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Tree Tomato

Cyphomandra betacea Sendt.

Cyphomandra hartwegi Sendt.

Solanum betaceum Cav.

The tree tomato, *Cyphomandra betacea* Sendt. (*C. hartwegi* Sendt.; *Solanum betaceum* Cav.) is the best-known of about 30 species of *Cyphomandra* (family Solanaceae). Among its various regional names are: *tomate, tomate extranjero, tomate de arbol, tomate granadilla, granadilla, pix,* and *caxlan pix* (Guatemala); *tomate de palo* (Honduras); *arvore do tomate, tomate de arvore* (Brazil); *lima tomate, tomate de monte, sima* (Bolivia); *pepino de arbol* (Colombia); *tomate dulce* (Ecuador); *tomate cimarron* (Costa Rica); and *tomate francés* (Venezuela, Brazil). In 1970, or shortly before, the construed name "tamarillo" was adopted in New Zealand and has become the standard commercial designation for the fruit.

Description

The plant is a small, half-woody, attractive, fast-growing, brittle tree; shallow-rooted; reaching 10 to 18 ft (3-5.5 m) in height; rarely as much as 25 ft (7.5 m). The leaves are muskily odorous, evergreen, alternate, more or less heart-shaped at the base, ovate, pointed at the apex, 4 to 13 1/2 in (10-35 cm) long and 1 1/2 to 4 3/4 in (4-12 cm) broad, thin, softly hairy, with conspicuous coarse veins. Borne in small, loose clusters near the branch tips, the fragrant flowers, 1/2 to 3/4 in (1.25-2 cm) wide, have 5 pale-pink or lavender, pointed lobes, 5 prominent yellow stamens, and green-purple calyx. The long-stalked, pendent fruit, borne singly, or in clusters of 3 to 12, is smooth, egg-shaped but pointed at both ends and capped with the

persistent conical calyx. In size it ranges from 2 to 4 in (5-10 cm) long and l 1/2 to 2 in (4-5 cm) in width. Skin color may be solid deep-purple, blood-red, orange or yellow, or red-and-yellow, and may have faint dark, longitudinal stripes. Flesh color varies accordingly from orange-red or orange to yellow or cream-yellow. While the skin is somewhat tough and unpleasant in flavor, the outer layer of flesh is slightly firm, succulent and bland, and the pulp surrounding the seeds in the two lengthwise compartments is soft, juicy, subacid to sweet; it is black in dark-purple and red fruits, yellow in yellow and orange fruits. The seeds are thin, nearly flat, circular, larger and harder than those of the true tomato and distinctly bitter. The fruit has a slightly resinous aroma and the flavor suggests a mild or underripe tomato with a faintly resinous aftertaste.

Origin and Distribution

Although its place of origin is not certain, the tree tomato is generally believed to be native to the Andes of Peru and probably also Chile, Ecuador and Bolivia where it is extensively grown, as it is also in Argentina, Brazil and Colombia. It is cultivated and naturalized in Venezuela and grown in the highlands of Costa Rica, Guatemala, Jamaica, Puerto Rico and Haiti.

It must have been carried at an early date to East Africa, Asia and the East Indies, as it is well established in the Nilgiri heights and the hills of Assam in southern India, and in the mountains of Malaya, and was popular in Ceylon and the Dutch East Indies before 1903. It has been grown in Queensland, Australia, in home gardens, for many years and is a practical crop in the highlands of the Australian part of New Guinea.

D. Hay & Sons, nurserymen, introduced the tree tomato into New Zealand in 1891 and commercial growing on a small scale began about 1920. Shortages of tropical fruits in World War II justified an increased level of production. A promotional campaign was launched in 1961; window banners and 100,000 recipe leaflets were distributed. This small industry prospered until 1967 when annual production reached a peak of 2,000 tons. There was a heavy loss of trees at Kerikeri in 1968. Replanting took place there and at the Bay of Plenty and cultivation of this crop continues to expand. In 1970, there were 209,110 trees on 476 acres (130 ha) in New Zealand. Shipment of the fresh fruits to Australia has not been very successful and the surplus crop is being delivered to processors for the making of preserves.

The United States Department of Agriculture received seeds from Argentina in 1913; from Sumatra and Ceylon in 1926. The plant was fruiting at the United States Department of Agriculture's Plant Introduction Station at Chico, California, in 1915. It is still grown casually in California and occasionally in Florida. It is frequently advertised and sold throughout the United States for growing indoors in pots as a curiosity. It fruits satisfactorily in northern greenhouses.

Varieties

There are apparently no named cultivars, but there are local preferences according to fruit color. Red fruits are chosen for the fresh fruit markets because of their appealing color. The dark-red strain (called "black") now leading in commercial plantings in New Zealand was obtained by selection around 1920 as a variation from the yellow and purple types grown up to that time. It was propagated and reselection thereafter resulted in this large, higher quality, red variety.

Plate LXVI: TREE TOMATO, *Cyphomandra betacea*

Yellow fruits are considered best for preserving because of their superior flavor.

Climate

The tree tomato is not tropical but subtropical. It flourishes between 5,000 and 10,000 ft (1,525-3,050 m)

in Ecuador; between 1,000 and 3,000 ft (305-915 m) in Puerto Rico; 1,000 to 7,500 ft (305-2,288 m) in India. In Haiti it grows and fruits to perfection at 6,000 ft (1,830 m). In cooler climates, it succeeds at lower elevations. It does best where the temperature remains above 50º F (10º C). Frost at 28º F (-2.2º C) kills the small branches and foliage of mature trees but not the largest branches and main stem. The tree will recover if such frosts are not prolonged or frequent. However, seedlings and cuttings are readily killed by frost during their first year.

Protection from wind is necessary as the tree is shallow-rooted and easily blown over. It is also brittle and its branches are easily broken by gusts, especially when laden with fruit. It is suggested that windbreaks be established for each 1/2 acre (1/5 ha) before setting out the plantation in order to protect the young plants. Hedges of *Albizia lophantha* Benth. and of *Hakea saligna* R. Br., kept trimmed and narrow, are popular in the North Auckland area of New Zealand.

Soil

The tree tomato cannot tolerate tightly compacted soil with low oxygen content. It requires fertile, light soil. It grows well on deep lateritic soil in Haiti. Perfect drainage is necessary. Water standing for even a few days may kill the tree.

Propagation

Seeds or cuttings may be used for propagation. Seeds produce a high-branched, erect tree, ideal for sheltered locations. Cuttings develop into a shorter, bushy plant with low-lying branches, suitable for exposed, windy sites. The tree does not always come true from seed, but is most likely to if one is careful to take seed from red fruits with black seed pulp or yellow fruits with yellow seed pulp.

In Brazil, seeds for planting are first washed, dried in the shade, and then placed in a freezer for 24 hours to accelerate germination. They are then planted in boxes of rich soil–12 in (30 cm) between plants and 24 in (60 cm) between rows–and virtually 100% will germinate in 4 to 6 days.

Culture

The seedlings are set out in the field when 2 to 2 3/4 in (5-7 cm) high, spaced 32 in (80 cm) apart in rows 6 1/2 ft (2 m) apart. In New Zealand, the trees are set 8 to 10 ft (2.5-3 m) apart in paired rows 8 ft (2.5 m) apart with 14 ft (4.25 m) between each pair. If the soil is very rich, 9 ft (2.75 m) is allowed between the rows and 16 ft (5 m) between the pairs. Closer planting is recommended in windy, unprotected locations–5 to 6 ft (1.5-1.8 m) between the plants and 8 to 10 ft (2.5-3 m) between the rows, and the trees may be staked to prevent swaying and disturbing the roots. In India, the trees are set out in pits 4 to 5 ft (1.2-1.5 m) apart.

Cuttings should be of 1- to 2-year-old wood 3/8 to 1 in (10-25 mm) thick and 18 to 30 in (45-75 cm) long; the leaves are removed and the base cut square below a node. They can be planted directly in the field and, while precocious, should not be permitted to fruit in the first year.

Recommended fertilizer application is 0.5 to 2.2 lbs (0.25-1.0 kg) per tree of NPK 5:6:6, half in early spring and half in midsummer. In the 5th or 6th year, the grower is advised to give a special feeding of 2 parts superphosphate, 1 1/2 parts nitrate of soda, 1 part sulphite of potash, in late winter or early spring, at the rate of 2 to 3 lbs (1-1.5 kg) per plant–approximately 10 to 16 cwt per acre, or 100 kg per hectare.

Because of the shallow root system, deep cultivation is not possible, but light cultivation is desirable to eliminate weeds until there is sufficient vegetative growth to shade them out.

Seedling trees are pruned back the first year after planting to a height of 3 or 4 ft (0.9-1.2 m) to encourage branching. Annual pruning thereafter is advisable to eliminate branches that have already fruited and induce ample new shoots close to the main branches, inasmuch as fruit is produced on new growth. Otherwise, the tree will develop a broad top with fruits only on the outer fringe. And wide-spreading

branches are subject to wind damage. Pruning facilitates harvesting and, if timed appropriately, can extend the total fruiting period. Early spring pruning of some of the owners' trees brings about early maturity; fall pruning of other trees delays fruit maturity to the following fall.

Irrigation

The tree tomato cannot tolerate prolonged drought and must have an ample water supply during extremely dry periods. A mulch is very beneficial in conserving moisture at such times.

Pollination

Tree tomato flowers are normally self-pollinating. If wind is completely cut off so as not to stir the branches, this may adversely affect pollination unless there are bees to transfer the pollen. Unpollinated flowers will drop prematurely.

Cropping and Yield

The tree usually begins to bear when 1 1/2 to 2 years old and continues to be productive for 5 or 6 years. If then adequately nourished, it may keep on fruiting for 11 to 12 years. In Brazil, each tree is expected to yield 44 to 66 lbs (20-30 kg) of fruit annually.

The crop does not ripen simultaneously and several pickings are necessary. The fruits are clipped, leaving about 1/2 in (12.5 cm) of stem attached. They are collected in bags worn by the harvesters.

In New Zealand, the fruits are sorted by size–small, medium and large–and packed in paper-lined wooden boxes for marketing. Because of its firm flesh and tough skin, the fruit can be shipped long distances without bruising. However, it deteriorates rather rapidly under ordinary storage conditions.

Pests and Diseases

The tree tomato is generally regarded as fairly pest-resistant. A looper caterpillar makes large holes in the leaves of young plants in the nursery but causes little damage to trees in the field. Occasionally the plants are attacked by the green aphis.

In South America and the Caribbean, the fruits are subject to attack by fruit flies–*Anastrepha* sp. and *Carpolonchaea pendula* (syn. *Silba pendula).* In Colombia, the tree tomato has been found to be the preferred host of the tree tomato worm *(Neoleucinodes* sp.) which infests also the tomato and the eggplant. The larvae feed on the fruits and cause heavy losses. Rigorous spraying and sanitary measures are required to reduce losses and means of biological control are being sought.

The principal disease is powdery mildew (both *Erysiphe* sp. and *Oidium* sp.), which may cause serious defoliation if not controlled. Minor problems include Sclerotinia disease *(Sclerotinia sclerotiorum),* the black lesions of which girdle stems and cause terminal wilting; and Ascochyta disease *(Ascochyta* sp.) which is evidenced by small, round, black, dead areas on leaves, especially mature leaves. Tree tomato mosaic virus causes pale mottling on leaves and sometimes on the fruits which has not been considered a serious disadvantage. Another virus disorder, called "bootlace virus", distorts the leaf, especially on young plants, reducing it to little more than the midrib. Affected plants are pulled up and destroyed.

The tree tomato is noted for its resistance to tobacco mosaic virus, though it is susceptible to cucumber mosaic virus and potato virus. Die-back, of unknown origin, at times is lethal to the flowers, fruit cluster, twigs and new shoots. A strain of Arabis mosaic virus (which, in combination with two other unidentified viruses, causes sunken necrotic rings on the fruit surface) was reported in two plantations in the TePuke-Tauranga area of New Zealand in 1971, together with the identification of its vector, the nematode *Xiphinema diversicaudatum.*

Abnormality: In Haiti and New Zealand, small, hard, irregular, semi-transparent "stones" occur in the flesh of tree tomatoes and must be strained out in the process of jam-making. It is not known if these are

similar to the "two gritty lumps in the wall of the fruit (on opposite sides)" mentioned by E.J.H. Corner as observed in Malaya. Samples of the stones were examined at the Division of Plant Industry, Florida State Department of Agriculture, and were found to contain "large amounts of sodium and calcium, probably as silicates, borates, aluminum-magnesium-oxygen complexes, or aluminates or magnesium oxides. In addition, small amounts of tin, copper, chromium, iron and phosphorus were found. " It is well known that plants may accumulate minerals from mineral-rich soils, but such stony accretions are found in the leaves, not in the fruits. At Tela, Honduras, concretions occur in mangosteens, often rendering the fruit inedible. The cause has not been determined.

Food Uses

Ripe tree tomatoes may be merely cut in half lengthwise, sprinkled with sugar and served for eating by scooping out the flesh and pulp. Or the halves may be seasoned and grilled or baked for 15 minutes for service as a vegetable. The fruit should not be cut on a wooden or other permeable surface, as the juice will make an indelible stain. For other purposes, the skin must be removed and this is easily done by pouring boiling water over the fruit and letting it stand for 4 minutes, then peeling is begun at the stem end. The peeled fruit can then be sliced and the slices added to stews or soups, or served with a sprinkling of sugar and perhaps with a scoop of vanilla ice cream. Seasoned with salt and pepper, the slices can serve as sandwich-filling or may be used in salads. Chopped slices are blended with cream cheese and used as sandwich spread.

Peeled, diced fruits, with diced onion, breadcrumbs, butter and appropriate seasonings are employed as stuffing for roast lamb. Tree tomato slices, alone, or combined with sliced apple, are cooked in pies. They may be packed in preserving jars with water or sugar sirup and cooked for 55 minutes, or may be put into plastic containers with a 50% sirup and quick-frozen for future use in pies or puddings. The peeled fruits can be pureed in a blender or by cooking, strained to remove the seeds and then packed in plastic containers and frozen. Lemon juice may be added to the puree' to enhance flavor. The peeled, stewed fruits are combined with gelatin, milk, sugar and lemon juice to make a dessert which is then garnished with fresh tree tomato slices. Peeled, sliced and seeded tree tomatoes, with lemon rind, lemon juice and sugar, are cooked to a jam; or, with onions and apples, are made into chutney. Chutney is prepared commercially in a factory in Auckland, New Zealand. Being high in pectin, the fruit is easily made into jelly but the fruit oxidizes and discolors without special treatment during processing. Whole, peeled fruits, with sugar, are cooked to a sauce for use on ice cream. The peeled fruits may be pickled whole, or may be substituted for tomatoes in a hot chili sauce.

Food Value Per 100 g of Edible Portion*

Moisture	82.7-87.8
Protein	1.5 g
Carbohydrates	10.3 g
Fat (ether extract)	0.06-1.28 g
Fiber	1.4-4.2 g
Nitrogen	0.223-0.445 g
Ash	0.61-0.84 g
Calcium	3.9-11.3 mg
Phosphorus (with seeds)	52.5-65.5 mg
(without seeds)	13.1 mg
Iron	0.66-0.94 mg
Carotene	0.371-0.653 mg
(or calculated as Vitamin A)	540 I.U.
Thiamine	0.038-0.137 mg

Riboflavin	0.035-0.048 mg
Niacin (with seeds)	1.10-1.38 mg
(without seeds)	1.011 mg
Ascorbic Acid**	23.3-33.9 mg

*Analyses made in Ecuador, Guatemala and India.

**Most of the ascorbic acid is lost in cooking.

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