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# Naranjilla

*Solanum quitoense* Lam.

*Solanum angulatum* Lam.

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An intriguing and highly appealing member of the nightshade family, Solanaceae, the naranjilla, *Solanum quitoense* Lam. (syn. *S. angulatum* Lam.), acquired its Spanish name, meaning "little orange" because it is round, and is bright-orange when fully ripe. In Ecuador it is called *naranjilla de Quito*, or *nuqui*; in Peru, *naranjita de Quito*. The Incas called it *lulum*. In Mexico, it is *lulun*; in Colombia, *lulo*, *naranjilla* or *toronja*. Variety *septentrionale* Schultes & Cuatr. is called *lulo de castilla*, *lulo de perro*, or *lulo morado*.

## Description

The naranjilla plant is a spreading, herbaceous shrub to 8 ft (2.5 m) high with thick stems that become somewhat woody with age; spiny in the wild, spineless in cultivated plants. The alternate leaves are oblong-ovate, to 2 ft (60 cm) long and 18 in (45 cm) wide, soft and woolly. There may be few or many spines on petioles, midrib and lateral veins, above and below, or the leaves may be completely spineless. Young leaves, young stems and petioles are coated with richly purple stellate hairs. Hairs on other parts may appear simple. Borne in short axillary clusters of as many as 10, the fragrant flowers, about 1 1/5 in (3 cm) wide, have 5 petals, white on the upper surface, purple hairy beneath, and 5 prominent yellow stamens. The unopened buds are likewise covered with purple hairs. A brown, hairy coat protects the fruit until it is fully ripe, when the hairs can be easily rubbed off, showing the bright-orange, smooth, leathery, fairly thick peel. The fruit, crowned with the persistent, 5-pointed calyx, is round or round-ovate, to 2 1/2 in (6.25 cm) across and contains 4 compartments separated by membranous partitions and filled with translucent green or yellowish, very juicy, slightly acid to acid, pulp of delicious flavor which has been likened to pineapple-and-lemon. There are numerous pale-buff seeds, thin, flat, hard and 1/8 in (3 mm) in diameter.



Plate LXIII: NARANJILLA, *Solanum quitoense*

## Origin and Distribution

The usually spineless naranjilla is believed to be indigenous and most abundant in Peru, Ecuador and southern Colombia. The forms found in the rest of Colombia and in the central and northern Andes of Venezuela and interior mountain ranges of Costa Rica may vary from partly to very spiny. Some botanists have suggested that these spiny forms belong to the botanical variety *septentrionale*. In Ecuador, 90% of commercial naranjilla cultivation is in a 15-mile area in the valley and adjacent hillsides of the Pastaza River, a tributary of the Amazon.

Seeds were first sent to the United States Department of Agriculture from Colombia in 1913; from Ecuador in 1914 and 1916. Many other introductions were made but the resulting plantings in California, Florida and northern greenhouses flourished only briefly, some set fruit, and all died. Trial plantings were made in the Philippines about 1922. The exhibition of fruits and 1,500 gallons of freshly made juice of Ecuadorian naranjillas at the New York World's Fair in 1939 roused a great deal of interest. In February, 1948, 20 naranjilla plants were set out in a field at the University of Florida's Agricultural Research and Education Center in Homestead, Florida. They flourished and were beginning to fruit when nearly all were destroyed by hurricanes. Dr. Milton Cobin tried grafting the naranjilla on the so-called "potato tree", *Solanum macranthum* Dunal of Brazil, hoping to give it wind-resistance. The grafted plants were set out in 1949 and fruited well. Seeds of acid and sweet strains were obtained from the United States Department of Agriculture in 1950. Some of the resulting plants were grafted onto *S. macranthum* and did well; others, set out on their own roots, became severely infested with rootknot nematodes and died. In 1951, the naranjilla was grafted onto *S. erianthum* D. Don but the plants were dwarfed by this rootstock and short-lived. A number of fruit fanciers took up the growing of grafted naranjilla plants in home gardens. Interest was aroused in Caribbean horticulturists and other visitors to the Homestead station. In the early 1950's, plantings were made in Puerto Rico, Jamaica, Panama, Hawaii and Queensland, and in the Meseta Central of Costa Rica where one of several growers set out 70,000 plants of the local wild variety which bears a larger fruit than the non-spiny South American type.

In 1962, a commercial plantation owned by Frederic Zeuner, proprietor of Cia Procesadora de Naranjilla Ltda, of San José, covered 1,200 acres (511 ha) and a \$55,000 factory was built to process the fruits. The pulp was being shipped to the United States in No. 10 cans. It was blended with apple or pineapple juice, put up in small cans and frozen for retail sale. In 1966, I was advised by the U.S. Agricultural Attaché in San José that this pilot effort failed because the canned product was not properly processed and had a metallic taste, also because of the collapse of the canners' contracts with farmers. Production of a better product with proper cooling and storage continued on a local scale. In 1963, the naranjilla was a relatively new crop in Guatemala and there was an experimental plantation and others that were semi-commercial.

The naranjilla is much admired as an ornamental foliage plant in northern conservatories but it will not fruit in temperate latitudes.

### **Varieties**

The botanical variety *septentrionale* already referred to is found in Valle, Cundinamarca, Magdalena, Santanderes and Tolima, in central and northern Colombia, and also in Ecuador and Venezuela. It is said to differ from the typical form, var. *quitoense*, of Ecuador, Peru and southern Colombia, only in having spines on the stem, branches, petioles, and principal veins of the leaves.

There is a sweet, but not very juicy strain around the Andean town of Baza, about 50 miles (80 km) east of Quito, Ecuador.

A wild, spiny form in Costa Rica, called *berenjena de olor* ("fragrant eggplant"), has woodier stem and branches and unusually large fruits to 2 1/2 in (6.25 cm) in diameter.

The fruit of seedling plants shows much variation. However, there seems to be little or no effort to select and name superior cultivars.

### **Climate**

In Colombia, the naranjilla flourishes in humid regions at elevations between 3,600 and 7,900 ft (1,600 and 2,400 m) where the annual rainfall is about 60 in (150 cm). Precipitation up to 120 in (250 cm) is tolerable if well distributed throughout the year. In Panama, the naranjilla has made good growth at altitudes from 4,000 to 6,000 ft (1,200-1,800 m). It is grown in southern Florida at near sea-level. The best plantations in Ecuador are between 5,000 and 6,000 ft (1,500-1,800 m), where the mean temperature is 62.6° to 66.2° F (17°-19° C). The naranjilla cannot tolerate temperatures over 85° F (29.4° C). It is not adapted to full sun but favors semi-shade.

### **Soil**

The plant does best in a rich, organic soil; also grows well on poor, stony ground, and on scarified limestone. It must have good drainage. In Latin America, naranjillas are planted on virgin soil in tracts where the large trees have been felled and the undergrowth burned off. The remaining trees provide semi-shade and wind protection.

### **Propagation**

The naranjilla can be propagated by air-layering or by cuttings of mature wood. In Latin America, it is

commonly grown from seeds which must first be spread out in the shade to ferment slightly to eliminate the mucilage, then washed, air-dried, and dusted with fungicide. There are about 140,000 seeds to the pound (.5 kg); 9,000 to the ounce (28 g). Seedlings are raised in nurseries by the same methods appropriate for tomato seedlings, and are ready for transplanting in 2 to 3 months.

In Florida, the naranjilla is easily cleft-grafted onto *S. macranthum* seedlings that have grown 2 ft (60 cm) tall and have been cut back to 1 ft (30 cm) from the ground, then split down the center for a distance of 1 to 2 in (2.5-5 cm). Selected scions 2 to 3 in (5-7.5 cm) long are inserted in the slit and tightly bound in place. It takes 2 to 3 weeks for the scion to fully unite with the stock. The plants are not set out until the scion has grown about 2 ft (30 cm). Other grafting methods—saddle, side, and whip—have also been successful.

Trials on tree tomato (*Cyphomandra betacea* Sendt.) seemed promising in 1952. In tropical Africa, the naranjilla has done well on the nematode-resistant relative, *S. torvum* Sw.

## Culture

Naranjilla plants should be set 6 to 8 ft (1.8-2.4 m) apart each way, which provides 1,250 plants per acre (3,000/ha). Colombians transplant young seedlings from the nursery bed into polyethylene bags containing 5 1/2 lbs. (2.5 kg) of soil, keep them in semi-shade, give them 4 oz (14 g) of super-phosphate and frequent irrigation. When 14 in (35 cm) high, they are set out in holes enriched with 8.8 lbs (4 kg) of organic compost, breaking the plastic bag as they place the plant in the hole. In Latin America, generally, the naranjilla is planted out in the afternoon of a cloudy day at the beginning of the rainy season. The planting hole is 12 x 12 x 12 in (30 x 30 x 30 cm) and a circle at least 3 ft (1 m) in diameter is kept free of weeds. The plant is a heavy feeder and growth is rapid if fertilizer is given once a month, though most plantations are given no such nutritional care. A 12-12-20 mixture of NPK at the rate of 3 oz (85 g) per plant every 2 months has been recommended. In the coffee zone of Caldas, Colombia, where the soil is organically rich but low in phosphorus, the addition of urea, superphosphate and potassium sulphate, has been found to double productivity.

Seedlings flower 4 to 5 months after transplanting. Fruiting begins 10 to 12 months from seed and is continuous for 3 years in Panama. When the plants reach 4 years of age, productivity declines and they begin to die. In Costa Rica, they are said to bear until 4 to 7 years old. Grafted plants begin to bear about 1 year from planting in the field. In Florida, they continue fruiting for 2 years, then they die back and are replaced by young ones. Watering is essential in dry periods.

## Harvesting and Yield

Though everbearing in its natural habitat, the naranjilla fruits mainly in the winter in Florida; rarely, or very lightly, in the summer. For eating out-of-hand, the fruits are picked fully ripe, at which stage the calyx naturally separates from the fruit, leaving a circular depression. In the field, workers remove the hairs by stooping down and rubbing the fruit in dry grass. For marketing, the fruits must be picked when half-colored to avoid falling and bruising and to assure they are firm enough to withstand handling and packing. They are individually cleaned with a dry cloth and then packed in wooden boxes holding 400 fruits—about 70 lbs (32 kg).

In large-scale processing operations, there are mechanized devices for inspection and grading of fruits, washing off the hairy coat, drying, and removing the peduncle and calyx. For underripe fruits with firmly adhering hairs, the machine must be equipped with brushes. Because of the continuous bearing, fruits must be collected every 7 to 10 days. In Ecuador, long trains of mules and burros make weekly trips with

sacks and boxes of naranjillas down the trails to central market places.

A healthy plant bears 100 to 150 fruits a year. A good annual yield is 135 fruits–20 lbs (9 kg)–per plant. This results in 25,000 lbs (10,417 kg) per acre, 60,000 lbs (27,273 kg) per hectare.

### Keeping Quality

Fully ripe naranjillas soften and ferment very quickly. Fruit picked when half colored will remain in good condition at ordinary temperatures for 8 days. They can be stored for 1 or 2 months at 45°-50° F (7.22°-10° C) and relative humidity of 70 to 80%.

### Pests and Diseases

The chief enemies of the naranjilla are the rootknot nematodes (*Meloidogyne* sp.) and grafting on nematode-resistant rootstock is essential to fruit production in southern Florida. In the Chinchiná coffee-growing region of Caldas, Colombia, nematicide-treatment of the soil each time it is invaded is considered too expensive, and the plants can therefore be kept in production only one year before they succumb to nematode damage. Nematodes are causing a drop in naranjilla production in various parts of the country and Dr. Charles Heiser of Indiana University is studying the possibility of hybridization with nematode-resistant wild relatives in order to save the industry. Measures to reduce nematode populations in Guatemalan fields include discarding nursery seedlings and adult plants that show typical symptoms (chlorosis, dwarfing, rachitic appearance), mulching, or frequent plowing during hot, dry spells. In Panama, the main stem and branches, and sometimes even the fruits, of mature plants are attacked by the *cochinilla blanca* (white, or West Indian, peach scale, *Pseudaulacaspis pentagona*). A number of other pests and diseases affect naranjilla plants in Colombia. Bacterial wilt is a serious problem in Puerto Rico.

### Food Uses

Ripe naranjillas, freed of hairs, may be casually consumed out-of-hand by cutting in half and squeezing the contents of each half into the mouth. The empty shells are discarded. The flesh, complete with seeds, may be squeezed out and added to ice cream mix, made into sauce for native dishes, or utilized in making pie and various other cooked desserts. The shells may be stuffed with a mixture of banana and other ingredients and baked. But the most popular use of the naranjilla is in the form of juice. For home preparation, the fruits are washed, the hairs are rubbed off, the fruits cut in half, the pulp squeezed into an electric blender and processed briefly; then the green juice is strained, sweetened, and served with ice cubes as a cool, foamy drink. A dozen fruits will yield 8 oz (227 g) of juice. Commercially, the juice is extracted mechanically from the cleaned and chopped fruits, strained, concentrated and canned or put into plastic bags and frozen.

Sherbet is made in the home by mixing naranjilla juice with corn sirup, sugar, water, and a little lime juice,

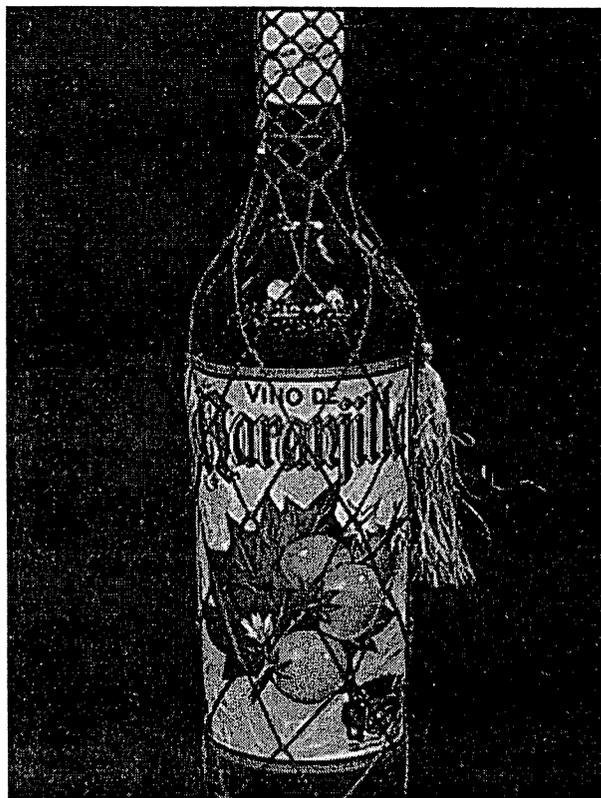


Fig. 113: Naranjilla (*Solanum quitoense*) juice is most prized fresh or preserved, but some is made into wine in Colombia.

partially freezing, then beating to a froth and freezing. Naranjilla jelly and marmalade are produced on a small scale in Cali, Colombia.

<b>Food Value Per 100 g of Edible Portion*</b>	
Calories	23
Moisture	85.8-92.5 g
Protein	0.107-0.6 g
Carbohydrates	5.7 g
Fat	0.1-0.24g
Fiber	0.3-4.6 g
Ash	0.61-0.8g
Calcium	5.9-12.4 mg
Phosphorus	12.0-43.7 mg
Iron	0.34-0.64 mg
Carotene	0.071-0.232 mg (600 I.U.)
Thiamine	0.04-0.094 mg
Riboflavin	0.03-0.047 mg
Niacin	1.19-1.76 mg
Ascorbic Acid	31.2-83.7 mg

\*According to analyses of fresh fruits in Colombia and Ecuador.

### **Toxicity**

People with very sensitive skin may find the hairs on the fruits irritating and should protect the hands when rubbing off the fuzz.

## **Closely Related Species**

Dr. Charles Heiser has made a survey of wild relatives of the naranjilla in the hope that one or more of them may be used in cross-breeding to incorporate nematode-resistance without adversely affecting the fruit quality, productivity and other desirable characteristics. He found *S. tequileme* A. Gray most like *S. quitoense*. It is native from central Mexico to central Ecuador, usually between 3,200 and 6,200 ft (1,000-1,900 m) of elevation, and its fruit is sometimes eaten though its hairy coat is more persistent than that of the naranjilla. Fertile hybrids of the two species have been achieved.

Among other wild species reported by Heiser as having edible, naranjilla-like fruits: *S. pseudolulo* Heiser, of Colombia, with cream-colored flesh and short hairs which are readily shed. The fruits are gathered and sold by local vendors. This species, also, has made fertile hybrids with *S. quitoense*.

*S. candidum* occurring in lowland areas from Mexico to northern Peru and called *huevo de gato*. The juice is less flavorful than that of the naranjilla and the hairs do not detach readily.

*S. pectinatum* Dunal (syn. *S. hirsutissimum* Standl.), often a small tree, ranges from Mexico to Venezuela and Peru, is known variously as *lulita*, *lulo de la tierra fria*, *toronja*, or *tumo*. It has juice of fine flavor but is handicapped by persistent hairs and the fruit reportedly contains alkaloids which may hinder its exploitation. The spiny plant is a local folk-remedy for hypertension.

The inedible *S. hirtum* Vahl., *huevo de gato*, found wild in Trinidad and Tobago, Yucatan, Central America, Colombia and Venezuela, is nematode-resistant and hybrids of this species and *S. quitoense* retain this character and have moderately good fruits. Dr. Heiser is encouraging further efforts at cross-breeding in Colombia and Costa Rica.

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Last updated: 3/29/99 by ch