

Otoba novogranatensis Moldenke

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MYRISTICACEAE (NUTMEG FAMILY)

Dialyanthera otoba (Humb. & Bonpl.) Warb. (Berichte der Deutschen Botanischen Gesellschaft 13: 89; 1895); *Myristica otoba* Humb. & Bonpl. (Plantae Aequinoctiales 2: 78; 1808-1809); *Otoba otoba* (Humb. & Bonpl.) H. Karst. (Deutsche Flora. Pharmaceutisch-medicinische Botanik 578; 1880-1883)

Aguanillo, bogamani verde, chispiador, coco, fruta dorada, hoja dorada, miguelario, otivo, otoba, otobo, otova, roble, saba, sangre de drago, sebo, white cedar, wine wood, zapatero (García 1974)

The geographic distribution of *Otoba novogranatensis* includes the humid and very humid tropical forests of the coastal lowlands and premontane in Costa Rica, Panama, and Colombia (Gentry 1979, 1993). The species is dominant in the Colombian Amazonian forests with fertile soils. In Costa Rica and Panama, it is abundant in the primary and secondary forests of the Atlantic and Pacific lowlands.

Otoba novogranatensis is a tall tree reaching 40 m in height and more than 1 m d.b.h. (Duke 1962a, 1962b; Gentry 1993, Standley and Steyermark 1949). The bole is straight and cylindrical in the distal two-thirds. It has conspicuous buttresses, especially in swampy areas. The branches extend horizontally on a monopodial axis. The young branches are rugose, strigose, glabrescent, and pubescent. The bark is gray, blackish gray, or reddish gray (in partially shaded places), almost smooth or with vertical fissures, scaly and exfoliates in irregular plates. It is pink internally but becomes red when it comes in contact with sunlight and air. It exudes red, astringent latex. The mean thickness is 3.0 mm. Leaves are simple, entire, petiolated, exstipulated, chartaceous or subcoriaceous, and distributed in a spiral. Leaf blade is wide, elliptic or obovate, apex acuminate or cuspidate, base symmetric, attenuate; it is bright, glabrous, green adaxially, and glaucous. The species grows well in plains or slightly undulate areas, sometimes moderately sloped. It grows well in fertile alluvial soils that are well drained, moderately drained, or inundated for short periods. These inundated areas are close to creeks or rivers. The elevation ranges from sea level to 1100 m, and the temperature range is 22 to 32 °C. The annual rainfall varies from 3500 to 8000 mm.

In green condition, sapwood and heartwood are reddish with small darker stripes. The air-dried wood is intense red or

reddish brown. Growth rings are not well defined. The wood grain is straight, sometimes interlocked; the texture is gross, the luster high, and the figure has silvery glare in the radial surface. The wood is tasteless and odorless. It is light or moderately light, with a basic specific gravity of 0.41, varying with tree origin. The average green weight is 740 to 750 kg per m³, with 81 percent water content; the air-dried wood weighs 490 to 500 kg per m³. The wood has density, volumetric contraction, and tangential/radial contraction ratio similar to those of wild nutmeg (*Virola koschnyi* Warb.), jaul (*Alnus acuminata* Kunth), and royal mahogany (*Carapa guianensis* Aubl.). The contraction ratio is unfavorable, but better than that of wild nutmeg (Llach 1971, Record and Hess 1949). Air-drying is good; the timber dries with minor fissures and twisting. It is easily worked and the surfaces obtained are smooth. The Runkel factor is 0.48 (group II: very good for making paper) and the Peteri's coefficient of flexibility is 0.61. The wood has low natural durability and is susceptible to insect attacks. Subterranean termites produce severe damage within 1 year. Chromogenous and xylophagous fungi produce rotting in several months. The timber is easily preserved and chemical penetration is uniform. The timber can be used to make boxes and crates. It is also used in carpentry, internal construction, cabinetwork, treated posts, veneers, plywood, lathed objects, and tables (Llach 1971). *Otoba novogranatensis* is used in perfume, candle, and soap manufacture and as medicine and a source of narcotics. Several South American Indian tribes use its resin in their religious ceremonies as part of an hallucinogenic snuff. The resin contains tryptaminic derivatives.

Otoba novogranatensis is dioecious. The pattern of flowering is irregular, subannual or episodic. Flowers have been found in January and February, May through October, and in

December. Both the blooming and the number of physiologically mature trees producing flowers in the different episodes vary in consecutive years. Flowers are small, actinomorphic, pedicellated, and unisexual. They are grouped in panicles or subspicate racemes. The staminate inflorescences are subspicate racemes (one to three per axil) and have variable lengths (average 10 to 12 cm; range 3 to 20 cm). They have many flowers in fascicles or pseudovercils (subspicate distribution) in the inflorescence axis; there is a terminal pseudovercill. Each pseudovercill may have 9 to 15 flowers, commonly 12. Flowers are pedicellated and greenish brown. In male and female flowers the perianth is reduced to a trimerous calyx, inconspicuous, tepaloid, fleshy, yellowish green, and usually pubescent. The male flowers have an androecium with three monadelphous stamens; the filaments are fused, forming a thick column. The pistillate inflorescence has two to five flowers per fascicle, usually four. The female flower is hypogynous, and the calyx is trimerous and tepaloid. The ovary is monocarpellar and the stigma inconspicuous, bilobed, and subsessile; the style is very short and curved. Pollination is entomophilous and the pollination vectors are small coleopterans (cantharophily, beetles). In both staminate and pistillate flowers, the floral pedicel is short (1 to 6 mm), greenish, glabrous or pubescent. An orbicular bract, precociously deciduous, subtends each fascicle. The ovules are anatropous, almost sessile, bitegmic, and crassinucellate.

The primary fruit crop occurs from December through February, but fruits can be found in other months. The fruiting periods may vary in consecutive years. There are two to four fruits per inflorescence. The fruit is monocarpellar, subglobose or ellipsoid, with a fleshy pericarp, almost glabrous. Fruits open longitudinally in two valves, along the carpellar entral and dorsal sutures. It is difficult to classify the fruit, but it may be considered a fleshy pod. Although fruits and seeds fall by gravity (barochory), most dispersal is ornithochoric and mammaliochoric. The native frugivorous avifauna are attracted by the fruit color display. The contrast between the red-orange aril, the brown-black seed, and the white inner fruit surface is striking. Streams and fish play a minor role in seed dispersal. Birds are the most important dispersers. Seeds are arillate, ellipsoid or ovoid, with acute, sharp distal ends. The

aril is intense orange or red and oily with astringent flavor. Commonly, the seeds are 18 to 24 mm long and 16 to 21 mm in diameter, excluding the aril.

Seeds are collected directly from the tree or the ground. A careful seed culling to eliminate small, damaged or malformed seeds improves the percentage of germination. Fresh seeds average 575 to 580 per kg. Seed behavior is recalcitrant and under natural conditions (temperature 26 to 30 °C; environmental humidity no less than 85 percent) seeds may be stored for only a few days. During this period, the germination process continues and embryo growth does not stop. The percentage of germination is 85 percent and the seeds are viable for 10 to 12 days. They dehydrate rapidly and die when the water content drops below 30 percent.

The seeds do not require pregerminative treatments and germinate well in sand beds. Germination is epigeal and the seedling is cryptocotylar. The radicle protrudes throughout the micropylar area 10 to 12 days after sowing. Under natural conditions, seedling mortality is high. In the greenhouse, *O. novogranatensis* seedlings develop faster than those of *Virola koschnyi*. Seedlings must be transferred to plastic bags before eophyll development.

The species probably can be used in monospecific or mixed plantations; it is suitable for natural forest management programs.

ADDITIONAL INFORMATION

Testa and tegmen form the seedcoat. The tegmen is thin in the mature seed and has numerous vascularized invaginations, penetrating the endosperm. The endosperm is whitish, massive, ruminated, soft, and very oily. The seed does not have perisperm. The embryo is microscopic. The haustorial cotyledons remain attached to the seedling for several months; the abscissio layer is formed in the proximal end, when the seedling is 5 to 7 months old.

Weevils (Conotrachelus, Curculionidae) attack many seeds in the ground under the tree crown; weevils also attack the *Virola* seeds. The insect larvae develop in the endosperm and damage the microscopic embryo, precluding germination.

