the proper time might eliminate this damage. The scale *Situlaspis yuccae* and the unique mealy bug *Puto simmondsia* have been reported. Infestations of spider mites, grasshoppers, and thrips may result in yield losses. A scale insect that inhabits the leaves also is not detrimental.

Fences may be necessary to eliminate browsing by wild animals that find the plant very palatable.

FURTHER READING

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SUGGESTED CITATION

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