

**LOCAL NAMES**

Arabic (gishta); Bengali (ata); Creole (cachiman); Dutch (kannelappel); English (sweet sop, custard apple, sugar apple); Filipino (atis); French (cachiman canelle, pomme de cannelle, attier); German (Rahm-Annone, Rahmapfel, Zimtapfel, Süßsack); Hindi (sitaphal, ata, sharifa); Indonesian (sarikaja, atis); Italian (pomo canella); Javanese (sirkaja); Khmer (tiép baay, tiép srôk); Lao (Sino-Tibetan) (khièb); Malay (nona sri kaya, sri kaya, buah nona); Mandarin (fan-li-chi); Portuguese (atta, fructa do conde); Sanskrit (sitaphal); Spanish (candongo, chirimoya, fructo do conde, anón, anona blanca, pinha, saramuya, anona); Swahili (mtomoko, mtopetope); Thai (lanang, makkiap, noina); Urdu (sharifa); Vietnamese (na, mang câú ta)

**BOTANIC DESCRIPTION**

*Annona squamosa* is a small, semi-deciduous tree, 3-7 m in height, with a broad, open crown or irregularly spreading branches; bark light brown with visible leaf scars and smoothish to slightly fissured into plates; inner bark light yellow and slightly bitter; twigs become brown with light brown dots (lenticels).

Leaves occur singly, 6-17 x 3-6 cm, lanceolate or oblong lanceolate, pale green on both surfaces and glabrate or nearly so; sides sometimes slightly unequal; edges without teeth, inconspicuously hairy, at least when young, minutely dotted on examination with a lens; thin, dull green to dark green on top surface, and pale blue-green and covered with bloom on underside; apex short or long pointed; base short pointed or rounded; petioles 0.6-1.3 cm long, green, sparsely pubescent.

Flowers greenish-yellow, fragrant, on slender hairy stalks, produced singly or in short lateral clusters about 2.5 cm long, 2-4 flowers but not at the base of the leaves; sepals pointed, hairy, green, about 16 mm long; 3 outer petals oblong, thick and rounded at the tips, fleshy, 1.6-2.5 cm long, 0.6 cm wide, yellow-green, slightly hairy, inside light yellow and keeled with a purplish or reddish spot at the thin, enlarged base; inner petals 3 minute, ovate, pointed scales; stamens very numerous, crowded, white, less than 16 mm long; ovary light green, styles white, crowded on the raised axis.

The aggregate fruit formed from the numerous pistils of a flower, which are loosely united, is soft and distinct from other species of the genus. Each pistil forms a separate tubercle, mostly 1.3-1.9 cm long and 0.6-1.3 cm wide. Fruit is round, heart shaped, ovate or conical, 5-10 cm in diameter, with many round protuberances; greenish-yellow when ripe, with a white, powdery bloom; the pulp is white, edible and sweetly aromatic; in each carpel is embedded a seed, oblong, shiny and smooth, blackish or dark brown, 1.3-1.6 cm long, numerous.

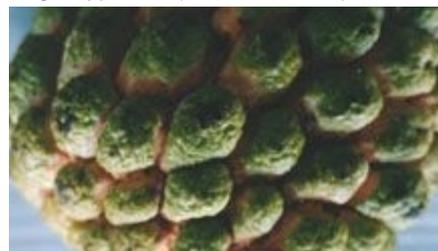
The genus name, 'Annona' is from the Latin word 'anon', meaning 'yearly produce', referring to the production of fruits of the various species in this genus. *A. squamosa* has been named botanically from Jamaica.

**BIOLOGY**

Trees start to bear fruit when 3-4 years old. In Puerto Rico and the Virgin Islands, flowering and fruiting occur throughout the year. In India, the leaves fall in January-February and are renewed in April-May when the flowers appear, and fruiting is in July-August.



Sugar apple fruit (Trade winds fruit)



Ripe purple sugar apple (Trade winds fruit)



Seedling: One-year-old seedling planted in home garden. (Rafael T. Cadiz)

**ECOLOGY**

*A. squamosa* is distributed throughout the tropics and is preeminently a desert fruit. Trees do well in hot and relatively dry climates such as those of the low-lying interior plains of many tropical countries.

*A. squamosa* has the reputation, particularly in India, of being a hardy, drought-resistant crop. This is only partly correct. Although the rest period and leaf fall enable the tree to bridge a severe dry season, it requires adequate moisture during the growing season, responding well to supplementary irrigation. The importance of moisture is borne out by the fact that in India as well as Southeast Asia, fruit set is largely limited to the onset of the rains, notwithstanding the prolonged flowering season. Trees are common on the dry coast of Puerto Rico, and also grow in Vieques, St Croix, St Thomas, St John, Tortola, and Virgin Gorda.

**BIOPHYSICAL LIMITS**

Altitude: 0-2000 m, Mean annual temperature: Up to 41 deg. C, Mean annual rainfall: Above 700 mm

Soil type: *A. squamosa* tolerates a wide variety of soils. It grows in rich, well-drained, deep rocky soils but prefers loose, sandy loams.

**DOCUMENTED SPECIES DISTRIBUTION**

- Native: Antigua and Barbuda, Argentina, Bahamas, Barbados, Bolivia, Brazil, Chile, Colombia, Cuba, Dominica, Dominican Republic, Ecuador, French Guiana, Grenada, Guadeloupe, Guyana, Haiti, Jamaica, Martinique, Montserrat, Netherlands Antilles, Paraguay, Peru, Puerto Rico, St Kitts and Nevis, St Lucia, St Vincent and the Grenadines, Surinam, Trinidad and Tobago, Uruguay, Venezuela, Virgin Islands (US)
- Exotic: Australia, Cambodia, China, Cyprus, Fiji, Greece, India, Indonesia, Laos, Malta, Mexico, New Zealand, Papua New Guinea, Philippines, Samoa, Solomon Islands, Sudan, Tanzania, Thailand, Tonga, Uganda, US, Vietnam, Zanzibar



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:** Fruits are normally eaten fresh. The pulp can be used as a flavouring in ice cream. Between 50-80% of the fruit is edible. The vitamin C content is appreciable (35-42 mg/100 g) and slightly higher than in grapefruit. The nutrient value of thiamine, potassium and dietary fibre is also significant.

**Fuel:** The tree is a good source of firewood.

**Timber:** The light yellow sapwood and brownish heartwood are soft, light in weight and weak.

**Poison:** Green fruits, seeds and leaves have effective vermicial and insecticidal properties.

**Medicine:** Leaves, shoots, bark and roots have been reported to have medicinal properties. The unripe fruit is astringent, and the root is a drastic purgative.

**SERVICES**

**Shade or shelter:** *A. squamosa* can be planted as a shade tree.

**Ornamental:** The attractive tree is grown in gardens.

**Intercropping:** Trees are grown with mango, banana and coffee trees.

**TREE MANAGEMENT**

Trees are planted 5-6 m apart or 10-12 m when grown with mango trees. This slow-growing tree must be protected from browsing animals. If well looked after, it will start producing fruit after about 2 years. Regular watering and weeding are required for good fruit production. Soil needs to be fertilized generously for better fruit yield. Commercial fertilizer containing 3% nitrogen, 10% phosphoric acid and 10% potash is recommended. A mature tree, 5 m high, produces several dozen fruits in a season. Biological control and chemicals including malathion and dimethoate acephate are used to control pests. Trees are sprayed with bordeaux, fermate, phygon, and zerbate to control anthracnose disease.

**GERMPLASM MANAGEMENT**

Seed storage behaviour is orthodox. If kept dry, seeds retain their viability for several years. No loss in viability occurs during 6 months hermetic storage at -20 deg. C and 1.5% mc, but loss in viability occurs if seeds are stored at room temperature.

**PESTS AND DISEASES**

The most common pests of *A. squamosa* are mealy bugs (*Planococcus* spp.), fruit flies (*Dacus* spp.), spotting bugs (*Amblypelta* spp.) and scales (*Parasaissetia* spp.). All these can be controlled in an integrated pest management programme. In the Philippines, a fruit-boring moth (*Annonaepestis bengalella*) is the most destructive pest. Another serious pest is a eurytomid wasp whose larvae bore into the fruits.

The trees are susceptible to *Colletotrichum gloeosporioides* and are attacked by *Aleurocanthus woglumi*. The major root rot disease is bacterial wilt (*Pseudomonas solanacearum*). Symptoms are collar rot, dark internal discoloration of the root and the wood tissue, tree decline and eventual death. Chemical control of the disease is not possible. *A. squamosa* rootstocks are highly susceptible. The major fruit diseases are black canker (*Phomopsis* spp.), diplodia rot (*Botryodiplodia* spp.) and purple blotch (*Phyphthora* spp.). The incidence of these fruit diseases increases under moist or wet conditions. They can all be controlled by a regular spray programme using either mancozeb or copper oxychloride.

**FURTHER READING**

Anon. 1986. The useful plants of India. Publications & Information Directorate, CSIR, New Delhi, India.

Hong TD, Linington S, Ellis RH. 1996. Seed storage behaviour: a compendium. Handbooks for Genebanks: No. 4. IPGRI.

Katende AB et al. 1995. Useful trees and shrubs for Uganda. Identification, Propagation and Management for Agricultural and Pastoral Communities. Regional Soil Conservation Unit (RSCU), Swedish International Development Authority (SIDA).

Little EL, Wadsworth FH. 1964. Common trees of Puerto Rico and the Virgin Islands. Agricultural Handbook. No. 249. US Department of Agriculture. Washington DC.

Mbuya LP et al. 1994. Useful trees and shrubs for Tanzania: Identification, Propagation and Management for Agricultural and Pastoral Communities. Regional Soil Conservation Unit (RSCU), Swedish International Development Authority (SIDA).

Popenoe W. 1974. Manual of the tropical and subtropical fruits. The Macmillann Company.

Smith JHN et. al. 1992. Tropical forests and their crops. Cornell University Press.

Troup RS. 1975. The silviculture of Indian trees. ed. 2, vol. 2. Government of India.

Verheij EWM, Coronel RE (eds.). 1991. Plant Resources of South East Asia No 2. Edible fruits and nuts. Backhuys Publishers, Leiden.

Vogt K. 1995. A field guide to the identification, propagation and uses of common trees and shrubs of dryland Sudan. SOS Sahel International (UK).

Williams R.O & OBE. 1949. The useful and ornamental plants in Zanzibar and Pemba. Zanzibar Protectorate.

**SUGGESTED CITATION**

Orwa C, A Mutua, Kindt R, Jamnadass R, S Anthony. 2009 Agroforestry Database: a tree reference and selection guide version 4.0 (<http://www.worldagroforestry.org/sites/treedbs/treedatabases.asp>)