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SCHISANDRACEAE

Schisandra chinensis schisandra

Schisandra (schizandra) or magnolia vine, *Schisandra chinensis* (Turcz.) Baill (*Schisandraceae*), is a vine native to north-eastern Asia. The deciduous vine is often found in shade or partially shaded environments and will grow up into a forest canopy. Schisandra prefers a well-drained, moist soil and will grow in environments with extremely cold winters (< −40°C).

The vines are dioecious and small clusters (one to five) of flowers are produced from buds on last year's growth. The flowers open in spring and are typically white but pink forms of the flower are common. The flowers are often scented. A cluster of fruit can be produced from a single flower. After fertilization, the flower parts elongate and take on the appearance of a currant (i.e. *Ribes nigrum*) strig. From one to several round berries will set from each inflorescence. The small (5–10 mm) berries ripen to a deep red colour in late summer.

While research in China is investigating managing the crop commercially, all commercially sold fruit is harvested from the wild. Where fruit cannot be reached, the vines are simply pulled down out of the forest canopy and the fruit stripped off the vine. While entire clusters are sold as fresh fruit in areas where the crop is native, fruit is typically dried.

Fresh fruit are tart and are often mixed with other very sweet fruit such as *Actinidia arguta* to provide a balanced flavour. Dried fruit are often soaked in hot water and drunk as a 'tea'. Schisandra fruit are a rich source of vitamin C and can commonly be found as an ingredient in treatments in traditional Chinese and Japanese (Kampo) medicine. In traditional Chinese medicine, schisandra is one of the ingredients in 'Sheng Mei' and is classified as an adaptogen or astringent and is used to increase the body's resistance and improve physiological processes. More specifically, schisandra is recommended to increase energy and strength and more recently as a liver protector. It is historically used for chronic cough and wheezing as well as for treatments for diabetes, insomnia and palpitations. In Chinese medicine, it is a stabilizer and binder and used to treat spleen and kidney 'deficiency'. Some research in laboratory animals indicates that it may be useful in treating HIV-1 infections and cardiomyopathy. Recently, schisandra, as a component of 'Sheng Mei', has been documented as an effective treatment for irritable bowel syndrome.

Chad Finn

Further reading

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SIMMONDSIACEAE

Simmondsia chinensis jojoba

Jojoba, *Simmondsia chinensis* (Link) Schneider (*Simmondsiaceae*), is a perennial, dioecious, evergreen woody shrub endemic to the Sonora desert of Mexico and the USA, where it grows at altitudes from sea level to about 1200 m, usually on coarse, sandy or gravelly soils with good drainage. Native jojoba populations, which usually grow on the rocky slopes of mountains, can be found in areas receiving an annual precipitation ranging from 80 to 450 mm and having temperatures ranging from 9°C to 50°C. The plant bears seeds that contain 50–55% of a chemically unique wax known as jojoba oil. The oil resembles sperm whale oil and is a mixture of monounsaturated long straight-chain esters of fatty alcohols and acids with a mean length of 42 carbons (Fig. S.11).

Indigenous Amerindians in northern Mexico and in the south-western USA have used jojoba seeds and oil for a variety of applications, including cooking, hair care, body oils and medicinal purposes, such as treating poison ivy rash, wounds, colds, cancers and kidney malfunction. Currently, the main uses of the oil are in the cosmetics industry.

World production

Jojoba can be cultivated both in hot dry desert areas and in Mediterranean climates. The crop is grown commercially in Argentina, the USA, Israel, Australia, Peru, Mexico and Egypt (Table S.27). Experimental and small-scale plantations are also found in many other countries, such as China, India, South Africa and Chile.

Uses

The oil is extracted by cold-screw pressing of dried and crushed jojoba seeds. It has special qualities rendering it suitable for the cosmetics industry, which is its principal user. The oil has excellent emollient and moisturizing properties, and stability to oxidation and high temperatures. It was found to be biologically safe, not causing skin or eye irritation. The oil and its derivatives are used primarily in the cosmetics industry in hair-care products (shampoos and conditioners), skin-care products (moisturizers and cleansers), scrubbing formulas, masks, massage oil, baby lotions, sun-care products, makeup and soaps. Jojoba oil is increasingly used as a pharmaceutical for the treatment of acne, psoriasis, eczema, sunburn and chapping. In addition, its use as a biopesticide has been approved by the US Environmental Protection Agency (EPA). The oil is marketed in three grades: pure natural golden, decolorized, and refined and bleached.

Table S.27. Areas planted and seed production of the major jojoba-producing countries.

Country	Area (ha)	Seed production (t) 2000	2001	2002 (estimate)
Argentina	2700	950	1050	500
USA	2200	1455	800	1000
Israel	650	1000	1050	1100
Australia	480	7	10	40
Peru	300	30	200	335
Mexico	290	85	91	90
Egypt	140	11	25	35
Total	6760	3538	3226	3090

Synthesis of jojoba-oil derivatives is based on exploitation of the two double bonds in the ester molecule. Jojoba oil can be isomerized, hydrogenated, chlorinated, sulphurized or transesterified to yield an array of products suitable for many industries. An excellent gear oil additive can be produced from jojoba oil, as can plasticizers, lubricants and antifoaming agents. These industrial uses are, however, restricted because of the low availability and high cost of the products.

The defatted jojoba meal by-product remaining after expression of the oil is rich in protein (25–30%). Use of the meal for animal feed is, however, restricted by the presence of toxic glycosides, which act as food-intake inhibitors. The most abundant glycoside is simmondsin ((2-cyano-methylene)-3-hydroxy-4,5-dimethoxycyclohexyl-β-glucoside), which makes up between 8 and 22% of the meal. Jojoba meal is thought to effect food-intake reduction by stimulating satiety. The meal can be detoxified by extraction with water or 80–90% ethanol.

Experiments showed that simmondsin was not toxic and its effects could be simulated by food restriction. Some side effects were however found. Simmondsin or meal containing it has been suggested as a supplement for the production of lean meat. A patent for using the crude meal as an additive in dietary pet food has been issued in the USA (patent 5,962,043–1999).

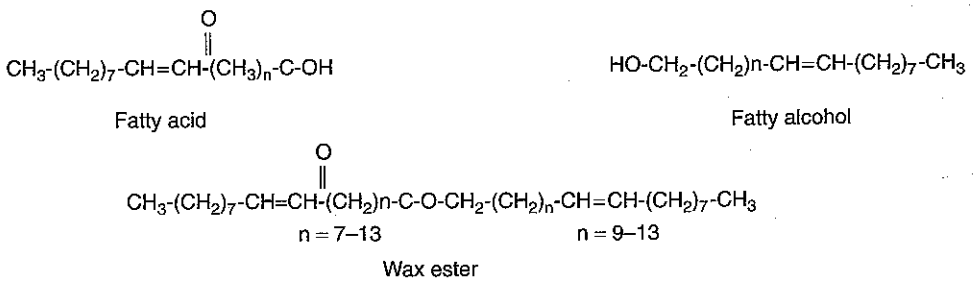

Fig. S.11. The fatty acid, fatty alcohol and wax ester (after their esterification) found in jojoba oil from the seeds of *Simmondsia chinensis*.