

Carica papaya

L.

Caricaceae

LOCAL NAMES

Arabic (fafay,babaya); Bengali (pappaiya,papeya); Burmese (thimbaw); Creole (papayer,papaye); English (bisexual pawpaw,pawpaw tree,melon tree,papaya); Filipino (papaya,lapaya,kapaya); French (papailler,papaye,papayer); German (papaya,melonenbraum); Hindi (papaya,papeeta); Indonesian (gedang,papaya); Javanese (kates); Khmer (lhong,doeum lahong); Lao (Sino-Tibetan) (houng); Luganda (papaali); Malay (papaya,betek,ketalah,kepaya); Sinhala (pepol); Spanish (figuera del monte,fruta bomba,papaya,papaita,lechosa); Swahili (mpapai); Tamil (pappali,pappayi); Thai (ma kuai thet,malakor,loko); Tigrigna (papayo); Vietnamese (du du)

BOTANIC DESCRIPTION

Carica papaya is an evergreen, tree-like herb, 2-10 m tall, usually unbranched, although sometimes branched due to injury, containing white latex in all parts. Stem cylindrical, 10-30 cm in diameter, hollow with prominent leaf scars and spongy-fibrous tissue. Has an extensive rooting system.

Leaves spirally arranged, clustered near apex of trunk; petiole up to 1 m long, hollow, greenish or purplish-green; lamina orbicular, 25-75 cm in diameter, palmate, deeply 7-lobed, glabrous, prominently veined; lobes deeply and broadly toothed.

Flowers tiny, yellow, funnel-shaped, solitary or clustered in the leaf axils, of 3 types; female flowers 3-5 cm long, large functional pistil, no stamens, ovoid-shaped ovary; male flowers on long hanging panicles, with 10 stamens in 2 rows, gynoecium absent except for a pistillode; hermaphrodite flowers larger than males, 5-carpellate ovary; occurrence depends on the season or age of the tree.

Fruits large, cylindrical, with fleshy orange pulp, hollow berry, thin yellowish skin when ripe, varied. Fruits formed from female flowers are oblong, spherical, pear-shaped; from hermaphrodite flowers, long, obovoid or pyriform. Seeds numerous, small, black, round, covered with gelatinous aril. Small latex vessels extend throughout the tree and are particularly abundant in fruit that has reached full size but has not yet begun to ripen.

The generic name is from the Latin 'carica', meaning 'edible fig', on account of the similarity of the leaves.

BIOLOGY

Carica papaya comes into fruiting within 5 months and live for 4-5 years. Usually male and female flowers are on different trees, but some flowers are bisexual. Pollinating agents include various insects such as larger bees (*Xylocarpa*, *Trigona*), honeybees, long-tongued sphinx moths (*Sphingidae*), humming-bird moths (*Macroglossa*) and wind. With open (uncontrolled) pollination, a cultivar may lose its identity in a few generations.



Fruits (L. Gilbert UT Austin)



Flowers (L. Gilbert UT Austin)



Carica papaya fruits (Chris Gardiner)

ECOLOGY

C. papaya grows satisfactorily in a wide range of areas from the equatorial tropics to temperate latitudes. However, it must be grown in warm, sunny sites sheltered from wind; preferably below 1500 m. Strong winds are detrimental, particularly on soils that cannot make up for large transpiration loss. *C. papaya* is not frost hardy; exposure to frost or cold wind usually results in leaf damage and subsequent death of the tree. Roots are very sensitive to waterlogging, and even short periods of flooding can kill the plant.

BIOPHYSICAL LIMITS

Altitude: 0-1 600 m, Mean annual temperature: (15) 21-33 deg. C, Mean annual rainfall: 1 000-2 000 mm

Soil type: A well-drained, permeable, well aerated, root-knot nematode free, fertile loamy soil, preferably rich in organic matter with neutral reaction (pH 6-7) is ideal for papaya growth.

DOCUMENTED SPECIES DISTRIBUTION

Native: Costa Rica, Mexico, United States of America

Exotic: Antigua and Barbuda, Australia, Bahamas, Barbados, Brazil, Cambodia, Cameroon, Chile, Colombia, Cuba, Democratic Republic of Congo, Dominica, Dominican Republic, Ecuador, Eritrea, Fiji, Grenada, Guadeloupe, Haiti, India, Indonesia, Jamaica, Kenya, Laos, Malaysia, Martinique, Montserrat, Myanmar, Netherlands Antilles, New Zealand, Nicaragua, Nigeria, Papua New Guinea, Peru, Philippines, Puerto Rico, Samoa, Singapore, Solomon Islands, South Africa, Sri Lanka, St Kitts and Nevis, St Lucia, St Vincent and the Grenadines, Sudan, Tanzania, Thailand, Tonga, Trinidad and Tobago, Uganda, Venezuela, Vietnam, Virgin Islands (US), 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: Ripe papaya is a favourite breakfast and dessert fruit that is available year-round. It can be used to make fruits salads, refreshing drinks, jam, jelly, marmalade, candies and crystallized fruit. Green fruit is pickled or cooked as vegetable or as a substitute for applesauce. About 60% of the ripe fruit is edible. The approximate content per 100 g edible portion is water 86.6 g, protein 0.5 g, fat 0.3 g, carbohydrates 12.1 g, fibre 0.7 g, ash 0.5 g, potassium 204 mg, calcium 34 mg, phosphorus 11 mg, iron 1 mg, sodium 3 mg, vitamin A 450 mg, vitamin C 74 mg, thiamine 0.03 mg, niacin 0.5 mg, and riboflavin 0.04 mg. The energy value is 200 kJ/100 g. Major sugars are sucrose (48.3%), glucose (29.8%) and fructose (21.9%). In Java, a sweetmeat is made from the flowers. Young leaves are sometimes eaten.

Latex or rubber: In some countries, *C. papaya* is grown in sizeable plantations for the extraction of papain, a proteolytic enzyme present in the latex, collected mainly from green fruit. Papain has varied uses in beverage, food and pharmaceutical industries: in chill-proofing beer, tenderizing meat, drug preparations for digestive ailments and treatment of gangrenous wounds. It is also used in bathing hides, degumming silk and softening wool. The latex yield can be about 70-130 kg of papain/ha per year.

Medicine: Carapine, an alkaloid present in papaya, can be used as a heart depressant, amoebicide and diuretic. The fruit and juice are eaten for gastrointestinal ailments; a fresh leaf poultice is used to treat sores. The fresh root with sugarcane alcohol can be taken orally or as a massage to soothe rheumatism. A flower decoction is taken orally for coughs, bronchitis, asthma and chest colds. In some countries, the seeds are used as an abortifacient and vermifuge.

TREE MANAGEMENT

Weeds must be controlled, especially during the initial stages of establishment. Herbicides, hand weeding, mulching and use of cover crops are some of the practical methods used in the control of weeds. Even though fairly resistant to drought, *C. papaya* requires a constant water supply. *C. papaya* is very responsive to fertilizers, and yield can be significantly improved by proper fertilization. Control of pH is also very important. Fruit production begins within a year of planting and is continuous thereafter. *C. papaya* produces 30-150 fruits/year. As the fruit is formed in the leaf axils, plants must be kept growing continuously for maximum yield. Mature trees may be rejuvenated by cutting back to 30 cm above the ground. The latex should be tapped at least once a week.

GERMPLASM MANAGEMENT

Seeds have orthodox storage behaviour; viability can be maintained for up to 3 years in hermetic air-dry storage at 12 deg. C. There are 300-700 seeds in each fruit and approximately 20 000 seeds/kg.

PESTS AND DISEASES

A white scale, *Pseudaulacpis pentagona*, thickly encrusts young trees. Scrubbing with a stiff brush is effective if done early. *Xyleborus* beetles bore into weak stems and kill the plant. Fruit flies (Diptera) lay eggs in ripening fruits, causing them to rot. Several mites attack *C. papaya*; the mites, *Hemitarsonemus latus* and several species of *Tetranychus*, cause leaves to yellow and shed and damage the fruit. Root-knot nematodes *Meloidogyne* spp. and *Rotylenchulus reniformis* may be serious pests. Beetles (Coleoptera) make holes on the trunk. Polyphagous grasshoppers and mole crickets cut seedlings at ground level.

Numerous fungi cause diseases on *C. papaya*. The disease anthracnose is caused by pathogens *Colletotrichum gloeosporioides* and *Glomerella cingulata*. The symptoms are spots on leaves and water-soaked spots on fruit, which develop into sunken lesions up to 5 cm in diameter. It can be controlled with copper oxychloride, dithane M-45 and maneb. *Pythium* spp., *Rhizoctonia* spp. and *Fusarium* spp. cause damping-off in seedlings. *Phytophthora* spp. cause root, foot and trunk rots. Aphids transmit a virus that causes ring spots; symptoms include chlorosis in younger leaves, vein clearing, mottling of laminae and shortened petioles. A virus related to the cucurbit mosaic and transmitted from cucumbers and watermelons by the green peach aphid (*Myzus persicae*) causes a bitter flavour in the fruit. A tree infected by the pathogen *Cercospora papayae* shows symptoms of round, grey-white lesions on leaves and black, sunken lesions on the fruit. The disease, known as cercospora leafspot, can be controlled with copper oxychloride, captan, maneb, zineb and ziram. Powdery mildew (*Oidium* spp.) attacks leaves of seedlings under humid, poorly ventilated conditions. Bunchy-top, a mycoplasma disease, is transmitted by a hopper (*Empoasca* spp.). Other diseases cause seed rot, premature shedding of leaves and dropping of flowers and young fruit. Control measures in nurseries and plantations, although costly, are often essential. In general, they include sterilizing the soil in nurseries, introducing disease-free soil in older plantation sites, following regular chemical spraying programmes, and practising plantation hygiene and crop rotation.

FURTHER READING

- Anon. 1986. The useful plants of India. Publications & Information Directorate, CSIR, New Delhi, India.
- Bein E. 1996. Useful trees and shrubs in Eritrea. Regional Soil Conservation Unit (RSCU), Nairobi, Kenya.
- Cobley L.S & Steele W.M. 1976. An Introduction to the Botany of Tropical Crops. Longman Group Limited.
- Crane E, Walker P. 1984. Pollination directory for world crops. International Bee Research Association, London, UK.
- Hong TD, Linington S, Ellis RH. 1996. Seed storage behaviour: a compendium. Handbooks for Genebanks: No. 4. IPGRI.
- International Board for Plant Genetic Resources (IBPGR). 1986. Genetic Resources of Tropical and sub-Tropical Fruits and Nuts.
- 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).
- Lanzara P. and Pizzetti M. 1978. Simon & Schuster's Guide to Trees. New York: Simon and Schuster
- Mariella P, Lanzara P. 1977. Guide to trees. Simon and Schuster.
- 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).
- Nicholson B.E, Harrison S.G, Masefield G.B & Wallis M. 1969. The Oxford Book of Food Plants. Oxford University Press
- Perry LM. 1980. Medicinal plants of East and South East Asia : attributed properties and uses. MIT Press. South East Asia.
- Rice RP, Rice LW, Tindall HD. 1987. Fruit and vegetable production in warm climates. Macmillan Press, London.
- Samson JA. 1986. Tropical fruits. 2nd Ed. Longman Scientific and Technical.
- Tankard G. 1987. Tropical Fruit: an Australian Guide to Growing and Using Exotic Fruits. Penguin Books.
- Timyan J. 1996. Bwa Yo: important trees of Haiti. South-East Consortium for International Development. Washington D.C.
- 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>)