Tropical Fruits
and Other Edible Plants
of the World

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An Illustrated Guide

ROLF BLANCKE

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To my wife, Juana, and my parents, Elke and Horst

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INTRODUCTION

Each year millions of people travel to tropical destinations, where they come into contact with exotic fruits, tubers, and spices, either in local markets, along country roads, or in the dishes they eat. But even at home, global commerce and migration have made tropical food products, which decades ago were virtually unknown outside the tropics, relatively easy to find. And those living in tropical regions are ever more likely to find tropical fruits from distant tropical countries in their local supermarkets. This new, year-round availability of tropical foods offers a wealth of possibilities for those who want to try out new foods, expand their culinary skills, or incorporate healthier foods into their diet.

The tropical regions are home to a vast variety of edible fruits and other plants. Of the more than 2,000 species that are commonly used as food in the tropics, only about 40 to 50 species are well known internationally, and, of these, only a few species—banana, mango, papaya, and pineapple, for example—are of singnificant commercial importance. This book illustrates and describes more than 300 species of tropical (and subtropical) species of fruit, palm, tuber, and spices. Besides describing all the common species, the author also includes many lesser known species such as mangosteen, maca, and soursop, as well as rare species like engkala, sundrop, and maprang. While some rare species will never gain popular acceptance—either because they are an acquired taste, contain too little pulp, or don't ship well—many are likely to become popular internationally, and some will become commercially important.

In each of the four chapters—fruits, palms, tubers, and spices and herbs—species appear in alphabetical order, arranged according to scientific name. In some cases, a plant could plausibly fit into more than one chapter. Cacao, for instance, is used both as a spice (the seeds) and as a culinary fruit (the pulp); since it is most commonly used as a spice, however, it has been placed in that chapter. A few species have been placed in the fruit chapter even though their edible parts (leaves or flowers, for example) are not, in botanical terms, fruits; in such cases, the author placed the species in the fruit chapter simply because it seemed the closest fit.

While the difference between a fruit and vegetable is a matter of common sense to the general reader, a few words of clarification are in order. To botanists, a fruit is the part of a flowering plant that develops from a fertilized flower into tissues that bear the seeds necessary for reproduction. This means that mangos, zucchinis, chilies, cucumbers, and tomatoes are all fruits. In a botanical sense, vegetables might best be classified as non-reproductive plant parts such as leaves, petioles, buds, shoots, and roots that are used as food. In a culinary sense, however, fruits are plant parts that are fleshy and sweet, whereas vegetables are plant parts that are not sweet. Fruits are commonly eaten raw or cooked to make desserts and other sweet dishes. Vegetables are mainly used for the preparation of savory dishes. In botanical terms, most nuts and grains are fruits.

Nomenclature

In 1753, Carl Linnaeus published his binominal classification system for plants, *Species Plantarum*, which relied on Latin names. Since then, over 1,200,000 plant names have been assigned to more than 400,000 species of flowering plants. Often, a given species gets a new scientific name because of new scientific evidence and advances in botanical classification. To avoid confusion, all plants mentioned in this book use the binominal scientific name and family name according to Tropicos® (www.tropicos.org), published by the Missouri Botanical Garden.

While each species of fruit has a single unique scientific name, many have dozens of common names, in a variety of languages. And, to make matters more confusing, the same common name is often applied to more than one species. In this book, for each species the author gives one or two of the most frequently used English common names. Local names are not included except in a few cases in which the local name has become internationally accepted; since many plants are grown throughout the tropics, a given species sometimes has literally hundreds of different local names. It would simply be impossible to list each and every one.

Tropical Regions

The tropics are a region along the equator that is delimited to the north by the Tropic of Cancer (23°26′N) and to the south by the Tropic of Capricorn (23°26′S). The climate is generally characterized by constantly warm temperatures averaging 25 to 27 °C (77 to 81 °F), with little variation from day to night or season to season. But the climate does vary in other ways; in some regions such as Southeast Asia there is a rainy season and

Agricultural workers harvesting pineapples on a plantation, ca. 1920, Hawaii.

Date palms festooned with ripe fruits, northern Israel.

a dry season, with dramatic fluctuations in precipitation. The tropics also include arid and semiarid climates, with relatively little rain and dry forest or savannah vegetation. In addition to the differences in precipitation, there is also an altitudinal change in temperature from sea level to snow peaked mountain in the Andes, eastern Africa, and the Himalayas.

Differences in temperature and in the timing and amount of rainfall result in distinct life zones. Regions with constantly high temperatures and year-round rainfalls usually have rainforests. Regions with distinct rainy seasons have seasonally deciduous forests or, in tropical Asia, monsoon forests. Arid and semiarid areas have dry forests, savannahs, or even deserts. Such diversity in temperatures and precipitation leads to a diversity of ecosystems that in part explains the astonishing diversity of edible plant species to be found in tropical climates.

Species Accounts

Each species account includes a range map to show the approximate native range of the plant. This is by no means exact. Fruits, seeds, plants, and plant parts have been traded and transported by humans since antiquity. And as people began carrying plant species from place to place, they also changed the original natural habitats of a given species, through agriculture and other human activities. Thousands of years ago, early sailors took the breadfruit from its native habitat in the South Pacific and spread it from island to island throughout Southeast Asia. Pineapple and tomato, both from South America, had been cultivated in Central America for centuries by the time Columbus arrived in 1492. Arab traders brought Asian citrus species and spices to the Mediterranean region.

Tea plantation in Cameron Highlands, Malaysia.

In colonial times, fruits like the pineapple were brought from colonies in the Americas back to the Old World, in this case Spain, and then transported to yet other colonies in the tropics. For these and other reasons, it is often nearly impossible to trace the exact native range of a food plant.

Each species includes one or two photographs, showing the plant with its fruits, flowers, or other edible parts. In addition to maps and photographs, the species accounts contain the following elements:

Description. For each species, the author includes a short botanical description to help identify the plant. While many of the botanical terms are explained in the glossary, this section is likely to be of greatest use for botanists.

Origin and Distribution. This section provides a short natural history of the species described. It focuses on its natural distribution, its domestication, and the extent to which humans have spread the plant beyond its original range. This section also often includes a description of the plant's preferred climate.

Food uses. All plants described in this book are used as food. Many fruits, palms, tubers, and spices and herbs are used in a countless number of ways. This section mentions the most common ways each fruit or vegetable is used. It often also describes unusual and lesser known ways a fruit is used; the cacao fruit, for example, contains the seeds used to make chocolate, but also provides a white, sweet pulp used in some places to make milk shakes.

Comments. This section is a potpourri, with all kinds of interesting information, on nutrition, medicinal use, origin of name, and related species.

Where to Find Tropical Fruits

The obvious and easiest way to find tropical fruits and other edible plants is to go to markets. Fortunately, even people who do not live in tropical countries are ever more likely to find tropical fruits in their local supermarket.

A second good option is to visit tropical botanical gardens, some of which have a special section for tropical fruit trees. A few famous examples are the Singapore Botanic Gardens, the Rio de Janeiro Botanical Garden, and Fairchild Tropical Botanic Garden, in Miami, Florida.

A third option is to visit private collections. Throughout the tropics people have started their own collections of exotic fruit trees and some are open to the public. Two better known private collections are the Tropical Fruit Farm, in Penang, Malaysia, and the Fruit & Spice Park, in Miami, Florida. The author, who lives in Puerto Viejo, Costa Rica, has a collection of more than 150 species of tropical fruits and exotic spices.

Fruits and vegetables on sale at Amphawa floating market, Bangkok, Thailand.

1
Fruits

Many tropical trees, bushes, and vines produce edible fruits. Although all are botanically fruits, it is largely their culinary use that determines whether they are classified as fruits or vegetables. Some plants like the mango (*Mangifera indica*) or the jackfruit (*Artocarpus heterophyllus*) are served fully ripe as a fruit and unripe as a vegetable.

For a long time now, dozens of species of tropical fruit—including bananas, mangos, and pineapples—have been popular outside of the tropics. But in recent years, many new species like the longan (*Dimocarpus longan*) and the litchi (*Litchi sinensis*) have grown in popularity in temperate regions. Even so, there are still many lesser known fruits that are rarely exported and used almost exclusively in tropical countries. The soursop (*Annona muricata*) is a good example. Although it is delicious, it is too soft and bulky to be transported over long distances.

Other tasty fruits like the peach palm (*Bactris gasipaes*) and the engkala (*Litsea garciae*) are so little known that an international market for them has yet to develop. This chapter, which presents 235 species of tropical fruit, will hopefully introduce readers to many new wonderful foods.

Abelmoschus esculentus (L.) Moench

OKRA, GUMBO

Malvaceae (Mallow family)

Description. Okra is an annual herbaceous plant with partly woody stems, 1.5–2 m (5–7 ft) tall. Alternate leaves are spirally arranged around branches. Blades ovate, 12–22 cm (5–9 in) long with 5–7 shallow lobes. Bright yellow flowers with a brownish-red spot at the base of each petal are borne singly in the axils of the upper leaves. Fruits are erect, 15–40 cm (6–16 in) long, often beaked capsules with longitudinal ridges and numerous hard, dark green or dark brown seeds. Unripe green fruits contain a mucilaginous sap, whereas ripe fruits are dry and light brown in color.

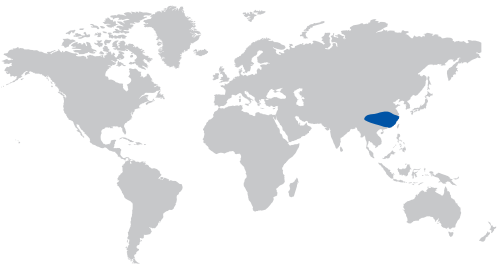
Origin and Distribution. The exact origin of okra is not known. The plant is probably native to tropical Africa, India, or Southeast Asia, where wild *Abelmoschus* species have the highest species diversity. Recent genetic research indicates that the crop might comprise multiple species of African and Asian origin. Okra is an ancient crop that was already being cultivated in Egypt around 2000 BC. Today the crop is widely grown as an annual vegetable throughout the tropics and subtropics and in warm temperate climates.

The cultivation of okra requires relatively little attention because of its natural resistance to drought, pests, and diseases. It is often grown in home gardens but also in extensive plantations. Main producers of okra are India, Pakistan, Iraq, and Ghana.

Food uses. The unripe fruit pods, which have a mild taste, are eaten as a vegetable in many regions of the world. They are usually boiled or stir-fried whole or in slices and served as a side dish, used in soups and stews, or cooked or fried with meat and other vegetables. The mucilaginous sap contains a soluble fiber used as a thickener in soups. Cooking or frying with vinegar or a sprinkle of lime reduces sliminess. Okra is an important ingredient in a traditional meat or seafood stew known as gumbo, a dish typical of the Gulf Coast of the United States. In India and Pakistan, okra slices are often fried with meat and spices or salted and pickled. Less often okra is eaten raw in salads. Unripe okra fruits can be dried for later use. The leaves and young shoots are edible and cooked as a vegetable similar to spinach or eaten raw in salads.

Comments. Okra is a vegetable low in calories but a good source of vitamin C, provitamin A, and the minerals calcium, magnesium, and potassium. The high content of mucilaginous sap makes the fruit ideal for people with stomach ailments. The seeds contain a greenish-yellow oil high in unsaturated fats. The high-quality oil, called ambretta, is used in the food and perfume industry and as a therapeutic oil. In times when coffee wasn't readily available, the seeds were roasted, ground, and used as a coffee substitute.

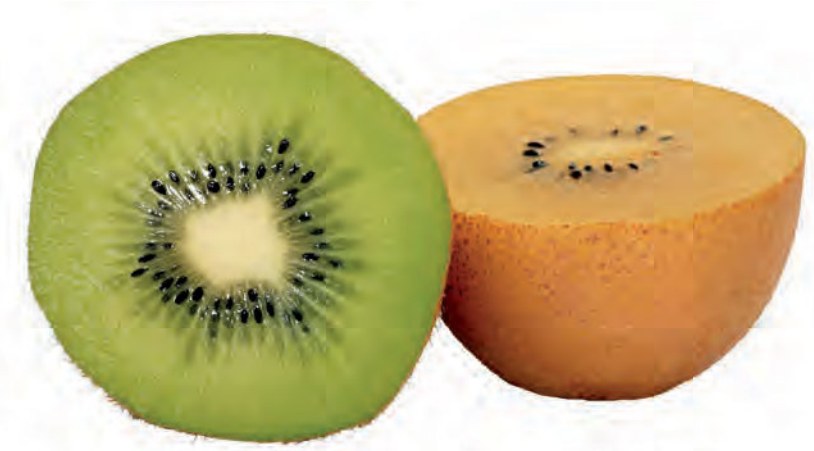
Unripe fruits are green.



Actinidia chinensis var. *deliciosa* (A. Chev.) A. Chev.

KIWIFRUIT

Actinidiaceae (Chinese gooseberry family)



This fruit is also known as Chinese gooseberry. Note that the skin of the golden variety is smoother than that of the green variety.

Description. The kiwifruit grows on a perennial, deciduous vine with branches up to 10 m (33 ft) long covered in short reddish-brown hairs. Opposite, cordate leaves 8–15 cm (3–6 in) long with long petioles and finely toothed leaf margins. Monoecious, fragrant white flowers are borne in small clusters in axils of leaves. Fruits ovate, olive-green berries 4–6 cm (1.6–2.4 in) long, with a thin skin covered in short brown hairs. The green to greenish-yellow, juicy and sweet to subacid flesh contains numerous tiny black seeds.

Origin and Distribution. Native to southern China, where the vine grows naturally in a subtropical or warm temperate climate. Widely cultivated for its fruits. Today the main producer of kiwifruits is Italy, followed by New Zealand and Chile.

Food uses. Ripe fruits are commonly eaten out of hand or used in fruit salads. They are also made into marmalade and juice. Kiwifruits are served as appetizers, in salads, or in fish, chicken, and meat dishes. Slices are used as garnish for cocktails, ice cream, desserts, and cakes. Slightly underripe fruits are used for preparing chutneys and jellies. Overripe fruits are fermented to produce a winelike, alcoholic drink.

Comments. Fruits are a very good source of vitamin C, with one fruit providing the daily requirement of an adult. Kiwifruits contain the proteolytic enzyme actinidin, which can be used to tenderize meat.

The popular and most widely planted variety, *A. chinensis* 'Hayward', was initially created in New Zealand in 1924. In 1959, mainly for marketing reasons, this variety was named kiwi after New Zealand's national bird.

Aegle marmelos (L.) Corrêa

BAEL FRUIT

Rutaceae (Citrus family)

Fruits turn yellowish or reddish when fully ripe.

Description. Medium-sized deciduous tree, 14–18 m (46–59 ft) tall, with a short trunk and stiff, spreading branches covered in sharp spines. Alternate leaves with 3–5 oval leaflets with finely toothed margins. Each leaflet is 4–10 cm (1.6–4 in) long by 2–5 cm (0.8–2 in) wide. Fragrant flowers are produced in small clusters on young branches. The fleshy flower petals are greenish on the outside and yellow inside. Woody, spherical to oval or pyriform, hard-shelled fruits measure 8–20 cm (3–8 in) in diameter. Green fruits turn yellowish or reddish when fully ripe. The inside of the fruit consists of 10–20 segments containing an orange, astringent, sour to fairly sweet pulp, which is very aromatic and fragrant and contains several oblong seeds.

Origin and Distribution. Native to a region ranging from Pakistan, central and southern India, Myanmar, and Bangladesh to Vietnam, Cambodia, and Thailand. The tree grows in tropical and subtropical dry forests of lowlands and foothills. It is particularly common in India, where the tree is considered sacred. It is often found in temple gardens or as a dooryard tree. It is rarely grown commercially.

Food uses. The pulp of bael fruit is eaten fresh after the hard shell is broken open. In Indonesia, the sweetened pulp is eaten as dessert. The pulp is often made into a drink similar to lemonade by mixing with water, ice, and sugar. This drink, called *bael ka sharbat* in India, is popular for its cooling effect. The pulp is also used to make sweets, jams, and pickles. Leaves and young shoots are eaten as vegetables in salads.

Comments. In Hinduism, the bael fruit is sacred and used in worship of Lord Shiva. The trifoliate leaf represents the 3-pronged trident held by Shiva that symbolizes the three fundamental powers of will, action, and knowledge. In Nepal, the fruit is used in fertility rituals for girls. The fruits have been used in traditional medicine to treat digestive disorders, as a tonic, and as a mild laxative, among many other purposes.

Aleurites moluccana (L.) Willd.

CANDLENUT

Euphorbiaceae (Spurge family)

Fruits can be either oval or round.

Description. Candlenut is an evergreen tree, 10–25 m (33–82 ft) tall with pyramidal crown and spreading branches. Alternate, pale green, long-petioled leaves 10–20 cm (4–8 in) long, elliptic to ovate or lobed with 3–5 pointed lobes. Small white flowers are produced in terminal panicles. Round or oval fruits 5–8 cm (2–3 in) in diameter with a hard, rough shell and 1 or 2 oily white seeds inside.

Origin and Distribution. The tree is probably native to a vast region from India, Sri Lanka, and Southeast Asia to northern Australia. The exact origin of this tree is unknown because of its early spread by humans. Cultivated throughout tropical Asia and Oceania, often as an ornamental.

Food uses. The oil-rich seeds, slightly toxic when raw, must be boiled or roasted before consumption. They are used in a variety of dishes, especially in Malaysia and Indonesia. In Java, the boiled seeds are ground to make a sauce eaten with rice and vegetables. Roasted and crushed candlenuts are an important ingredient that adds a characteristic taste to *poke*, a raw fish salad served as an appetizer in Hawaiian cuisine.

Comments. Seeds contain about 63% fat, 19% protein, and 8% carbohydrate.

The oil has been used for millennia as fuel for illumination. To make candles, the oily nuts were crushed, mixed with kapok fibers, and mounted on a split bamboo pole. The oil is also important in traditional medicine, used mainly as a laxative and to treat headaches, fever, and diarrhea and to stimulate hair growth. It is also employed in the manufacture of paints and varnishes and as a wood preservative.

The closely related species *A. fordii* (tung tree), native to southern China, Myanmar, and Vietnam, provides an oil used in the production of resins, paints, and grease.

Alibertia edulis (Rich.) A. Rich. ex DC.

PURUI, MARMELADA

Rubiaceae (Coffee family)

Description. Purui is an evergreen shrub or small tree, 4–6 m (13–20 ft) tall, with stiff horizontal branches. Opposite, dark green, glabrous leaves with interpetiolar stipules. Blades lanceolate to oblong-elliptic, 12–22 cm (5–9 in) long by 3–6 cm (1.2–2.4 in) wide, with pointed apex. Cream-white unisexual flowers with 4–5 pointed petals are produced in terminal inflorescences. Fruit a globose, yellow-green to yellow berry measuring 2–4 cm (0.8–1.6 in) in diameter, turning blackish-brown to black when fully ripe. The soft gray pulp has an aromatic, sweet-sour taste and contains numerous small flat seeds.

Origin and Distribution. Native to tropical America, from southern Mexico and Cuba south to Brazil and Bolivia. The tree, which fruits and flowers most of the year, grows in wet lowland tropical rainforest and premontane forests as well as in seasonal forests with a distinct dry season. It is rarely cultivated and fruits are usually collected from wild trees.

Food uses. The fully ripe fruits are sometimes eaten out of hand. More often the pulp is made into marmalade or jellies. In Brazil, the fruit is used to make ice cream, sweets, desserts, and juices. Ground roasted seeds can be made into a substitute for coffee.

Comments. The common name *purui* means "sweet and sour fruit" in the Tupi-Guarani language of the Tupi tribe of southern Brazil.

Amaranthus caudatus L.

ANDEAN AMARANTH, KIWICHA

Amaranthaceae (Amaranth family)

Description. Fast-growing annual herb, 0.8–2.5 m (2.6–8 ft) tall and irregularly branched with a reddish or purple stem. Simple, alternate leaves elliptic with long petioles. Blades 5–15 cm (2–6 in) long. Small flowers in yellowish, reddish, or purple inflorescences, 0.3–0.9 m (12–35 in) long, that can be erect or become pendent. Black or reddish-brown fruits are spherical to slightly flattened achenes measuring 1–1.5 mm (0.04–0.06 in) in diameter. One plant can produce up to 50,000 seeds. Amaranth is considered a pseudograin, having a grainlike character without belonging botanically to the grass family (Poaceae).

Origin and Distribution. Native to inner-Andean valleys of Ecuador, Peru, Bolivia, and northwestern Argentina, amaranth is one of the most ancient cultivated plants of South America. Remnants of the seeds have been found in excavations dating back more than 4,000 years. Its cultivation was prohibited during the Spanish conquest because the plant, being an integral part of ancient Andean cultures, was used in religious rituals and offerings.

Amaranth is cultivated mostly in inner-Andean valleys at elevations between 1,500 and 3,200 m (4,900–10,500 ft). To a lesser extent, it is also cultivated in the Himalaya regions of India and Nepal.

Food uses. The seeds are rich in starch and protein and used very much like other grains. Amaranth is traditionally an ingredient in soups and stews. The seeds can be ground into flour and used in bakery goods. Amaranth seeds are commonly toasted like popcorn and served as a breakfast cereal or made into granola bars. Amaranth leaves and stems are eaten cooked as a green vegetable.

Comments. This ancient crop, a staple food for most pre-Columbian cultures of South America, has recently become a focal point of interest because of its extraordinary nutritive values. Seeds contain about 30% more protein than most other cereals and are high in essential amino acids like lysine.

They are also rich in vitamins and dietary minerals like iron, magnesium, copper, phosphorus, and manganese. Some scientists consider amaranth the crop of the future. Besides being highly nutritive, it is easy to grow, can withstand droughts, produces a large quantity of seeds, and requires very little fuel to cook with.

Several species of *Amaranthus*, including *A. cruentus*, *A. blitum*, and *A. tricolor*, are cultivated for their leaves. In tropical Asia, the leaves and stems are used as a cooked or steamed vegetable in many savory side dishes or as an ingredient in soups or stir-fries. The roots are also eaten. They are cooked and often served with tamarind, tomatoes, and chili sauce.

Since the plant is not a true grass, amaranth seeds contain no gluten, unlike most other common grains, which are in the family Poaceae.

Anacardium occidentale L.

CASHEW APPLE

Anacardiaceae (Cashew family)

Description. The cashew apple is a small, bushy, evergreen tree, 6–10 m (20–33 ft) tall, often with a twisted trunk. Alternate leaves spirally arranged or in terminal clusters. Blades obovate to oval, 10–20 cm (4–8 in) long by 5–10 cm (2–4 in) wide. Flowers in terminal panicles 15–25 cm (6–10 in) long. Each flower small, reddish with 5 pointed petals. Fruits are the well-known cashew nuts, which are botanically drupes. The kidney-shaped fruit consists of a double shell that contains an allergenic phenolic acid and an edible seed kernel. The cashew apple, which is botanically a pseudofruit, is formed by the receptacle of the cashew flower. When ripe it forms the red or yellow, pear-shaped, 5–12-cm-long (2–5 in) cashew apple, with fibrous, juicy, and astringent pulp. The flavor of the yellow flesh ranges from subacid to fairly sweet.

Origin and Distribution. The cashew apple is native to dry areas of eastern tropical Brazil. It grows naturally in semideciduous and *caatinga* dry forests. In about 1560 the tree was brought to Goa, India, by Portuguese traders. From there it spread to Southeast Asia and Africa.

Food uses. The succulent cashew apple is sometimes eaten fresh but usually made into juice that is very popular in Latin America. The juice is also fermented to produce an aromatic wine. In Goa, the fermented juice is distilled into a brandy called *feni*. The seed kernel, which is produced by removing the toxic shell in a complex process, is commonly sold as a snack after being roasted and salted. Seed kernels are also sold sugared or covered with chocolate.

The cashew apple is botanically a pseudofruit.

The nuts are used whole or ground in Indian cuisine. They are often made into sauces for savory dishes. In Malaysia, the young leaves are eaten raw in salads.

Comments. Cashew nuts are rich in mono- and polyunsaturated fats and high in dietary minerals like iron, magnesium, phosphorous, and zinc. The cashew apple is a good source of vitamin C. The pseudofruit had been used by indigenous people of South America to produce a brown dye.

The anacardic acid extracted from the shell of the seed shows antibacterial properties. It was used by local tribes to cure sores on feet and hands and to treat tooth infections.

Ananas comosus (L.) Merr.

PINEAPPLE

Bromeliaceae (Pineapple family)

The Portuguese word *ananas* derives from *nanas*, used by the Tupi Indians of southern Brazil, meaning "excellent fruit."

Description. Pineapple is an herbaceous terrestrial plant, 0.5–1.5 m (1.6–5 ft) tall, with very short reduced stem and narrow, elongated, fleshy leaves 60–180 cm (23.6–71 in) long, forming a rosette. Leaves are tipped with a spine and numerous recurved spines on the leaf margins. Varieties grown in plantations are usually spineless. Plants bloom after 18–24 months and die after fruiting. Tubular purple or reddish flowers emerge from an elongated stem, surrounded by bright red leaves and topped by a tuft of short leaves. Compound fruit oval or cone-shaped, 20–35 cm (8–14 in) long, with persistent tuft of stiff leaves on top and waxy yellow, yellow-orange, or yellowish-green rind with hexagonal units. Yellow or whitish flesh juicy, aromatic, subacid to very sweet, usually without seeds, although small hard brown seeds may be present.

Origin and Distribution. Probably native to southern Brazil and Paraguay. The pineapple was cultivated in all of tropical America long before the arrival of the Europeans. It was a staple food and an important part of ceremonies and religious rites. Columbus reportedly saw his first pineapple on the island of Guadeloupe in 1493 and brought fruits back to Europe. For centuries, European horticulturists struggled to grow pineapples in greenhouses. For a long time, the fruit remained a luxury food for the wealthy.

Spaniards and Portuguese introduced the pineapple to their Asian and African colonies early in the sixteenth century. It was introduced into Hawaii in 1813 and the first commercial plantation started there in 1900 by James Dole, soon followed by Del Monte.

Food uses. Pineapples are usually eaten fresh or added to fruit salads, used for juice production, or canned. They are made into sauces, fillings, desserts, and ice cream and cake topping. The juice is part of many mixed drinks and cocktails like the well-known *piña colada*. In tropical Asia, it is an important ingredient in curries and sweet-and-sour meat dishes. In the Philippines, the pulp is fermented and served as *nata de piña*. The young shoots are eaten as a vegetable in various tropical countries.

Comments. Because of their distant resemblance to pine cones, early Spanish explorers of the seventeenth century called the fruit *piña*.

Pineapple fruits are a good source of manganese, vitamin C, and vitamin B1. They contain the proteolytic enzyme bromelain, which is able to break down protein. It is used as a digestive aid, as a meat tenderizer, and in marinades as well as in medicine and the food industry.

Pineapples are among the commercially most important tropical fruits; the top producers are Thailand and the Philippines. Costa Rica, where the varieties 'Golden' and 'Hawaiian' are grown, is the largest exporter of fresh fruits. The most commonly grown cultivar is 'Smooth Cayenne', with spineless leaves, juicy yellow flesh, and mild flavor.

Annona cherimola Mill.

CHERIMOYA

Annonaceae (Custard apple family)

The delicious pulp of cherimoya has a satiny texture.

Description. Cherimoya is a small, mostly evergreen tree, 5–10 m (16–33 ft) tall with spreading branches. Young branches are covered with fine rust-colored hairs. Alternate, 2-ranked leaves simple, leathery, elliptic to ovate, 8–20 cm (3–8 in) long. Pale green, fleshy flowers with 3 greenish, thick and downy outer petals and 3 smaller and pinkish inner petals. Compound fruits conical or heart-shaped, 10–22 cm (4–9 in) in diameter, skin green with scalelike markings that can be smooth or form small protuberances. Flesh white, juicy with delicious, fruity, subacid to sweet aroma. Fruits contain numerous glossy, hard black seeds.

Origin and Distribution. Native to inter-Andean valleys of Ecuador, Colombia, and Bolivia and possibly Peru, where the tree grows naturally at elevations between 700 and 2,400 m (2,300–7,900 ft). The cherimoya was cultivated in pre-Columbian times and spread very early, before the arrival of the Spanish, to mountainous regions of Central America. European traders took seeds to Africa and Asia, where the tree is cultivated on a small scale. Although tropical in its origin, it is adapted to higher altitudes with a subtropical or warm-temperate climate, tolerating even light frosts.

Food uses. The fruit is commonly eaten fresh, the pulp being scooped out with a spoon. Fruits halves kept in the freezer can be eaten like ice cream. The seeded pulp is used in fruit salads and for making ice cream, sherbets, and sorbets. Cherimoyas are excellent for making blended juices, milk shakes, and cocktails. The pulp can be fermented to produce an alcoholic beverage with a taste reminiscent of a tropical fruit punch.

Comments. The name *cherimoya* is sometimes wrongly applied to other members of genus *Annona*, including atemoya (*A. squamosa* × *A. cherimola*) and custard apple (*A. reticulata*, p. 21).

Cherimoyas are a good source of carbohydrate, fiber, iron, and niacin. As with other *Annona* species, the seeds, which contain several different alkaloids, are poisonous and must be removed before the fruit is mixed in a blender.

Annona glabra L.

POND APPLE, ALLIGATOR APPLE

Annonaceae (Custard apple family)

Description. The pond apple is a small deciduous tree, often with a thick base, 4–10 m (13–33 ft) tall. Alternate, leathery leaves elliptic to oblong, 12–26 cm (5–10 in) long, glossy with pointed tip. Solitary, hermaphroditic flowers cream-white with 3 fleshy, triangular outer petals. Smooth fruits globose, heart-shaped or oval, yellowish-green to yellow when ripe. Soft, sweet pulp orange-yellow, aromatic, with numerous winged, brown seeds.

Origin and Distribution. Native to tropical America from southern Florida to Argentina and Peru. Also grows naturally in West Africa. Occurs often in swamps or along rivers and lakes. Usually rare outside its natural habitat, but can be invasive where escaped from cultivation.

The tree is not grown in plantations, since the fruits are of inferior quality compared with closely related species of the same family. The pond apple is sometimes used as rootstock for other *Annona* species. The tree requires a humid tropical climate and can withstand prolonged flooding and waterlogged soils.

Food uses. The pulp, with a fruity, agreeable taste reminiscent of banana and overripe pineapple, is sometimes eaten fresh. Fully ripe pond apples are used to make jams, jellies, and fruit wine.

Comments. The pond apple is undoubtedly a minor member of the *Annona* genus, which contains important fruit tree species like the cherimoya (*A. cherimola*) and the soursop (*A. muricata*, p. 19). The tree is an important food source for many bird and mammal species. The common name *alligator apple* reflects the fact that alligators in the Everglades swamps of southern Florida sometimes eat the ripe fruits that fall in the water.

Annona montana Macfad.

MOUNTAIN SOURSOP

Annonaceae (Custard apple family)

Description. Mountain soursop is a medium-sized tree with spreading branches, 8–12 m (26–39 ft) tall. Alternate, aromatic, oblong to elliptic leaves. Blades very glossy, dark green, 8–18 cm (3–7 in) long. Flowers yellowish with 3 fleshy, triangular outer petals and 3 inner petals. Fruits nearly spherical, 12–16 cm (5–6 in) in diameter with yellowish-green skin with short spines and white to lemon-colored soft flesh containing several inedible seeds. Depending on variety, the taste of the flesh ranges from very sweet to subacid and even bitter.

Origin and Distribution. Native to tropical America. The tree grows under tropical and subtropical conditions, tolerating a wide range of soil types and withstanding even light frosts.

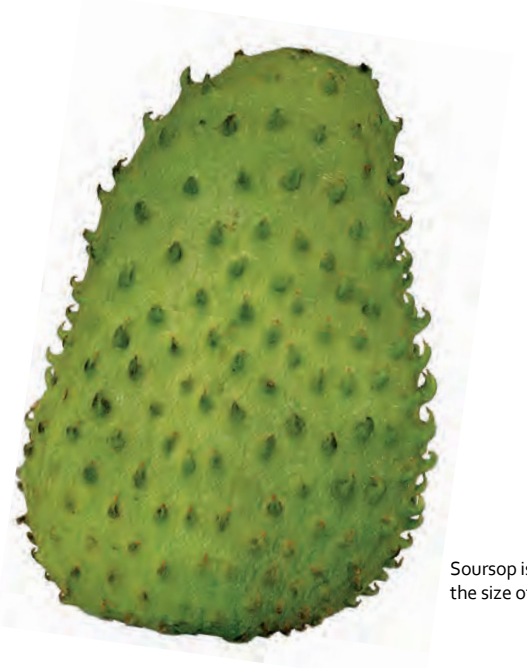
Food uses. The lemon-colored flesh of superior varieties is eaten fresh or made into milk shakes or fruit juices. Pieces of the flesh can be added to fruit salads or used as a garnish for desserts.

Comments. The mountain soursop is much less appreciated than its close relative, the soursop (*A. muricata*). The fairly cold-hardy tree is sometimes used as rootstock to graft other *Annona* species. Another minor member of the Annonaceae is *A. glabra*, the alligator apple (p. 17), native to tropical America and West Africa and producing oval to heart-shaped fruits with a yellow skin. The pulp is sometimes made into jelly or wine.

Annona muricata L.

SOURSOP

Annonaceae (Custard apple family)



Soursop is a giant fruit, sometimes the size of a football.

Description. Soursop is a small evergreen tree 8–12 m (26–39 ft) tall. Alternate, leathery, shiny elliptic leaves, 6–12 cm (2.4–5 in) long. Yellowish-green flowers with 6 fleshy petals of which the outer 3 are fleshy and produced solitarily or in small clusters on branches and trunk. Aggregate fruits are ovoid or of irregular shape, dark green and covered in numerous soft spines. Fruits can grow to 20–40 cm (8–16 in) in length and weigh up to 4 kg (8.8 lbs) or more. Pulp creamy white, soft, juicy, fibrous with a pleasant sweet flavor. Fruits contain numerous black, shiny, very hard seeds. When fully ripe, the fruit changes color from dark green to light yellowish-green.

Origin and Distribution. The soursop is probably native to tropical regions of Central America, the Antilles, and northern South America. It is widely cultivated in Africa and tropical Asia and has become naturalized in many regions. The tree prefers a humid tropical climate and is usually grown in tropical lowlands. It can withstand short dry seasons.

Food uses. The soft, juicy pulp has a delicious, highly aromatic flavor reminiscent of pineapple mixed with banana. After the poisonous seeds are removed, the pulp is blended with water or milk to make delicious fruit drinks and milk shakes. The fruit is also used to flavor ice cream, sorbets, and yogurts. In Mexico, the chilled pulp is served as a dessert; in the Philippines, the unripe fruit is eaten as a vegetable.

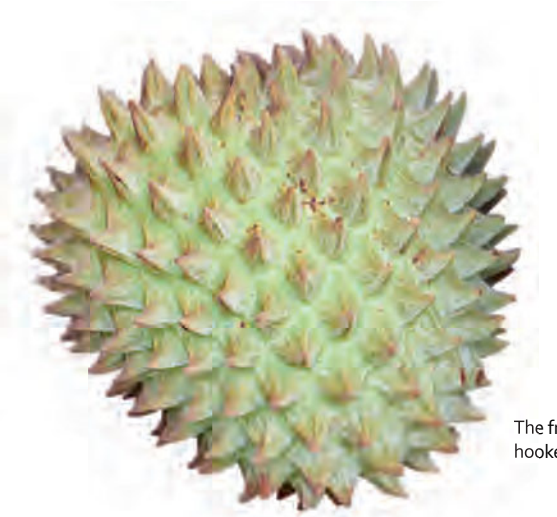
Comments. The fruit is rich in carbohydrates and a good source of vitamins B1, B2, and C. Leaves, bark, and seeds have played an important role in indigenous medicine. The toxic seeds were used to kill external parasites like fleas and lice. A leaf decoction was used to lower fever, treat sores and wounds, and prevent insomnia.

The genus consists of approximately 110 species, of which several, including cherimoya (*A. cherimola*, p. 16) and custard apple (*A. reticulata*, p. 21), are grown for their edible fruits.

Annona purpurea Moc. & Sessé ex Dunal

SONCOYA

Annonaceae (Custard apple family)



The fruit is covered with hooked spines.

Description. Soncoya is a medium-sized deciduous tree, 7–12 m (23–39 ft) tall. Alternate leaves elliptic to oblong, 18–30 cm (7–12 in) long, with pointed apex. Blades brown, pubescent on both sides. Solitary flowers with 3 thick brown petals, yellowish-purple on the inside, and 3 thin, creamy-white inner petals. The fragrant flowers are pollinated by insects, especially beetles. Fruits round, 12–20 cm (5–8 in) in diameter with a thick stalk and surface covered with hooked spines. Soft orange pulp aromatic and sweet but somewhat fibrous. Taste reminiscent of mango.

Origin and Distribution. Native from southern Mexico and Central America to northern South America. Very rarely cultivated outside its natural range. It is almost exclusively grown as a dooryard tree. The soncoya requires a tropical climate with or without a dry season and constant warm temperatures.

Food uses. The pulp of ripe fruits is eaten out of hand or used to make fruit drinks with water or milk.

Comments. The soncoya is of minor horticultural interest compared with the more well-known members of this genus, including the soursop (*A. muricata*, p. 19) and the cherimoya (*A. cherimola*, p. 16). Different parts of the plant have been used in traditional Mesoamerican medicine. The bark of the tree is said to be effective against dysentery and the fruit juice was used to alleviate fever as well as cold and flu symptoms.

Alternate leaves are elliptic to oblong, with a pointed apex.

Annona reticulata L.

CUSTARD APPLE

Annonaceae (Custard apple family)

The pulp of custard apple is sweet and aromatic.

Description. Custard apple is a small deciduous tree, 4–10 m (13–33 ft) tall, with an open crown and spreading branches. Alternate leaves oblong, 10–20 cm (4–8 in) long by 2–7 cm (0.8–2.8 in) wide, pointed at the apex. Fragrant flowers with 3 yellowish-green and cream-colored petals are borne in small, drooping clusters of 3 or 4. Compound fruits heart-shaped or of irregular shape, 8–18 cm (3–7 in) in diameter, with yellow-brown or reddish skin when ripe, with varying degree of reticulation. Pulp soft, cream-colored, sweet and aromatic, with numerous black, glossy seeds. The sweetness and aroma of the fruit depend on the variety and the individual.

Origin and Distribution. Probably native to the Caribbean and Central America, where it grows in tropical lowlands and mountains up to 1,000 m (3,300 ft). The plant spread in pre-Columbian times throughout tropical America and has become naturalized in many regions. The tree is fairly common in southern Africa and tropical Asia. The custard apple requires a tropical climate and more humid conditions than the closely related sugar apple (*A. squamosa*, p. 22).

Food uses. The fruit is less valued than other members of its genus, especially the sugar apple, the cherimoya (*A. cherimola*, p. 16), and the soursop (*A. muricata*, p. 19). Custard apples are usually eaten fresh, or the pulp is scooped out and made into milk shakes, ice cream, or sauces for cakes. The flesh is served with cream and sugar and eaten as dessert.

Comments. The tree is sometimes used as rootstock for other *Annona* species. As with those other *Annona* species, the crushed seeds were commonly used as an insecticide to kill lice. Several parts of the plant play an important role in traditional medicine. Leaf extracts are used to treat skin infections, and leaf infusions are reputed to have a calming effect on humans.

Annona squamosa L.

SUGAR APPLE

Annonaceae (Custard apple family)

Description. Sugar apple is a small deciduous tree with an open crown and irregular branching, 3–8 m (10–26 ft) tall. Alternate leaves oblong, 6–16 cm (2.4–6.3 in) long by 3–5 cm (1.2–2 in) wide. Fragrant flowers are produced singly or in small clusters at tips of branches. Flowers 2–4 cm (0.8–1.6 in) long with fleshy, elongated, yellowish-green petals and a dark red base. Aggregate fruits gray-green, heart-shaped, 5–12 cm (2–5 in) in diameter with numerous round protuberances. Pulp yellowish-white, soft, in conical segments. The juicy, sweet, delicious-tasting flesh contains several to many hard black or brown seeds.

Origin and Distribution. Native to tropical America, though the exact origin is unknown. The sugar apple grows naturally in warm lowlands under dry or humid conditions. Seeds of the species were brought to India by Portuguese sailors before 1590. Today it is a popular fruit throughout tropical India. Spaniards brought the fruit tree to the Philippines, from where it spread to the rest of tropical Asia and northern Australia. The sugar apple is cultivated in small-scale plantations or as a dooryard tree in most tropical and some subtropical countries.

Food uses. The pulp is eaten fresh. In parts of Asia, the strained pulp is used to flavor ice cream or to prepare milk shakes. It is important to remove the seeds before putting the pulp in an electric blender, since the crushed seeds are toxic. The pulp is processed industrially for the manufacture of desserts and ice creams.

Comments. The seeds of the sugar apple are toxic to humans when crushed and ingested. They were used by indigenous people as an insecticide to kill lice and other insects. A decoction of the leaves is used in traditional medicine of tropical America as a tonic, digestive aid, and febrifuge. This species is geographically the most widely grown *Annona* species.

Antidesma bunius (L.) Spreng.

BIGNAY

Phyllanthaceae (Leafflower family)

Description. Bignay is an evergreen tree growing 3–30 m (10–100 ft) tall with a dense crown. Alternate, oblong leaves 10–25 cm (4–10 in) long by 5–8 cm (2–3 in) wide, with glossy dark green, leathery blades. Reddish male and female flowers emit a strong smell and grow on separate trees. Male flowers are borne in terminal or axillary spikes and female flowers in terminal racemes up to 25 cm (10 in) long. Round fruits measuring 6–10 mm (0.24–0.4 in) in diameter grow in long pendent clusters. Fruits ripen unevenly, so showy clusters with white, pale green, yellow, red, and almost black fruits are produced. Each fruit contains a single seed embedded in a juicy, subacid, translucent, colorless pulp that has a tart and fairly sweet flavor when fully ripe.

Origin and Distribution. Native from India to Southeast Asia and northern Australia. It is planted mainly as a dooryard tree in its area of natural distribution. Grows in tropical and subtropical climates.

Food uses. Fruits are eaten fresh but more often made into jams and jellies. Bignay is squeezed to make juice, fermented to make wine, and distilled to make brandy. In Indonesia, the ripe fruits are cooked in the preparation of fish dishes and to make a sauce for seafood. Young leaves are stewed or eaten raw with rice as a green vegetable in several parts of Southeast Asia.

Comments. Two closely related species are the Herbert River cherry (*A. dallachyanum*) from northern Australia, with dark red fruits, and the black currant tree (*A. ghaesembilla*), from Cambodia and Vietnam, which grows as a shrubby tree and produces similar dark red or dark purple fruits.

Recent studies have shown that bignay fruits are high in flavonoids and phenolic acids, making the fruit potentially important as a natural antioxidant.

Arachis hypogaea L.

PEANUT

Fabaceae (Bean family)

Description. The peanut is an annual herbaceous plant growing 30–60 cm (12–24 in) tall. Opposite, compound leaves with 2 pairs of obtuse to broad elliptic leaflets, 2–7 cm (0.8–2.8 in) long. Flowers pealike with yellow petals and red venation. After pollination, the flower stalk elongates, bends down, and buries the developing fruit several centimeters into the soil. Seedpods with rough, light brown shells irregularly shaped, normally 3–6 cm (1.2–2.4 in) long, containing 1–4 seeds, each covered in a reddish-brown seed skin.

Origin and Distribution. Native to Bolivia and probably also indigenous to southern Peru and Paraguay. The domesticated peanut is unknown as a species in the wild. Possible progenitors are *A. ipaensis* and *A. duranensis*. Excavations of burial sites on the Andean slopes of northern Peru have produced the oldest archaeological evidence of peanuts, dating back 7,600 years. The peanut was commonly depicted on textiles and ceramics by many South American pre-Columbian civilizations, including the Moche, Inca, and others.

Food uses. Peanuts are enjoyed raw or roasted with salt, often mixed with other nuts and seeds. They are made into or used as an ingredient in a vast variety of products, including candy, granola bars, cookies, and peanut butter. In Peru, peanuts are ground and made into a delicious, thick sauce with chilies, vegetables, and spices, served with rice and chicken (*ají de gallina*) or other meats and seafood. Peanut oil, which is rich in monounsaturated fat, is used as cooking oil. The highly nutritious seeds were often used as survival food by Arctic expeditions. In West Africa, ground peanuts are used in meat stews and soups.

The highly nutritious peanut was often used as survival food by Arctic expeditions.

Comments. Peanuts are a very good source of fat and protein, containing 38–47% oil, 24–35% protein, vitamins B and E, niacin, and folate as well as a high content of minerals like potassium, manganese, and phosphorous.

The largest exporters of peanuts are the United States, Argentina, and Brazil. China and India are the largest producers of peanuts, but the harvest is largely consumed in domestic markets.

Artocarpus altilis (Parkinson) Fosberg

BREADFRUIT

Moraceae (Mulberry family)

Description. Breadfruit is an evergreen tree, 20–30 m (66–100 ft) tall. Large, deeply lobed, alternate leaves ovate, 30–80 cm (12–31 in) long by 20–50 cm (8–20 in) wide, with a glossy, dark green surface and yellowish veins. Flowers monoecious; male spikes to 25 cm (10 in) long, female flowers in clusters with up to 2,000 single flowers. Fruits round, 20–30 cm (8–12 in) in diameter, with a warty light green surface and a cream-colored, starchy flesh. The pulp of the ripe fruit turns soft and yellowish in color. All parts of the plant contain white, sticky latex.

Origin and Distribution. The breadfruit is probably native to New Guinea and the Malay Archipelago. From there it spread with the colonization of the South Pacific islands by indigenous tribes. Today the tree is grown as a fruit or shade tree in many tropical countries having a warm, humid climate.

The breadfruit came to fame because of its role in the mutiny on the HMS *Bounty* in 1789. Under the command of Captain William Bligh, this ship was to sail with 1,000 potted breadfruit saplings from Tahiti to Jamaica, where the fruits were intended to feed the growing slave population. Within a month of the voyage, the crew rebelled because of a lack of fresh drinking water, and they expelled Captain Bligh and his supporters from the ship. Bligh survived the mutiny. In 1791, in a second attempt he successfully managed to transport breadfruit saplings to Jamaica. The slaves rejected the breadfruit, though, preferring plantains as food instead.

Food uses. Unripe, firm breadfruits taste similar to potatoes and can be used as such. They are commonly prepared as a cooked vegetable in numerous dishes and form an essential part of Asian curries. Fruits are also roasted, baked, stuffed, or mashed. Ripe, sweet-tasting breadfruits are used in desserts. In Hawaii, breadfruit *poi* is prepared by mashing breadfruit and baking it in an underground oven. Fresh fruit is cut in slices and dried in the sun to preserve it. A common way of preserving ripe breadfruits is to bury them in the ground, where they ferment. The product is a sour-tasting, soft, cheeselike paste, sometimes mixed with coconut milk and then cooked in banana leaves. In many African countries, baked breadfruit slices are served with salt and pepper as a side dish with everyday meals.

In Hawaii, breadfruit poi is prepared by mashing breadfruit and baking it in an underground oven.

Comments. The usually seedless breadfruit and seeded breadnut (p. 26) are sometimes treated as two varieties of *A. altilis*. In this book they are treated as different species, with the seeded variety *A. camansi* and the seedless *A. altilis*, according to a recent publication by the Breadfruit Institute at the National Tropical Botanical Garden at Kauai, Hawaii. Breadfruits contain up to 25% carbohydrates and 70% water.

Artocarpus camansi Blanco

BREADNUT

Moraceae (Mulberry family)

Description. Breadnut is an evergreen tree, 10–20 m (33–66 ft) tall, with an open branching structure. All parts of the tree contain milky sap. Very large leaves up to 60 cm (24 in) long, leathery, glossy dark green, deeply lobed. Separate male and female flowers are produced on the same tree. Greenish female flowers on short, fleshy spikes develop into a large, syncarpous fruit. The flowers do not fuse as they do in breadfruit (*A. altilis*, p. 25). Fruits are green, spherical, 7–15 cm (2.8–6 in) in diameter, and covered in numerous short spines. Pulp cream-colored, firm when unripe, turning soft with ripeness, with 20–60 light brown seeds similar to chestnuts.

Origin and Distribution. The tree is probably indigenous to Papua New Guinea, Indonesia, and the Philippines. The breadnut was supposedly brought to the American continent around 1770 by French sailors, who took breadnut seeds from the Philippines to the French West Indies. Today the breadnut is grown throughout the tropics together with the closely related breadfruit. The breadnut, grown for its edible fruits and seeds and as a shade tree, requires a humid, tropical climate.

Food uses. Immature fruits are thinly sliced, boiled in saltwater, and eaten in curries, soups, and stews in a manner similar to breadfruit. Normally, though, breadnuts are grown not for their starchy pulp but for their edible seeds. The seeds, similar in taste and appearance to chestnuts (*Castanea sativa*), are boiled, steamed, or roasted and consumed as salted snacks commonly sold by street vendors. In West Africa, the boiled seeds are sometimes mashed and served as a side dish. The seeds provide an edible oil and can be processed into a nut paste and canned in brine.

Comments. The breadnut is thought to be the wild ancestor of the breadfruit, to which it is very closely related and sometimes considered conspecific. The nutritious seeds, which contain 13–19% protein and are high in potassium and phosphorus, are relatively low in fat compared with other nuts like almonds and macadamia nuts.

Artocarpus heterophyllus Lam.

JACKFRUIT

Moraceae (Mulberry family)

Description. Jackfruit is an evergreen tree up to 25 m (82 ft) tall with alternate, glossy, somewhat leathery leaves. Blade 15–23 cm (6–9 in) long, oval or lobed on young shoots. All parts of the plant contain a white, sticky latex. Flowers and fruits are produced on the trunk and on older branches (cauliflory). Male inflorescence in oblong clusters 5–10 cm (2–4 in) long with tiny flowers, and female flowers in clusters. Aggregate fruits are green to yellowish-green when ripe, with a thick, rubbery rind with conelike points. Fruits, which are known to be the largest tree-borne fruits in the world, are irregular in shape and can reach an enormous size and weight of more than 50 kg (110 lbs). The pulp, which consists of fully developed perianths called bulbs, has a yellowish color and a soft texture when ripe.

Origin and Distribution. Native to the Sahyadri Mountains of western India. It is commonly cultivated and widely naturalized throughout Southeast Asia, fairly common in tropical Africa, and uncommon to rare in tropical America. The tree, which is sensitive to frost, grows best in a humid tropical climate.

Food uses. Unripe fruits are cut into small pieces, boiled in saltwater, and served like a starchy vegetable. They are used very much like the breadfruit (*A. altilis*, p. 25) in Asian curries. Sliced and dried fruits are also commonly marketed. Very young, unripe fruits are sometimes pickled. Ripe fruits, which have a strong odor caused by the presence of capron acid, are eaten raw or cooked. They are made into desserts, chutneys, jams, jellies, and even ice cream. The pulp can be fermented and then distilled to produce a strong liquor. The seeds are used in curries or preserved in syrup, or boiled and roasted for eating as a snack.

Comments. The hard, termite-resistent wood of the tree is used for making boats and furniture, and in general construction. A yellow dye called *basanti* is extracted from the heartwood by boiling sawdust and wood chips. It is used for dyeing silk and also for dyeing the cotton robes of Buddhist priests.

Artocarpus hypargyreus Hance ex Benth.

KWAI MUK

Moraceae (Mulberry family)

Kwai muk makes an attractive ornamental for use in larger gardens.

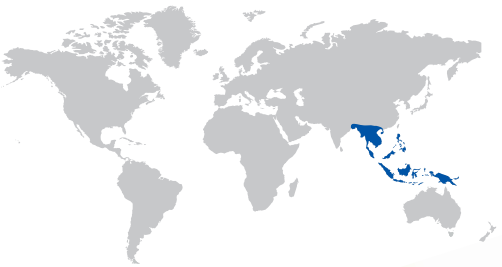
Description. Kwai muk is a slow-growing evergreen tree, reaching 10–15 m (33–49 ft) in height, with a round, broad crown. All plant parts contain a white latex. Alternate, glabrous, simple leaves elliptic to elliptic-obovate, 10–15 cm (4–6 in) long by 5–8 cm (2–3 in) wide, with prominent veins on the lower side. Monoecious flowers in yellowish inflorescences. Syncarp fruits 5–10 cm (2–4 in) in diameter, round or irregularly formed with a thin, light green to yellowish-green and softly pubescent skin. Pulp dark pink to orange-red, very soft, with 1–7 seeds or entirely without seeds.

Origin and Distribution. The Kwai muk is native to southern China, where it grows wild in Kwangtung Province, on Hainan Island, and in Hong Kong. The tree is occasionally cultivated in Southeast Asia but rarely elsewhere in the tropics.

Although best adapted to a moist, warm, subtropical or tropical climate, the Kwai muk can withstand light frosts.

Food uses. Fruits are picked from the tree when fully ripe, since unripe fruits produce large amounts of sticky latex when cut. They have an agreeable, sweet-sour taste and are most commonly enjoyed fresh. They can also be preserved by drying, in syrup, or with salt.

Comments. With its rounded, dense crown, slow growth, and beautiful foliage, the Kwai muk makes an attractive ornamental for landscaping in larger gardens. The prolific tree can produce more than 2,000 fruits per tree, per season. With its useful fruit, the Kwai muk is a somewhat underestimated member of the genus *Artocarpus*, best known for the breadfruit (*A. altilis*, p. 25) and the jackfruit (*A. heterophyllus*, p. 27).



Artocarpus integer Merr.

CHAMPEDAK

Moraceae (Mulberry family)

Champedak has a soft yellow pulp that is sweet and juicy.

Description. Champedak is a medium-sized to large deciduous tree, 15–40 m (50–130 ft) tall. Alternate leaves obovate to elliptic, 15–25 cm (6–10 in) long by 3–12 cm (1.2–5 in) wide. Male inflorescence a 5 cm-long (2 in), whitish-yellow spike, with female flowers borne in small heads. Fruits, which are produced on the stem and older branches, are globose to cylindrical or of irregular shape, 20–35 cm (8–14 in) long by 10–15 cm (4–6 in) wide. Reticulated and warty skin yellowish, brown, or orange-green. Soft yellow pulp odoriferous, sweet, juicy, with several kidney-shaped seeds.

Origin and Distribution. Native to Southeast Asia. Widely planted throughout tropical Asia, especially in Malaysia. Uncommon to rare in most other tropical regions except for Jamaica and Uganda.

Food uses. Green fruits are used in curries and rice dishes. Unripe fruits are also pickled. Ripe fruits are eaten fresh, preserved in syrup, or made into ice cream. In Indonesia, Singapore, and Malaysia, food stalls sell fried bananas (*pisang goreng*), sometimes served with a sauce made of ripe champedak fruits. As with other *Artocarpus* species, the starchy seeds are boiled or roasted and eaten as snacks.

Comments. There are two distinct varieties of the champedak: *kapa* and *barka*. The former has sweet, fragrant pulp and the latter a nonfragrant, bland taste. Champedak fruits are preferred by many over the better known and closely related jackfruit (*A. heterophyllus*, p. 27).

The tree provides a strong and durable wood that is not attacked by termites. A yellow dye extracted from the heartwood is used for dyeing silk. Ripe fruits are often fed to cattle; elephants eat the leaves, fruit, and bark.

Artocarpus lakoocha Wall. ex Roxb.

LAKOOCHA

Moraceae (Mulberry family)

Description. Deciduous tree 6–10 m (20–33 ft) tall with large, leathery, elliptic leaves 25–30 cm (10–12 in) long by 20–25 cm (8–10 in) wide. Blades entire or lobed, downy on the underside. Orange-yellow male and reddish female flowers are borne separately on the same tree. Compound fruits, which weigh 250–300 grams (0.55–0.66 lbs), are round or of irregular shape, 5–12 cm (2–5 in) in diameter with a velvety dull yellow surface sometimes tinged with pink. Pulp orangy-yellow, subacid to sweet with 20–30 fleshy seeds.

Origin and Distribution. Native to the humid sub-Himalayan regions of India, where it grows to an elevation of about 1,200 m (3,900 ft). Also probably indigenous to Malaya and Sri Lanka. The lakoocha is cultivated on a small scale throughout Southeast Asia but is very little known elsewhere in the tropics.

Food uses. The fruits can be eaten fresh but are most commonly made into chutneys and curries. The sour-tasting male flowering spikes and immature fruits are often pickled or made into a sauce. In India, the pulp is used similar to tamarind (*Tamarindus indica*, p. 233) in recipes for spicy dishes.

Comments. The lakoocha tree provides heavy and durable wood of excellent quality, similar to teak (*Tectona grandis*) and used for furniture making, boat building, and construction purposes.

Extracts of the heartwood are being investigated by the pharmaceutical industry for anti-aging and bleaching effects on the human skin.

Artocarpus odoratissimus Blanco

MARANG

Moraceae (Mulberry family)

Marang leaves have a rough, sandpapery surface.

Description. Marang is an evergreen tree with spreading branches, 25–30 m (80–100 ft) tall. Leaves alternate, with rough, sandpapery surface, 20–45 cm (8–18 in) long by 15–30 cm (6–12 in) wide. Monoecious flowers produce male and female spikes. The female flowers develop into an ovoid or irregularly shaped, yellowish-green to yellowish-brown fruit, weighing about 1 kg (2.2 lbs) and measuring 15–20 cm (6–8 in) in diameter. The thick rind is densely covered in short, soft spikes. The white flesh (aril) has a strong, sweet, and very aromatic smell and contains numerous brown seeds.

Origin and Distribution. The marang is probably native to the Philippines and Borneo. It is cultivated mainly in Southeast Asia and is uncommon to rare in other parts of the tropics. The tree prefers a warm and humid tropical climate.

Food uses. The fruits, which turn yellowish-brown in color when fully ripe, are cut open and the sweet, soft pulp surrounding the seeds is extracted from the shell. The seeds taste similar to peanuts but have a crunchier texture and are boiled in saltwater or roasted and consumed as snacks.

Comments. The opened fruit must be eaten quickly, because it loses its flavor rapidly through oxidization. This tendency has largely limited the fruit to local consumption.

Two closely related species, the pedalai (*A. sericicarpus*) and the pingan (*A. sarawakensis*), originate from the same region in Southeast Asia. The former is distinguished by its rind covered in long, soft, hairlike spines and red color when ripe; the latter has the shape of the marang but is orange.

Averrhoa bilimbi L.

BILIMBI

Oxalidaceae (Wood sorrel family)

Descrpition. Small evergreen tree reaching 5–10 m (16–33 ft), with a short trunk. Leaves alternate, imparipinnate, clustered at branch extremities, 30–60 cm (12–24 in) long with 11–39 leaflets, ovate or oblong with an acute tip, 3–10 cm (1.2–4 in) long by 1–2 cm (0.4–0.8 in) wide. Fragrant flowers small, purplish to yellowish-green. Flowers borne in small panicles directly on the trunk and thicker branches. Fruits look like small cucumbers, ellipsoid or almost cylindrical, 5–10 cm (2–5 in) long with faint longitudinal ridges. Skin glossy, light green with crisp, juicy, and exceedingly sour flesh.

Origin and Distribution. Probably native to the Moluccan Islands of Indonesia. The tree is popular throughout Southeast Asia, where it is very often grown in home gardens. In the late eighteenth century, the bilimbi was brought from Indonesia to Jamaica, from where it slowly spread. It is occasionally grown in Africa and tropical America and requires a tropical climate.

Food uses. The very sour fruits are sometimes eaten raw after dipping in salt and spices. More often the fruits are used to prepare relishes, chutneys, and sour marmalades. In Costa Rica, diced, stewed, and seasoned fruits are served with rice and beans. In Asia, the bilimbi is often used instead of mango in chutneys and served as a side dish to curries. Fruits are also made into sour jellies and pickled in brine. In the Aceh province of Indonesia, sun-dried bilimbis are sold in traditional markets. They are used to give a subtle, acidic taste to many typical, savory Aceh dishes. The acidity can be reduced by soaking the fruits in saltwater for several hours. Fruits are made into a refreshing lemonade-like beverage.

Fruits look like small cucumbers, ellipsoid or almost cylindrical.

Comments. In rural areas of Asia, the juice of the bilimbi, rich in oxalic acid, is used as an effective stain remover and to clean iron objects. In the Philippines a sweet variety of the bilimbi is grown, called *balimbing*; the sour variety is called *kamias*.

Averrhoa carambola L.

CARAMBOLA, STARFRUIT

Oxalidaceae (Wood sorrel family)

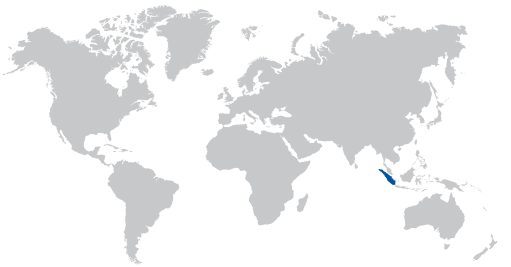
Cross sections of the fruit are shaped like a star.

Description. Small, shrubby, slow-growing tree with broad crown. Leaves alternate, compound, with 4–6 pairs of leaflets plus one terminal one. Small pink or purple flowers 4–6 mm (0.16–0.24 in) wide are produced in small clusters in leaf axils and on branch tips. Fruits ovoid, 8–14 cm (3–6 in) long, strongly 5-ribbed, orange-yellow to yellow-green with a thin waxy skin. The orange-yellow flesh is juicy and has a crisp, applelike texture; the taste ranges from very sour to quite sweet. The tree acquired its name from a cross-section of the fruit, which resembles a 5-pointed star. Fruits are produced year-round.

Origin and Distribution. The starfruit is native to tropical regions of South and Southeast Asia, with probable centers of origin in Sri Lanka and the Moluccas. It is now cultivated throughout the tropics and subtropics, mainly in home gardens.

Food uses. Whole ripe carambolas are blended with sugar, ice, and water to make refreshing fruit drinks. Slightly underripe fruits are eaten raw with salt as a snack. Star-shaped slices of the ripe fruit are used as garnish for tropical dishes, cocktails, fruit salads, cakes, and tarts. The fruits of unripe, sweet varieties can be pickled or made into jams and preserves. In Java, the sour-tasting flowers are used in salads. In Southeast Asia, carambolas are cooked as a sweet-sour vegetable in stews and curries. Fruits of sweet varieties are eaten raw.

Comments. Carambolas are an excellent source of vitamin C and a good source of vitamin A. In traditional herbal medicine, the fruits have been used to lower blood sugar in patients with diabetes.



Baccaurea dulcis (Jack) Müll. Arg.

BUAH RAMBAI, TOEPA, KETUPA

Phyllanthaceae (Leafflower family)

The thick rind encloses a juicy, gelatinous pulp.

Description. Large evergreen tree, 25–35 m (82–115 ft) tall, often with a buttressed trunk up to 50 cm (20 in) thick and a dense crown. Alternate, glabrous, elliptic to obovate leaves 15–22 cm (6–9 in) long. The leaves are often clustered at the tips of the branches. Small, yellowish, dioecious flowers 3 mm (0.1 in) wide are produced in pendent racemes 5–15 cm (2–6 in) long. Spherical, yellowish-brown to reddish-yellow fruits are grouped in dense clusters on larger branches and on the trunk. The thick rind encloses a juicy, gelatinous, translucent or white pulp and usually 3 reddish-purple seeds. Unripe fruits contain a white, sticky sap.

Origin and Distribution. The buah rambai is native to Sumatra and Java in western Indonesia, where it grows naturally in lowland and premontane dipterocarp rainforests. The tree is cultivated mainly in Malaysia and Indonesia and to a lesser extent in other tropical regions of Southeast Asia but very rarely elsewhere. When in season, the fruits are commonly available in local markets.

Food uses. The fruits, which have a subacid to fairly sweet taste, are usually eaten fresh. The pulp is cooked with sugar and spices to make desserts and jams. Whole fruits are pickled in vinegar.

Comments. The durable and termite-resistant wood of the ketupa tree is used for making furniture and for boat building.

Baccaurea motleyana (Müll. Arg.) Müll. Arg.

RAMBAI

Phyllanthaceae (Leafflower family)

Ovate fruits grow in showy, pendent clusters.

Description. Small evergreen tree with compact crown, 8–14 m (26–46 ft) tall. Spiraled leaves 16–32 cm (6–12 in) long by 8–16 cm (3–6 in) wide with indented veins on upper leaf surface. Dioecious, fragrant flowers with yellow sepals in pendent racemes 50–80 cm (20–31 in) long, produced directly on the trunk and thicker branches. Ovate fruits in showy, pendent clusters. Fruits 3–5 cm (1.2–2 in) long with thin white, pink, or yellowish-brown skin and translucent to white, juicy pulp. The segmented flesh, which tastes sweet to sweet-sour, contains 1 brown seed per segment.

Origin and Distribution. The tree grows wild on the Malay Peninsula, in parts of Sumatra, and in Borneo. The rambai is cultivated for its fruit and as a shade tree throughout Southeast Asia but is rare in the African and American tropics. It requires a tropical climate with high humidity.

Food uses. Ripe fruits are eaten out of hand or made into jellies and jams. The pulp is used to make desserts and fruit wine. Occasionally the fruits are used to prepare chutneys and pickles.

Comments. The tree is planted in tropical Asia as an attractive, slow-growing ornamental and shade tree. The genus *Baccaurea* consists of more than 100 species, distributed mainly from Southeast Asia to the West Pacific.

Baccaurea ramiflora Lour.

BURMESE GRAPE, MAFAI

Phyllanthaceae (Leafflower family)

Description. Evergreen tree with a spreading crown, 12–22 m (39–72 ft) tall. Alternate, elliptic to obovate, glabrous leaves, 10–24 cm (49 in) long, spirally clustered around branches. Small yellow, dioecious flowers are produced in pendent racemes, 20–30 cm (8–12 in) long, on the trunk and older branches. Fruits ovoid to ellipsoid berries, 2–3.5 cm (0.8–1.4 in) long, with pale yellow, orange, or deep red skin. A white, juicy pulp surrounds 2–4 reddish seeds. Unripe fruits contain a sticky latex.

Origin and Distribution. Native to southern China, Burma, Laos, Cambodia, Vietnam, Thailand, and Malaysia. The tree grows naturally between sea level and 1,600 m (5250 ft) in the humid understory of tropical rainforests. Cultivated as a fruit tree in South and Southeast Asia. Rare elsewhere in the tropics.

Food uses. The sweet pulp of fully ripe fruits is eaten fresh. The fruits are boiled with sugar to make desserts and preserves. The pulp is also used to make beverages and fermented to make a winelike drink.

Comments. The bark and roots produce a reddish-brown dye. The fruits are used locally to treat skin diseases. The valuable wood is used to make furniture.

Of the genus *Baccaurea*, which comprises more than 100 species, all native to the Indo-Malayan region and the West Pacific, several species are cultivated for their edible fruits. *B. dulcis* (buah rambai, p. 34), native to Sumatra and Malaysia, produces yellowish-orange fruits eaten out of hand and used in preserves and desserts. *B. ramiflora* is also known by the synonym *B. sapida*.

Bactris guineensis (L.) H.E. Moore

PRICKLY POLE

Arecaceae (Palm family)

Description. Small to medium-sized palm, 5–7 m (16–23 ft) tall, forming dense, impenetrable clumps of 100 or more slender stems measuring 2–5 cm (0.8–2 in) in diameter and covered in numerous short spines. Pinnate leaves 40–60 cm (16–24 in) long with linear, dark green leaflets measuring 10–20 cm (4–8 in) in length. The rachis is covered in sharp spines 3–4 cm (1.2–1.6 in) long. Monoecious flowers are borne in cream-colored racemes beneath a woody, light brown, spiny bract measuring about 20 cm (8 in) in length. Dark purple or black fruits globose, 2–4 cm (0.8–1.6 in) in diameter with a single seed. The pulp is somewhat fibrous and has a sour taste.

Origin and Distribution. The plant grows wild in the lowlands of northern South America and in Central America north to Nicaragua. It prefers a tropical climate with a distinct succession of wet and dry seasons. Clumps of these palms can be seen as remnants in pastures and in secondary forests, often close to the coast. Fruits are usually collected from wild plants. Rarely cultivated outside its natural range.

Food uses. Ripe fruits are boiled and the resulting, deep red to purple juice is sweetened to make a refreshing drink. The juice is also made into jellies and fermented into wine. In Venezuela, an alcoholic drink called *ron de Píritu* is prepared by macerating fruits for several months in rum or clear cane liquor. The palm heart is edible and of good flavor but seldom harvested because of its small size. The seeds contain about 25% oil, which can be used for human consumption.

Comments. The woody stems are used in construction and furniture making. In Colombia, the hollow stems are made into a musical instrument called a *guacharaca*. The dense and spiny clumps of *B. guineensis* form important habitats and hiding places for native wildlife, and the fruits are eaten by a wide variety of birds and mammals. In some parts of its natural range, the palm is slowly disappearing because of modern cattle ranching and farming practices (farmers treat the plant as a weed). This plant is also known by the synonym *B. minor*.

Barringtonia procera (Miers) R. Knuth

CUTNUT

Lecythidaceae (Brazil nut family)

Description. Medium-sized evergreen tree, 15–25 m (50–80 ft) tall. Nearly sessile leaves whorled at nodes. Shiny dark green, leathery, simple leaves 30–70 cm (12–28 in) long by 10–25 cm (4–10 in) wide. Yellow, white, or red flowers with long stamens in showy, pendulous, brushlike spikes up to 1 m (3 ft) long. Indehiscent fruits greenish-gray to purplish-gray, 6–11 cm (2–4 in) long. Each seed is enclosed by a fibrous white to purple endocarp.

Origin and Distribution. The cutnut is indigenous to the Solomon Islands, West Papua, Papua New Guinea, and Vanuatu. The tree grows wild in humid tropical lowlands and is common throughout its natural habitat. Rarely cultivated elsewhere.

Food uses. The tasty and nutritious seed kernels are eaten raw or roasted as snacks. In the Western Solomon Islands, the roasted kernels are baked into puddings together with edible hibiscus (*Abelmoschus manihot*) and coconut cream.

Comments. Seed kernels contain about 10% protein, 25% carbohydrate, and fat. They are consumed almost exclusively within their geographic origin and exported only on a small but growing scale, mainly from Vanuatu.

In addition to *B. procera*, two closely related species occurring in the same geographical region, *B. edulis* and *B. novae-hiberniae*, are cultivated for their edible nuts. All three species are called cutnut in English. Distinguishing between the species is often difficult, though *B. procera* can be distinguished from the other two species by its large, glossy, nearly sessile leaves.

Benincasa hispida (Thunb.) Cogn.

WAX GOURD, WHITE GOURD

Cucurbitaceae (Cucumber family)

Description. Annual creeping vine, which grows to several meters in length, climbs with tendrils up to 35 cm (14 in) long. Leaves and stems are covered in fuzzy hairs. Alternate, deeply 5-lobed cordate leaves, 12–26 cm (5–10 in) long by 10–24 cm (4–9 in) wide. Large bell-shaped, golden yellow, monoecious flowers are produced singly in the axils of leaves. Fruits are large berries, 30–60 cm (12–24 in) long, spherical or cylindrical, with white waxy skin and firm whitish flesh with numerous flat, light brown seeds.

Origin and Distribution. Native to Southeast Asia. The plant is cultivated as an annual vegetable in tropical and subtropical regions around the world.

Food uses: Immature fruits are used in salads and as a vegetable in stir-fries, soups, and other savory dishes. Small chunks of the ripe fruit, which have a mild and slightly sweet taste, are often used in curries, soups, and stews or diced and served as a side dish. In India and Pakistan, pieces of the fruit are used to make a popular candy called *petha*, often sold by street vendors and in the markets. Fruits can be baked or stuffed with meat and vegetables. Fruit slices are sometimes preserved by drying in the sun. Young shoots and flowers are fried and eaten as vegetables. The seeds are roasted and eaten as salted snacks.

Comments. Ripe fruits can be stored for months without spoilage because the waxy coating on the skin prevents moisture loss and rotting.

Bertholletia excelsa Bonpl.

BRAZIL NUT

Lecythidaceae (Brazil nut family)

In the wild, the hard seeds of the Brazil nut are dispersed primarily by rodents like the agouti.

Description. Very large, emergent evergreen or dry season deciduous rainforest tree with a straight trunk up to 50 m (164 ft) tall and reaching 1–2 m (3–6 ft) in diameter. Alternate, simple leaves 25–35 cm (10–14 in) long by 12–16 cm (5–6 in) wide. Small, greenish-white flowers in panicles 8–12 cm (3–5 in) long. Fruits are woody brown capsules 12–16 cm (5–6 in) wide with 1 cm (0.4 in)-thick hard walls. Inside are 8–24 tightly packed triangular seeds with hard woody walls. In the wild, these hard seeds are dispersed primarily by rodents like the agouti.

Origin and Distribution. The Brazil nut grows naturally in the Amazon and Orinoco river basins of Venezuela, the Guyanas, Surinam, Brazil, Colombia, Peru, and Bolivia. The tree requires a tropical humid climate characteristic of equatorial lowland rainforests. The tree grows on well-drained *terra firme* soils that are not inundated during seasonal floodings.

Food uses. The seeds are consumed primarily raw as snacks. They are also employed similar to macadamia nuts in bakery goods and sweets.

Comments. Brazil nuts contain about 69% fat, 18% protein, and 13% carbohydrate. They are an excellent source of selenium, copper, manganese, and magnesium as well as thiamin and calcium.

Most Brazil nuts are gathered from wild trees by workers called *castanheiros*. Plantations have so far been rather unproductive, mainly because of the absence of certain large bee species that pollinate the flowers of the Brazil nut tree. These bees are present when attracted exclusively by an orchid species of the genus *Coryanthes* that grows in the same habitat as the Brazil nut tree. The collection of Brazil nuts from wild trees is often cited as an example of sustainable use of tropical lowland rainforests. *B. excelsa* is considered a threatened species, mainly as a result of destruction of primary Amazonian rainforests.

The seed oil is also used as a lubricant and in the cosmetics industry. The genus is named after C. L. Berthollet (1748–1822), a French scientist and politician.

Blighia sapida K.D. Koenig

AKEE, ACKEE

Sapindaceae (Soapberry family)

Mature fruits split open and display three large, shiny black seeds.

Description. Medium-sized evergreen tree up to 12 m (39 ft) tall with a dense, compact crown. Leathery leaves pinnate, compound, 20–30 cm (8–12 in) long with 6–8 obovate-oblong leaflets. Flowers unisexual, fragrant, yellowish-green in color. Fruits pear-shaped, red to yellow-orange in color when ripe. Mature fruits split open and display three large, shiny black seeds surrounded by a fleshy, ivory-colored aril.

Origin and Distribution. The akee is native to West Africa. It was probably brought to Jamaica in the seventeenth century with slave ships sailing from West Africa to the Caribbean. Over the next century the akee spread to other Caribbean islands and to southern Florida. It is widely planted as a shade tree and an ornamental.

Food uses. The akee must be treated with care. Only ripe fruits that have split open are harvested, and only the ivory-colored aril surrounding the seed is actually eaten. Unripe or overripe fruits and the seeds are always poisonous, and consumption can cause severe sickness and eventually lead to death through hypoglycemia (Jamaican vomiting sickness). Harvested correctly and prepared properly, the akee is a nutritious vegetable rich in essential fatty acids, vitamin A, and protein. It is a major ingredient in West African and Jamaican cuisine. The national dish of Jamaica is akee with salt fish, a dish prepared with salted codfish and boiled akee arils sautéed with green plantain, tomato, onion, bell pepper, and spices. Akee fruits are also available as canned and frozen products.

Comments. The tree is named after William Bligh, captain of the HMS Bounty, who introduced the fruit to science in 1793 after returning to England from a later, successful voyage to Jamaica. The akee is closely related to the rambutan (*Nephelium lappaceum*, p. 164) and to the longan (*Dimocarpus longan*, p. 91). Although native to Africa, it is the national tree of Jamaica.

An akee tree with ripe fruits attracts a great number of frugivorous birds.

Borojoa patinoi Cuatrec.

BOROJÓ

Rubiaceae (Coffee family)

The borojó has been used for centuries to enhance the human libido.

Description. Small evergreen tree, 3–5 m (10–16 ft) tall, with opposite, glossy, oval leaves with distinct venation. Unisexual flowers are produced on separate trees. Female flowers with 5 white petals are arranged singly whereas white male flowers emerge in small clusters. Fruits globose, 8–13 cm (3–5 in) in diameter, average weight 750–1,000 g (1.3–3.3 lbs), green with brown skin, soft and acidic pulp containing 100–600 seeds.

Origin and Distribution. Native to the understory of humid lowland rainforests of eastern Panama, northwestern Colombia, and parts of western Ecuador. This tree is rarely cultivated outside its natural range except in botanical gardens and collections of tropical fruit trees. It is grown commercially in western Colombia.

Food uses. The pulp of ripe fruits is traditionally used to make jams and marmalades. In Colombia, dessert dishes and ice cream are prepared from the fruit. The pulp is also used to make wine and a juice believed to have aphrodisiac and energizing properties.

Comments. The borojó, with a high content of phosphorus, protein, iron, calcium, and vitamins B and C, has been used for centuries to enhance libido in humans. It is also used in traditional medicine to treat bronchitis and hypertension. The fruit is currently under investigation for its aphrodisiac qualities and its high nutrional value, especially its high content of amino acids and minerals such as phosphorus.

The plant is particularly common in the Chocó region of Colombia. In the Amazon region, two species, *B. sorbilis* and *B. verticillata*, are also cultivated for their fruits. Both are very similar and closely related to the borojó. The genus *Borojoa* is related to the genus *Alibertia* and sometimes included in that genus.

Bouea macrophylla Griff.

GANDARIA, MAPRANG

Anacardiaceae (Cashew family)

This fruit has a sweet or sweet-sour taste with a scent of turpentine.

Description. Medium-sized evergreen tree, 12–20 m (40–65 ft) tall, with a dense, rounded crown. Alternate, lanceolate to elliptic, leathery leaves 20–40 cm (8–16 in) long by 5–8 cm (2–3 in) wide. Small greenish or yellow flowers in pendent panicles. Oval orange-yellow fruits 3–6 cm (1.2–2.4 in) long, resembling a small mango. The juicy, orange-colored flesh, which adheres to the seed, has a sweet or sweet-sour taste with a scent of turpentine. Fruits contain one seed.

Origin and Distribution. The tree grows naturally in a region ranging from Myanmar and southern Thailand to Malaysia, Sumatra, and western Java. Cultivated throughout tropical Asia as a dooryard fruit tree and shade tree, also occasionally grown in Africa and tropical America. The tree grows best below 500 m (1,600 ft) in a tropical monsoon climate with a distinct short dry season and long wet season. It is grown commercially for its fruit in Thailand and Malaysia.

Food uses. Unripe fruits are eaten raw, often sprinkled with lime juice and salt. Unripe, entire fruits (including the seed) are usually used in chutneys and pickles. They are chopped up and employed in savory dishes like curries and form an essential ingredient in *rojak*, a typical spicy fruit and vegetable dish of Malaysia, Singapore, and Indonesia. In Indonesia, the pickled fruits are eaten in a traditional mixed vegetable or fruit dish called *asinan*. Green fruits are also an ingredient in the spicy *sambal* sauce. Ripe fruits, especially the sweet varieties, are eaten fresh or cooked with sugar to make desserts and preserves. Young leaves are eaten raw in salads or cooked as a vegetable.

Comments. A closely related species from Thailand and Malaysia, the plum mango (*B. oppositifolia*), has smaller, sour fruits, which are used in an unripe state the same way that gandaria fruits are used.

Brosimum alicastrum Sw.

MAYA BREADNUT

Moraceae (Mulberry family)

Description. Large evergreen tree with a pyramidal crown and erect trunk, 30–45 m (100–150 ft) tall. All plant parts contain milky white latex. Alternate, simple leaves, elliptic to lanceolate, 5–20 cm (2–8 in) long by 2–8 cm (0.8–3 in) wide. Monoecious male and female flowers are borne in the axils of leaves. Male flowers yellow without a corolla, borne in small clusters. Female flowers greenish. Fruits spherical, 1.5–3 cm (0.6–1.2 in) in diameter, greenish-yellow, orange, or dark red when fully ripe. Pulp sweet and aromatic with a single large edible seed.

Origin and Distribution. Native to rainforests and seasonally dry forests of southern Mexico and Central America. It is a dominant, emergent tree species of tropical forests of Central America. The tree was widely planted by the Mayans at least 2,000 years ago. The pulp and the nutritious seeds played an important role in the diet of Mesoamerican civilizations.

Food uses. The sweet pulp can be eaten fresh or made into juices and jellies. The seed tastes similar to chestnuts and is usually eaten boiled. The seed can also be leached and ground into flour used to make porridge and tortillas. Roasted seeds taste somewhat like chocolate or coffee. In Guatemala they are ground into a powder to produce a beverage. Stewed nuts taste similar to mashed potatoes and are used in a variety of savory dishes.

Comments. This tree, also known as breadnut, is not closely related to the Asian breadnut tree (*Artocarpus camansi*, p. 26), although it does belong to the same family. The seeds of the Maya breadnut are a very good source of fiber, potassium, calcium, iron, zinc, folic acid, protein, and vitamins A, C, E, and B. Seeds contain the amino acid tryptophan, which is almost absent from corn, another staple food of Central America and Mexico.

The tree plays an important role in the ecology of Mesoamerican forests, since the fruits are eaten by a great variety of wild animals like peccaries, monkeys, toucans, squirrels, opossums, and many more.

The leaves and fallen fruits make high-quality cattle feed. The wood of the tree is used to make furniture.

Bunchosia argentea (Jacq.) DC.

PEANUT BUTTER FRUIT

Malpighiaceae (Acerola family)

Description. Small evergreen shrub or tree with stiff, spreading branches, 2–4 m (6–13 ft) tall. Opposite, simple, elliptic leaves 6–10 cm (2.4–4 in) long by 4–6 cm (1.6 –2.4 in) wide. Small yellow flowers with 5 petals are borne in the axils of leaves. Fruits oval, 2–3 cm (0.8–1.2 in) long with a curved, pointed apex. Fruits turn from green (over orange background) to dark red when fully ripe and have a soft orange pulp.

Origin and Distribution. Native to tropical lowland regions of Central and South America from Costa Rica south to Peru and Brazil. The tree requires a tropical climate with or without a dry season. It is rarely cultivated outside its natural range except in botanical gardens or as a curiosity.

Food uses. Fully ripe fruits, which taste very much like peanut butter and also have a similar consistency, are eaten out of hand or made into sandwich spread. They are also used to prepare milk shakes, fruit juices, jellies, and preserves. Ripe fruits do not keep well and must be processed and kept in the refrigerator. Slightly underripe fruits are also edible; they have a crisp flesh and taste like carrots.

Comments. Although the fruit tastes good and deserves more attention, it is not very popular in its natural range. When in fruit, the tree makes an attractive ornamental as the fruits are multicolored. Also known by the synonym *Malpighia argentea*.

B. armeniaca is a closely related species from South America growing at higher elevations, between 1,500 and 2,500 m (5,000–8,000 ft). The fruits are used like those of *B. argentea*. The genus *Bunchosia* consists of 50–60 species, all native to tropical America.

Byrsonima crassifolia (L.) Kunth

NANCE

Malpighiaceae (Acerola family)

In Costa Rica a liqueur is made from slightly fermented nance fruits, which are kept in clear sugarcane liquor for at least two weeks.

Description. Evergreen shrub or small tree, 6–10 m (20–33 ft) tall. Leathery leaves opposite, simple, with ovate to elliptic blades 5–15 cm (2–6 in) long. Yellow and red flowers, 1.5 cm (0.6 in) in diameter with 5 petals, are produced in terminal, erect racemes. Fruits are bright yellow drupes, 1–2 cm (0.4–0.8 in) wide, with juicy, white, subacid to sweet pulp with a single hard stone.

Origin and Distribution. Nance occurs naturally throughout tropical and subtropical America. It grows in lowlands and middle elevations up to 1,800 m (6,000 ft). The tree is common in degraded savannas and dry forests because of its resistance to drought and fire but also grows in lowland rainforest habitats with high precipitation. The plant requires a tropical or warm subtropical climate with dry or moist conditions and a sunny location. It grows on a wide variety of soils, including those that are rocky, sandy, or degraded. The nance, commonly grown as a dooryard tree in tropical America, is rarely cultivated in commercial plantations.

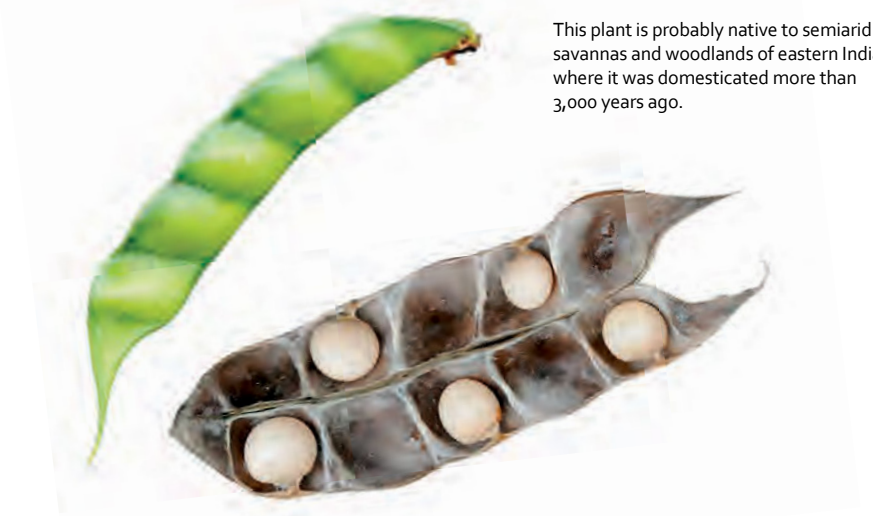
Food uses. The aromatic fruits are eaten raw as a snack, sometimes seasoned with lime juice and salt. They are also cooked to prepare desserts, sweets, ice cream, and jams. Nance is used to flavor carbonated drinks, and in Costa Rica a liqueur (*crema de nance*) is made from slightly fermented nance fruits, which are kept in clear sugarcane liquor for at least two weeks. Another alcoholic drink made from nance fruits is *chicha de nance*, a beerlike drink prepared from fermented fruits. Ripe fruits are sometimes used instead of olives in rice and meat dishes.

Comments. Green nance fruits have been used by indigenous people of Central America to dye cotton a light brown color. The astringent bark of the tree has been used in folk medicine to treat diarrhea, digestive disorders, and fever. Fruits contain up to 240 mg (0.008 oz) vitamin C per 100 g (0.22 lbs) fruit. Nance trees are an important source of nectar for honey bees.

Cajanus cajan (L.) Huth

PIGEON PEA, CONGO PEA

Fabaceae (Bean family)



This plant is probably native to semiarid savannas and woodlands of eastern India, where it was domesticated more than 3,000 years ago.

Description. A short-lived perennial shrub (often annual, when cultivated), 3–4 m (10–13 ft) tall. Alternate, pubescent leaves with three lanceolate leaflets, 5–10 (2–4 in) cm long by 2–4 cm (0.8–1.6 in) wide. Flowers yellow, often with purple streaks in axillary racemes. Flat, pubescent fruit pods 5–10 cm (2–4 in) long, with 2 to 10 light brown, reddish or black, round seeds.

Origin and Distribution. Although the precise origin is unknown, the plant is probably native to semiarid savannas and woodlands of eastern India, where it was domesticated more than 3,000 years ago. Another possible place of origin is eastern Africa, where the plant has been in cultivation since prehistoric times. It is unknown in the wild. This drought and heat resistant shrub is grown on a small scale throughout the tropics, in semiarid and humid climates.

Food uses. Pigeon peas, which are a very good source of protein, are used similar to beans and peas. They can be employed in soups and stews or made into flour. Sprouted seeds are eaten cooked in a variety of typical Indian and African dishes. Young, tender seed pods are consumed as a green vegetable. In many parts of Africa the young shoots and leaves are also eaten.

In Pakistan, India, Nepal, and Bangladesh pigeon peas are used to make *dal*, a thick stew made from beans, peas, and lentils.

Comments. Up to 16% of the dry matter of the pigeon pea is protein. The plant is an important forage crop for domestic animals.

Canarium odontophyllum Miq.

DABAI, SIBU OLIVE

Burseraceae (Torchwood family)

Description. Large evergreen tree, 30–45 m (100–150 ft) tall. Alternate, compound leaves 50–60 cm (20–24 in) long with oblong to lanceolate leaflets, each 15–20 cm (6–8 in) long. Dioecious, small yellowish flowers are produced in large panicles. Purple to purplish-black oblong fruits 3–4 cm (1.2–1.6 in) long, with fleshy yellow mesocarp, contain a single large 3-angled seed. Unripe fruits are almost white in color.

Origin and Distribution. Native to Borneo. Occasionally cultivated in Southeast Asia, especially in Malaysia, Indonesia, and the Philippines. In Borneo, fruits are often harvested from wild trees. Very rare in other tropical regions. The plant grows as a canopy tree in lowland dipterocarp rainforests with constant high temperatures and humidity.

Food uses. Ripe fruits are consumed after soaking in hot water to soften. They have a rich, creamy texture similar to avocado and are used like olives in savory dishes and salads. They are often eaten with a soy sauce dip. Ripe dabais are sometimes sprinkled with sugar and consumed as a snack. The fruits are also used to make sauces, mayonnaise, and pickles.

The seed kernel, which has a delicious, nutty flavor and a crisp texture, is eaten raw or roasted. In Southeast Asia, kernels are often added to savory dishes like stir-fries and rice dishes.

Comments. The dabai fruit has high nutritional value; it is rich in unsaturated fats (38–44% oleic acid and 12–14% linoleic acid), protein, and carbohydrates as well as minerals like magnesium and calcium.

Canarium ovatum Engl.

PILI NUT

Burseraceae (Torchwood family)

Description. Medium-sized evergreen tree with resinous wood, 15–24 m (50–78 ft) tall. Alternate, compound leaves, 30–40 cm (12–16 in) long with 3–5 pairs of oval, leathery, shiny green leaflets, each 10–20 cm (4–8 in) long. Young leaves are reddish-pink in color. Small yellowish-green, dioecious (or sometimes hermaphroditic) flowers are borne in terminal or axillary, cymose inflorescences. Fruits are drupes with a shiny, purplish-black skin, 4–8 cm (1.6–3.2 in) long; a fibrous, greenish-yellow mesocarp encloses a single large brown seed.

Origin and Distribution. Originally from the Philippines and possibly other parts of Malesia. The tree is grown mainly in Southeast Asia and very rarely cultivated in other tropical regions. It requires a tropical climate with rainfall evenly distributed throughout the year.

Food uses. The seed kernel can be eaten raw or roasted. The raw nuts taste like roasted pumpkin seeds; when roasted, the seeds' mild, nutty flavor and tender, crispy texture are superior to that of almonds. Roasted seeds are usually sold salted or glazed with sugar. The seeds are also used in the preparation of chocolate, ice cream, granola bars, and baked goods. They are an important ingredient in the Chinese dessert called "moon cake," traditionally prepared during the Mid-Autumn Festival. The oil-rich pulp from the mesocarp of the ripe fruit is eaten boiled, seasoned with pepper and salt. The seed kernel produces a yellowish oil similar in quality to olive oil. Young shoots of the plant are eaten as a green vegetable in salads.

Comments. The seed kernels are rich in fat and protein and a very good source of calcium, phosphorous, and potassium. The main producer of pili nuts is the Philippines, where the fruits are collected from wild trees. The pili nut is still a minor fruit but has the potential to become equally important as the macadamia nut (*Macadamia integrifolia*, p. 143) because of its superior taste and high yields. A single fully grown tree can produce up to 10,000 fruits in a single year.

Capsicum frutescens L.

CHILI PEPPER

Solanaceae (Nightshade family)

Description. Small, perennial shrub. Leaves alternate, obovate to lanceolate with short, pointed apex. Small, greenish-white to yellowish-white flowers are produced in small clusters at the nodes. Elongated or round fruits, which are botanically berries, are usually bright red or orange when ripe and contain several round, flat seeds. Shape, size, and color of the fruits can be highly variable.

Origin and Distribution. It is confirmed by excavations that chili peppers have formed an important part of human diet in South America for at least 7,500 years. Columbus came in contact with chili peppers on his voyages to America; he called the unfamiliar spice "pepper" after the black pepper known from Asia. Portuguese and Spanish traders, who controlled transatlantic commerce, took this new spice to Europe, where at first it was considered a curiosity and planted as an ornamental. From there it reached the colonies of India, the Philippines, and China and spread to Persia and Turkey. Chilies were reportedly grown in Indonesia around 1540.

Food uses. Hot chilies are made into spicy sauces like Tabasco sauce and used as an ingredient in curry powder. It is hard to imagine Indian curries, Hungarian goulash, or Indonesian sambal without spicy chili peppers. In several Asian countries the leaves are cooked as vegetables and used in soups.

Comments. The substance responsible for the spicy taste of chilies is capsaicin and related chemicals. These are found in the outer fruit walls and in the seeds. Nonspicy varieties lack this compound. Spicyness is measured in Scoville heat units (SHU), with bell pepper rated at 0, jalapeño at 3,000–6,000 SHU, and the naga jolokia from India at more than 1 million SHU. Capsaicin is the active ingredient in pepper sprays used for self-defense. Ripe chili peppers are rich in vitamin C and carotenes and contain considerable amounts of iron, vitamin B, magnesium, and potassium.

Carica × *heilbornii* V.M. Badillo

BABACO, CHAMBURO

Caricaceae (Papaya family)

Description. Herbaceous, sparsely branched shrub, 2–4 m (7–10 ft) tall, with persistent leaf scars on the gray trunk. Alternate leaves clustered at tips of shoots. Cordate leaves 40–50 cm (16–20 in) long, blades deeply divided into 3 to 5 segments with long hollow petioles. Cream-colored female flowers are produced singly in the axils of leaves. Yellow, distinctively 5-angled, slender fruits 25–35 cm (10–14 in) long with yellowish-white, juicy, slightly acidic flesh. Fruits are produced parthenocarpically, as no seeds are present in the fruit.

Origin and Distribution. Native to inter-Andean valleys of Ecuador and northern Peru, where the plant grows in subtropical mountain climates at between 1,500 and 3,000 m (5,000–10,000 ft) elevation. The babaco seems to be a natural hybrid of *Carica stipulata* and *C. pubescens* (p. 53). Cultivated in mountainous regions of the tropics or in subtropical climates without frost.

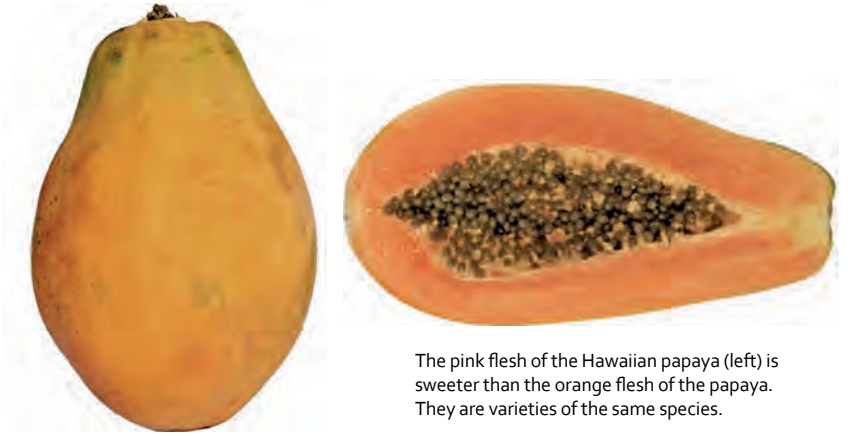
Food uses. Fully ripe fruits are eaten fresh and used in fruit salads or desserts. The flesh is commonly blended with ice, water, and sugar to prepare refreshing fruit drinks. Babacos are preserved in syrup or used for filling pies and cakes. In Ecuador, the fruits are cooked with sugar and spices such as cinnamon and served as a dessert called *dulce de babaco*, often accompanied by ice cream or whipped cream.

Comments. The plant is also known by the synonym *Vasconcellea* × *heilbornii*. The babaco is cultivated mainly in Ecuador and southern Colombia and to a lesser extent in Chile, Australia, and New Zealand. Since the plant does not produce seeds, it is propagated through cuttings.

Carica papaya L.

PAPAYA

Caricaceae (Papaya family)



The pink flesh of the Hawaiian papaya (left) is sweeter than the orange flesh of the papaya. They are varieties of the same species.

Description. Treelike, single-stemmed plant, softwooded, 5–10 m (16–32 ft) tall; trunk is conspicuously scarred where leaves have fallen off. Leaves are spirally arranged at the top of the trunk. Large, deeply palmate leaves 40–65 cm (16–26 in) long with 5–9 lobes and with petioles 35–100 cm (14–39 in) long. Stem, leaves, and unripe fruits contain milky latex. Dioecious, hermaphrodite or monoecious flowers are produced in axils of leaves. Flowers yellowish-green, with 5 waxy petals. Fruits melonlike, oval to round, orange-yellow to yellow, 15–50 cm (6–20 in) long with smooth skin. Soft flesh orange, juicy, and sweet, sometimes with a musky flavor. The central cavity contains numerous small round black seeds covered by a thin, gelatinous aril.

Origin and Distribution. The exact origin of the Papaya is unknown, as it was already commonly cultivated and traded in pre-Columbian times. Probably native to southern Mexico and Central America. Columbus reputedly called the papaya the "fruit of the angels." Very early Spanish and Portuguese sailors took seeds to their colonies in Africa and tropical Asia. Around 1550, papayas were already growing in the Philippines. Today papayas are cultivated as dooryard plants or in plantations all over the tropics.

Food uses. Ripe papayas are usually eaten fresh, often sprinkled with lime juice and sugar. They are a common ingredient in fruit salads or made into a delicious fruit drink by blending the flesh with water, ice, and sugar. The ripe flesh is frequently made into a sauce served with desserts and ice cream. Papayas are sometimes used in the preparation of savory seafood and meat dishes.

Unripe, green fruits are normally boiled before consumption because they contain latex. Cooked, they are often served as a vegetable side dish in curries or used in soups and stews. Green papayas are especially popular in Thai cuisine. Young leaves and male flowers are cooked and eaten as a leaf vegetable in Asia. The black, edible seeds have a spicy taste and are sometimes used as a substitute for black pepper.

Comments. Besides being rich in fiber, papayas are a very good source of vitamins A, C, and E, folate, pantothenic acid, and the minerals potassium and magnesium. They also contain the proteolytic enzyme papain, which can break down protein. It has been used as a meat tenderizer for millennia. It is also used to treat digestive problems, injuries, and allergies.

The top papaya producer in the world is Brazil, followed by Nigeria, India, and Mexico.

Carica pubescens Lenné & K. Koch

MOUNTAIN PAPAYA

Caricaceae (Papaya family)

Mountain papayas are a very good source of vitamin C.

Description. Evergreen softwood tree, sparsely branched, 3–5 m (10–16 ft) tall. Alternate leaves are concentrated at the tips of the plant and the branches. Cordate leaves deeply palmately lobed. Blades 40–50 cm (16–20 in) wide with petioles 30–40 cm (12–16 in) long. Male and female flowers on separate plants. Yellowish male flowers in panicles 10–15 cm (4–6 in) long. Yellowish-green female flowers, with 5 fleshy petals, are borne singly on short stalks. Obovoid, orange to yellow fruits, 6–16 cm (2.4–6 in) long, with 5 pronounced longitudinal lobes and a soft yellow to orange flesh. Fruits contain numerous round brown seeds. The plant and unripe fruits contain a milky latex.

Origin and Distribution. Native to the Andes of South America from Colombia south to central Chile. The plant grows naturally in inter-Andean valleys between 1,800 and 3,200 m (5,900–10,500 ft). Frequently cultivated as a dooryard tree within its natural range. Also grown in areas with a subtropical climate and in cool mountain climates of Southeast Asia and Africa. The tree can withstand light frosts.

Food uses. Fully ripe fruits have a slightly acidic and tart but aromatic taste and are eaten fresh, often sprinkled with sugar. They are made into juice or used for making marmalades or jellies. Fruits are also often stewed, sweetened, and served as dessert. Chunks of ripe fruit can be preserved in syrup. Unripe fruits are often boiled and consumed as a vegetable.

Comments. Mountain papayas are a very good source of vitamin C. Unripe fruits contain the proteolytic enzyme papain, which is used as a meat tenderizer and in medicine for treating wounds. The tree is also known by the synonyms *Carica candamarcensis* and *Vasconcellea pubescens*.

Carissa congesta Wight

KARANDA

Apocynaceae (Dogbane family)

Description. Sprawling or climbing evergreen shrub, 3–5 m (10–16 in) tall, with thorns up to 5 cm (2 in) long in the axils of leaves. Leaves opposite, oval to elliptic, 3–8 cm (1.2–3 in) long, leathery, dark green and glossy. Fragrant flowers white, often with a pink tubular base and 5 twisted petals. Fruits ovate to round, 1–3 cm (0.4–1.2 in) long, in clusters of 3–10 with purple-red to purple skin. Pulp red or pink, subacid to sweet, juicy with 2–8 small seeds. All plant parts contain sticky white latex.

Origin and Distribution. The karanda grows naturally in a region ranging from India, Sri Lanka, Bangladesh, and Myanmar to Malaysia. The fruit is cultivated throughout Southeast Asia and some parts of Africa. It is very uncommon in tropical and subtropical America.

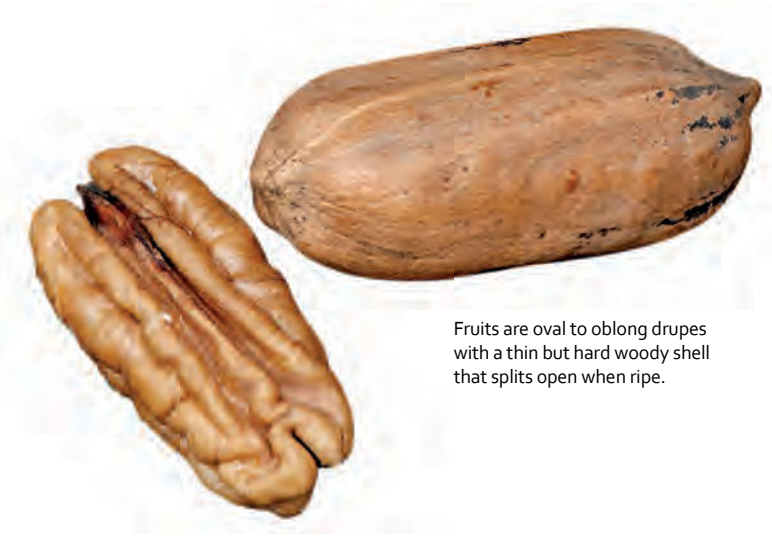
Food uses. Fruits are eaten raw or sprinkled with sugar to reduce acidity. Ripe karandas are boiled to get rid of the latex and obtain the juice, which is used to make refreshing beverages. Ripe fruits are rich in pectin and therefore used to make jellies and jams. Sweet varieties are used as fillings for tarts or in desserts and puddings. Underripe fruits are made into chutneys and are used as a vegetable in Asian curries. Green fruits are pickled in India.

Comments. With its showy flowers, the karanda is often planted as an ornamental or trimmed into a hedge. The plant's heavily branched root system makes it suitable for erosion prevention on slopes. Fruits are rich in iron and contain fair amounts of vitamin C. The unripe fruits are astringent and used in some regions to treat diarrhea. The plant is also known by the synonym *C. carandas*.

Carya illinoinensis (Wangenh.) K. Koch

PECAN NUT

Juglandaceae (Walnut family)



Fruits are oval to oblong drupes with a thin but hard woody shell that splits open when ripe.

Description. Large deciduous tree, 30–45 m (100–150 ft) tall. Alternate compound leaves with 9–17 leaflets, each 6–13 cm (2.4–5 in) long. Flowers monoecious with small male flowers in pendulous catkins. Inconspicuous female flowers are clustered in groups of 4–6. Fruits are oval to oblong drupes with a thin but hard woody shell that splits open when ripe. The walnutlike seed is irregularly formed, 3–6 cm (1.2–2.4 in) long, and brown.

Origin and Distribution. Native to northwestern Mexico and southern and central United States north to Illinois and Iowa. The seeds were commonly consumed by indigenous tribes of North America in precolonial times. Today the tree is widely cultivated in subtropical regions of South America, Africa, Israel, China, and Australia. It requires warm, humid summers but can withstand cold winters with frost.

Food uses. The seeds are consumed raw as snacks or used in bakery goods and sweets and as garnish on desserts. They are also used in savory dishes. A traditional recipe of the southern United States is pecan pie, made from corn syrup and pecan nuts.

Comments. Pecan nuts are very nutritious as they are high in protein and unsaturated fats as well as the minerals manganese, magnesium, phosphorous, and zinc. The United States is the largest producer of pecan nuts, providing 80–90% of world production. Pecan trees are very long lived and produce a valuable timber for use in furniture making and construction.

Casearia decandra Jacq.

WILD HONEY TREE, GUAÇATUMBA

Flacourtiaceae (Flacourtia family)

When fruiting, the wild honey tree is an important food source for a wide variety of frugivorous birds.

Description. Small, bushy, evergreen tree, 4–6 m (13–20 ft) tall. Alternate, simple, elliptic leaves 4–8 cm (1.5–3 in) long with finely toothed margins and slightly pubescent blades. Small white or cream-colored hermaphroditic flowers are borne in almost sessile clusters in the axils of leaves. Fruits are cream-colored, spherical capsules measuring 0.7–1 cm (0.3–0.4 in) in diameter with soft orange-red pulp and 1–4 whitish seeds.

Origin and Distribution. Native to tropical regions from the West Indies and Honduras in Central America south to Bolivia, Paraguay, and northern Argentina. Occasionally cultivated but generally rare outside its natural range. The tree requires a tropical or warm subtropical climate without frosts.

Food uses. Ripe, sweet fruits are usually eaten out of hand. The fruit is rarely seen in markets but mainly picked off the tree and consumed fresh.

Comments. Guaçatumba trees are occasionally planted in tropical gardens to attract wildlife. When in flower, they provide nectar for many different insect species, including honey bees and butterflies. In fruit, they are an important food source for a wide variety of frugivorous birds; this is a valuable tree for supporting insect and bird diversity. The hard wood is sometimes used for fence posts.

Casimiroa edulis La Llave & Lex.

WHITE SAPOTE

Rutaceae (Citrus family)

Ripe fruits of superior varieties have a sweet, delicious pulp with an avocado-like consistency.

Description. Small to medium-sized evergreen tree, 6–15 m (20–50 ft) tall. Alternate leaves palmately compound with 3–7 leaflets that are glabrous, lanceolate, 5–12 cm (2–5 in) long by 3–5 cm (1.2–2 in) wide. Small greenish-yellow flowers are produced in axillary or terminal panicles. Globose fruits greenish to pale yellow, 5–10 cm (2–4 in) wide, smooth skinned, ovoid or asymmetrically shaped. Soft whitish to yellow pulp with 1–6 hard white seeds. Depending on variety, the flavor of the fruit ranges from rather bland or even bitter to sweet and aromatic.

Origin and Distribution. Native from southeastern Mexico south to Costa Rica. The tree grows naturally in humid montane forests between 800 and 2,500 m (2,600–8,200 ft). Occasionally cultivated in its natural range, rarely elsewhere.

Food uses. Ripe fruits of superior varieties have a sweet, delicious pulp with an avocado-like consistency and are usually eaten out of hand. The pulp is also made into marmalades, desserts, ice cream, and milk shakes. In parts of Central America, a fermented winelike drink is prepared from the fruits.

Comments. The genus is named after Casimiro Gómez de Ortega (1741–1818), director of the Royal Botanical Garden of Madrid under the rule of George III of Spain. The word *tzapotl*, meaning soft, sweet fruit in the Nahuatl language, was loosely applied to a large variety of unrelated fruits. This has led to some confusion, as several fruit trees belonging to different, not even closely related families, including Sapotaceae, Rutaceae, and Ebenaceae, all bear the common English name sapote.

The poisonous seeds contain glycosides, which exhibit medicinal properties. They have been used in traditional medicine to lower blood pressure and as a sedative.

Cassia grandis L.

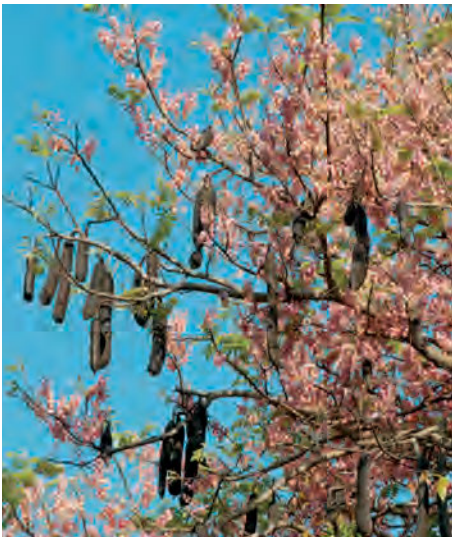
PINK SHOWER TREE, CARAO

Fabaceae (Bean family)

Description. Medium-sized deciduous tree, 15–25 m (50–82 ft) tall. Alternate, compound leaves with 10–20 pairs of elliptic to oblong leaflets, each 3–6 cm (1.2–2.4 in) long by 1.5–2.5 cm (0.6–1 in) wide. Reddish-pink flowers in lateral racemes 10–20 cm (4–8 in) long. Dark brown, cylindrical, straight or slightly curved pendent fruits 30–60 cm (12–24 in) long with tough, woody, rugose exocarp and numerous brown seeds, embedded in compartments filled with a thick, sticky, dark red pulp.

Origin and Distribution. Native from southern Mexico to Venezuela, Ecuador, and Brazil. The tree grows naturally in humid lowland forests, especially those that are seasonally dry. Often grown as a showy ornamental.

Food uses. The pulp, which has an interesting flavor reminiscent of carob (*Ceratonia siliqua*) or of a mix of chocolate and cherries, is used in Latin America to make fruit drinks. The pulp is boiled with water or milk and then chilled and sweetened with sugar. It is often served to young children.



Comments. The nutritious pulp of the carao is commonly used in traditional Latin American medicine to treat anemia and as an aphrodisiac. The seeds are used as a laxative. Powdered pulp is often sold in local markets of Central and South America. The fruit is currently being researched for medicinal properties.

The pulp has a flavor reminiscent of carob (*Ceratonia siliqua*) or of a mix of chocolate and cherries.

Chenopodium quinoa Willd.

QUINOA

Chenopodiaceae (Goosefoot family)

Description: Erect, sparsely branched herb, 1–2 m (3–6 ft) tall. Lobed leaves alternate, ovate, with long petioles and a pointed apex. Tiny flowers are produced in apical, spikelike, strikingly purple, yellow, or reddish inflorescences. Fruits are drupes 1.5–2.5 mm (0.06–0.1 in) across. Seeds are harvested after a four-month growing season.

Origin and Distribution: Native to the Andes of South America from Colombia south to Argentina and Chile. Grown mainly in mountains between 2,500 and 3,800 m (8,000–12,500 ft) altitude. The plant has been cultivated in its native habitat for at least 6,000 years and is still of major importance as a staple food crop in the region, although at lower altitudes it has been largely replaced by barley and wheat.

Food uses: The boiled or roasted seeds have a mild flavor and firm texture similar to that of brown rice and are a traditional, ubiquitous ingredient in soups and stews throughout the Andes. Flour made from quinoa is used to make bread, cookies, tortillas, and desserts. The seeds are fermented to produce a beerlike alcoholic beverage called *chicha*. The baked ash (called *llipta* in Quechua) made from burned stalks and dry leaves is chewed together with coca leaves to enhance the stimulating effect of the drug. Today quinoa is gaining inportance as an ingredient in cereals and granola bars. Untreated quinoa contains toxic saponins, which are removed by processing and washing before consumption.

Comments: The Incas considered quinoa a sacred food and called it the "mother of seeds." The seeds are very rich in high-quality protein containing all nine essential amino acids. They are also high in minerals like calcium, magnesium, and iron as well as vitamins and fatty acids like omegas 3, 6, and 9. During Spanish colonial rule, the cultivation of quinoa was prohibited and punished by death sentence. The intent of the ruling was to eradicate local customs, weaken the indigenous tribes, and establish wheat and barley as new crops. Because of its high nutritional value, quinoa is now quickly gaining importance in Andean countries like Bolivia and Peru as an export crop.

Chrysobalanus icaco L.

COCO PLUM, ICACO

Chrysobalanaceae (Chrysobalanus family)

Description. Low growing, sprawling, evergreen shrub that usually does not grow taller than 1.5 m (5 ft), although it occasionally grows into a small tree reaching a maximum height of 5 m (16 ft). Leaves alternate, leathery, broad-oval to round, 4–10 cm (1.6–4 in) long and 3–6 cm (1.2–2.4 in) wide. Young leaves have a coppery color. Flowers small and white, in axillary racemes. Fruits globular to ovoid, 3–5 cm (1.2–2 in) long, with pale yellow, pink, or dark purple skin and one single, ridged seed.

Origin and Distribution. Native to coastal regions of tropical America. The plant may also be indigenous to the coasts of western Africa. It grows naturally in coastal swamps and along beaches. The coco plum has been introduced and naturalized in coastal areas of many tropical countries. On some islands like Fiji and French Polynesia the plant has become invasive and poses a threat to native ecosystems.

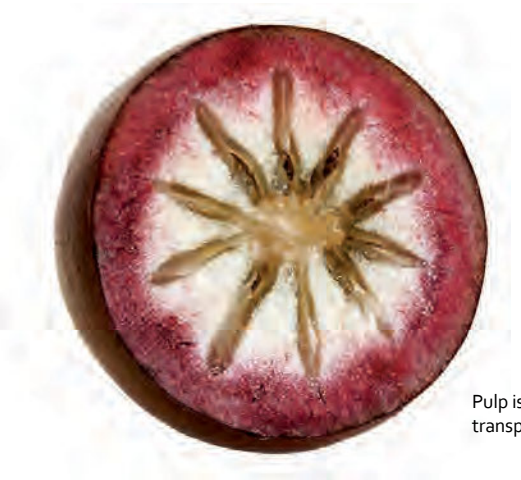
Food uses. The sweet fresh fruits, although somewhat insipid, are eaten out of hand. They do sometimes cause an astringent taste in the mouth. The fruits are commonly stewed with sugar or made into jam. They were one of the most important fruits used by early European settlers in coastal areas of Florida. In Cuba the boiled fruits are made into a sweet preserve and eaten as dessert. The seeds can be roasted as nuts.

Comments. This salt-tolerant shrub is frequently grown as an ornamental or trimmed to a hedge. It is also planted along beaches to prevent soil erosion.

Chrysophyllum cainito L.

STAR APPLE

Sapotaceae (Sapodilla family)



Pulp is soft, gelatinous, purple or transparent, with multiple seed cells.

Description. Evergreen tree with a dense, rounded crown, 20–30 m (65–100 ft) tall. All parts of the tree contain a sticky white latex. Leaves alternate, leathery, elliptic, 8–16 cm (3–6 in) long, upper surface glossy with yellowish-golden pubescent hairs on the lower surface. Branchlets are densely pubescent. Small, sweetly fragrant, yellowish-white to purplish-white flowers are borne in small clusters in the axils of leaves. Fruits round, 8–10 cm (3–4 in) in diameter, with purple, reddish, or purplish-green skin. Pulp soft, gelatinous, purple, or transparent, with multiple seed cells. Fruit, when cut in half, resembles a multipointed star; contains up to 10 flattened, dark brown seeds.

Origin and Distribution. The tree is native to the West Indies but has been naturalized in Central and South America. It was recorded by Spanish historian Cieza de León growing in Peru as early as 1550. The tree was introduced to Asia in the seventeenth and eighteenth centuries. Today the star apple is grown to some extent for its fruits and for its ornamental value in Africa and Asia, especially in India and the Philippines.

Food uses. The fruit is eaten fresh by cutting it in half and scooping out the pulp. The bitter rind contains latex and is inedible. In Jamaica, the flesh is mixed with orange juice, sugar, nutmeg, and sherry. The pulp is also blended with condensed milk and sour orange juice to form a dessert called "matrimony." In the Philippines, the star apple flesh is used in a popular dessert called *halo-halo*, containing shaved ice, milk, beans, coconut and various other fruits.

Comments. The genus *Chrysophyllum* consists of 70–80 species distributed mainly in tropical America. The tree plays an important role in folk medicine. Because of its high tannin content, a decoction of the bark is used as a stimulant and to treat diarrhea and dysentry. The valuable, reddish wood is used to make furniture.

Citrofortunella microcarpa (Bunge) Wijnands

CALAMONDIN, CALAMANSI

Rutaceae (Citrus family)

Description. Small, slender evergreen tree 3–8 m (10–26 ft) tall. Simple leaves alternate, oval, 4–8 cm (1.6–3.2 in) long with winged petioles. Flowers white, very fragrant, 2.5 cm (1 in) wide, borne singly or in small groups in axils of leaves at tips of branches. Aromatic fruits 3–4.5 cm (1.2–1.8 in) in diameter with glossy, orange, very thin skin dotted with conspicuous oil glands. Pulp divided into 5–10 segments, very juicy, aromatic, and sour.

Origin and Distribution. The calamondin probably originated in southern China, from where it spread very early to Indonesia, the Philippines, and India. The tree is commonly grown as an ornamental and as a fruit tree throughout the tropics and subtropics. The calamondin, which is unknown in the wild, is believed to be a cross between the Mandarin orange (*C. reticulata*, p. 74) and the kumquat (*Fortunella* spp., p. 109).

Food uses. The juice of the calamondin is used similar to lime juice in refreshing drinks and to season salad dressings and fish dishes. It is also used to flavor desserts, ice cream, and sweet pies. The juice can be frozen and used as ice cubes in iced tea or cocktails. calamondin juice is used as a natural tenderizer in beef and pork marinades.

The fruits, often mixed with kumquats, are used to make marmalade. In Malaysia, a chutney is prepared from calamondin fruits together with green mango, vegetables, and spices. In the Philippines, calamondins are very popular as a sour ingredient in a variety of fish, pork, and chicken dishes.

Comments. The frost-sensitive calamondin is known outside the tropics mainly as a potted indoor ornamental. The fruits are a good source of vitamin C. In Asia, calamondin juice is taken as a remedy for coughing and rubbed on the skin to relieve itching insect bites.

Citrullus lanatus (Thunb.) Matsum. & Nakai

WATERMELON

Cucurbitaceae (Cucumber family)

Description. Annual, herbaceous, creeping vine with curly tendrils growing 8–12 m (26–39 ft) in length. Alternate, hairy, deeply palmate leaves with 3–7 pronounced lobes, 10–20 cm (4–8 in) long and wide. Solitary, monoecious, yellow to pale green tubular flowers are borne in leaf axils. Spherical to ovoid fruits measure 20–30 cm (8–12 in) in diameter in wild varieties and up to 60 cm in cultivated forms. Rind smooth, dark green to yellowish-green with light green stripes or dots. Red, orange, yellow, or even white flesh very juicy, sweet, crisp with numerous or few edible brown or black seeds.

Origin and Distribution. Native to semiarid and arid regions of southern Africa. Watermelons are cultivated in tropical and subtropical regions with semiarid or seasonally dry climates. The watermelon is thought to have been domesticated at least 4,000 years ago, and the plant was grown as a crop in the Nile Valley in ancient Egypt. It is believed that watermelon seeds reached the Americas during the slave trade in the seventeenth century.

Food uses. The rind of ripe fruits is commonly pickled, stewed, or stir-fried in Southeast Asia and served with savory dishes. The seeds are eaten as a snack after roasting and salting. Immature fruits and leaves are boiled and eaten as vegetables. The peel of the fruit is traditionally used to make jam. In southern Africa, the seeds are roasted and ground into a flour locally called *tsamma*, a nutritious food with a nutty taste. Watermelons were a traditional source of water and food for inhabitants of the Kalahari Desert.

Comments. There are more than 1,000 varieties of watermelon. The fruits contain about 92% water and 6% carbohydrate and are a good source of vitamin C and beta carotene.

Citrus aurantiifolia (Christm.) Swingle

MEXICAN LIME, KEY LIME

Rutaceae (Citrus family)

Description. Small, bushy, evergreen tree, 3-5 m (10–16 ft) tall, with dense foliage and sharp spines on branches and trunk. Leaves dark green, leathery, aromatic when crushed, elliptic to ovate, 5–7 cm (2–2.75 in) long, with a minutely serrated edge and a winged petiole. Flowers first pinkish then white, singly or in small racemes, 2–2.5 cm (0.8–1 in) in diameter with 4–6 petals and yellow anthers. Fruits globose, sometimes slightly pointed at apex, light green turning pale yellow when fully ripe. Pulp greenish-yellow, aromatic, juicy, and very acidic, usually with several small white seeds.

Origin and Distribution. Native to Indomalayan region. The plant, which was virtually unknown in Europe prior to 1300, was probably carried by Crusaders from the Middle East through North Africa to the Mediterranean and Western Europe. In the sixteenth century, seeds were taken by Spaniards and Portuguese sailors to their colonies in the Americas. Lime trees were reportedly growing in Haiti around 1520. The Mexican lime, which thrives in humid, warm climates, is grown in most tropical and some subtropical countries around the world.

Food uses. Lime juice is used to flavor fruit juices and to prepare alcoholic drinks such as *caipirinha*, a well-known Brazilian cocktail made from cane sugar, lime juice, cane liquor, and crushed ice. Wedges of lime and the flavorful juice are used to garnish and season a great variety of fish and seafood dishes. The juice is often employed instead of vinegar in the preparation of salad dressings and sauces.

In Central and South America, lime juice is used to marinate diced fish filets to prepare a popular dish called *ceviche*. In India, green fruits are pickled, and in Malaysia they are preserved in syrup. Lime juice is boiled with sugar to form a syrup used in pie and cake fillings. Limes are a common ingredient in Thai, Mexican, and Vietnamese dishes. The oil obtained from the peel is used to flavor candies, soft drinks, ice cream, and many other food products. It is also utilized in the perfume industry and in a variety of other cosmetic products.

Comments. Limes were issued to British sailors in the nineteenth century to prevent scurvy caused by a lack of vitamin C during long voyages. This led to the common nickname of "limey" for British sailors.

Citrus aurantium L.

SOUR ORANGE, BITTER ORANGE

Rutaceae (Citrus family)

Description. Small tree with long spines on branches and trunk, 5–10 m (16–32 ft) tall. Alternate leaves simple, blade elliptic with broad-winged petioles. White, very fragrant flowers with 5 petals, borne singly or in small clusters in axils of leaves. Orange fruits round or oblate, 7–9 cm (2.75–3.5 in) wide with rough, bitter-tasting peel. The very acidic, juicy pulp is divided into 8–10 segments with numerous seeds.

Origin and Distribution. Native to southeastern Asia. Early sailors spread this useful tree throughout tropical Asia and the southern Pacific islands. It was reportedly grown in Italy around 1000 AD and was the first orange variety to reach the New World, around 1570, when it was grown in the Spanish colonies of Mexico and later introduced into St. Augustine in Florida. Today the sour orange is grown in many tropical and subtropical countries around the world.

Food uses. The very sour juice is diluted and sweetened to prepare refreshing drinks similar to lemonade. The juice is often used instead of lime juice or vinegar in salad dressings and seafood dishes. In Central America and the Caribbean islands, it is used to marinate meat. In India, the unripe, pickled fruits are eaten as a side dish with curd rice (*thayir sadam*).

Bitter orange is famous as a main ingredient in orange marmalade. An oil (bitter orange oil) extracted from the dried peel is used to flavor sweets, ice cream, soft drinks, chewing gum, and liqueurs such as, for example, Cointreau and Curaçao. An essential oil extracted from the fragrant flowers, called Neroli oil, is also employed in the production of sweets, drinks, and baked goods.

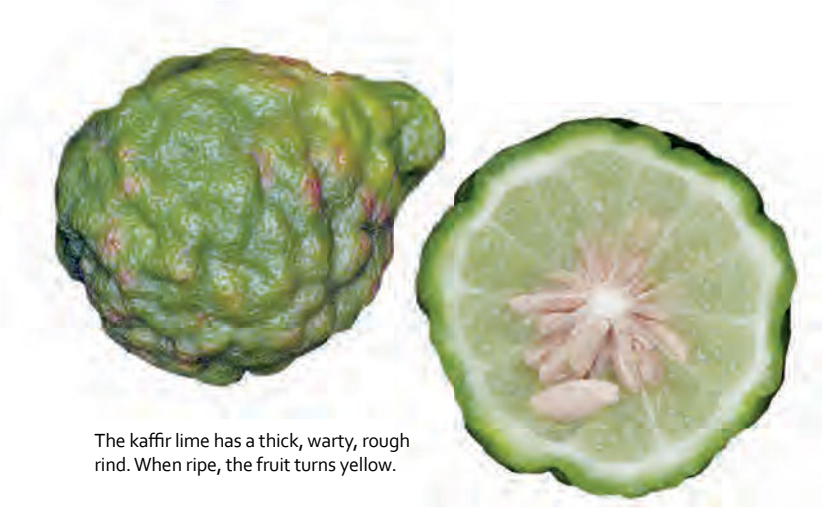
The exterior of the fruit varies widely, from smooth to rugose, from green to orange to yellow.

Comments. The peel of the bergamot orange (*C.* × *bergamia*) produces bergamot oil, an important ingredient in many perfumes and a flavoring in teas such as Earl Grey. Sour oranges are very hardy plants, relatively free of disease, and therefore cultivated as a rootstock for many other *Citrus* species. Extracts from the peel, which are thought to suppress the appetite, have been used in weight-loss products as a substitute for ephedra. Although used in ancient Chinese medicine, their effectiveness as an aid for weight loss is controversial.

Citrus hystrix DC.

KAFFIR LIME

Rutaceae (Citrus family)



The kaffir lime has a thick, warty, rough rind. When ripe, the fruit turns yellow.

Description. Evergreen shrub or small tree, 4–8 m (13–26 ft) tall and with many sharp spines. Alternate, obovate, strongly aromatic leaves with very broadly winged and leaflike, elliptic petioles, giving it a distinctive double-leaf look. Flowers white, hermaphroditic, with 5 petals. Almost spherical fruits 3–5 cm (1.2–2 in) in diameter, green turning yellow when ripe, with a thick, warty, rough rind. Segmented, juicy pulp with several whitish seeds and very acidic taste.

Origin and Distribution. Native to Southeast Asia, where the plant is widely grown in plantations and as a dooryard tree. This species requires a humid tropical or warm subtropical climate. Cultivated worldwide in the tropics and subtropics as a fruit tree or as a potted plant.

Food uses. The very sour juice of green fruits is used in Southeast Asia to add zest to drinks, desserts, ice cream, and also seafood dishes. In Southeast Asia the very fragrant, lime-scented leaves are widely used as a culinary spice to lend a characteristic flavor to savory and often spicy dishes like the famous *tom yam* soup of Thailand. The leaves are commonly combined with garlic, galangal, ginger, and chili to spice up stir-fries and Thai curries. Leaves and juice are employed together with several other spices to produce the typical Laotian and Cambodian vegetable paste called *krueng*, similar to Thai curry paste. In Indonesia, the leaves form an essential part of a dish called *sayur asam*, a popular meat and vegetable dish served with tamarind sauce. The oil of the fruit rind is used to flavor liqueurs and rum.

Comments. Leaves and fruit rind are used in parts of Southeast Asia in traditional herbal medicine. The oil of the rind has insecticidal properties.

Citrus × *latifolia* Tanaka ex. Q. Jiménez

PERSIAN LIME, TAHITI LIME

Rutaceae (Citrus family)

Description. Evergreen tree with spreading branches, 4–6 m (13–20 ft) tall. Leaves alternate, lanceolate to elliptic with winged petioles. Flowers white with a tinge of pink. Fruits oval to oblong, 5–8 cm (2–3 in) long with rounded bases and a pointed apex. Smooth skin green but becoming pale yellow when fully ripe. Pulp greenish-yellow, fairly aromatic, not very juicy, usually without seeds.

Origin and Distribution. The origin of the Persian lime is unknown, although it may come from the Middle East. It is thought to be a hybrid of the key lime (*C. aurantiifolia*, p. 64) and either the citron (*C. medica*, p. 72) or the lemon (*C. limon*, p. 69). The lime is grown in tropical and in subtropical regions.

Food uses. The fruits of the Persian lime are less aromatic and less sour than the key lime but are used in much the same way in drinks, salad dressings, and numerous other foods. Slices of Persian lime are often used to decorate a variety of dishes and cocktails.

Comments. The Persian lime is often preferred by producers because the tree is almost thornless and hardier, produces larger, seedless fruits, and has a longer shelf life than the key lime. The main producers of Persian limes are the United States, Mexico, and Brazil.

Citrus limettioides Tanaka

SWEET LIME

Rutaceae (Citrus family)

Description. Evergreen tree, 5–8 m (16–26 ft) tall, with drooping branches covered in long, sharp spines. Alternate, oval leaves aromatic when crushed, dark green, leathery, with serrated margins and narrowly winged petioles. Purple-tinged white flowers single or in small clusters, with 4–6 spreading petals. Fruits oval, obovate, or round, apex with short nipple, 6–7 cm (2.4–2.75 in) in diameter, yellow to yellowish-green when ripe with sweet, juicy flesh.

Origin and Distribution. The exact origin of the sweet lime is unknown. Some botanists believe the plant is a natural hybrid between a Mexican lime (*C. aurantiifolia*, p. 64) and a sweet variety of the lemon (*C. limon*) that may have originated in India. The fruit was introduced to Mediterranean Europe by Arab traders between 1000 and 1200 BC and brought to the Americas in the sixteenth or seventeenth century by Spanish and Portuguese explorers. Today the sweet lime is cultivated in many tropical and subtropical countries, often as a dooryard or ornamental tree.

Food uses. The sweet lime is a less well-known member of the *Citrus* genus. The fruits are usually eaten fresh like an orange or made into juice. The fruit is also suited for making jellies and marmalade. In India, it is sometimes made into preserves. In Spain, the sweet lime is eaten as dessert.

Comments. The fruits are high in vitamin C. They are used in traditional medicine to treat fever and colds. The rind contains the essential oils limonene and pinene, among others. The oil is sometimes used for flavoring drinks and food items. The sweet lime is very often confused with the sweet lemon (*C. limetta*).

Citrus limon (L.) Osbeck

LEMON

Rutaceae (Citrus family)

Description. Small evergreen tree reaching 3–7 m (10–23 ft) in height. Branches bear sharp, stiff thorns. Alternate, dark green, elliptic leaves with finely toothed margins. Crushed leaves produce an intense lemonlike scent. Purplish-white flowers are produced singly or in small clusters in axils of leaves. Round to oval fruits with a nipplelike apex and thick, bright yellow rind. The juicy, very acidic pulp is divided into 8–10 segments with or without seeds depending on variety.

Origin and Distribution. Its exact origin is unknown, but it is widely believed that the lemon is native to northeastern India and probably also to Myanmar and southern China. Arabs distributed the fruit in the Mediterranean region, where the trees were first used as ornamentals in Islamic gardens. Columbus reportedly brought lemon seeds to the Americas, where they were first planted in Hispaniola in 1493. In the eighteenth century, lemons were employed to treat scurvy in British sailors.

This fruit tree is cultivated throughout the subtropics and mountainous areas of the tropics.

Food uses. Lemon slices are used to garnish salads and seafood dishes, and the juice adds zest to countless other dishes around the world. Lemon juice is an important ingredient in marinades, ice cream, sherbets, bakery goods, soft drinks, desserts, and candy. The aromatic rind is used as garnish and flavoring for cakes, puddings, liqueurs, and rice dishes. The peel is sometimes candied or made into marmalades. Pickled lemons are a common feature in Moroccan meat dishes.

Comments. Lemons are employed in a variety of nonculinary uses like aromatherapy and as a cleaner and deodorizer in household uses. In 2007, India and Mexico, followed by Argentina, were the leading world producers of lemons. Some of the commercially important varieties are 'Eureka', 'Lisbon', and 'Ponderosa'. Ripe fruits contain 50–60 mg (0.0017–0.002 oz) vitamin C per 100 g (0.22 lbs) fruit.

Citrus × *limonia* (L.) Osbeck

MANDARIN LIME, RANGPUR LIME

Rutaceae (Citrus family)

Ripe fruits turn from green to deep orange.

Description. Small evergreen citrus tree with sharp, axillary spines, 5–7 m (16–23 ft) tall. Leaves alternate, aromatic, ovate or elliptic, 5–7 cm (2–2.75 in) long and with small, rounded teeth. Flowers white, often purple-tinged, slightly fragrant, borne singly or in small clusters. Fruits round to obovate with irregular surface. Ripe fruits turn from green to deep orange. Peel dotted with oil glands. Orange pulp very juicy with an exceedingly sour, mandarin-like aroma.

Origin and Distribution. The Mandarin lime, unknown in the wild, is thought to be a hybrid between Mandarin orange (*C. reticulata*, p. 74) and lemon (*C. limon*, p. 69) that probably originated in northern India. It is grown as a dooryard fruit tree in many tropical countries, but it is in general less popular than the Mexican lime (*C. aurantiifolia*, p. 64). It is more tolerant of cold than the Mexican lime, however, and can be grown in some subtropical regions such as those found in California.

Food uses. The juice of Mandarin limes is used very much like lime juice to prepare "lemonades" and to flavor cold drinks. It is a common ingredient in marinades for salads and various meat and fish dishes. The fruit is prized and considered superior to the sour orange for making marmalade. In Central America, the sour juice of the Mandarin lime is employed in *ceviche*, a dish consisting of diced fish filets marinated in lime juice for several hours with onion, bell pepper, salt, and cilantro. Mandarin limes and salt are used to season green, unripe mango slices, which are sold as snacks by street vendors in Latin America.

Comments. Although not as well known as the Mexican lime, the Mandarin lime deserves attention for its exquisite aroma. Two very similar varieties of the Mandarin lime exist: the Kusiae lime, which produces yellow, oval to round fruits with a very limelike aroma, and the Otaheite Rangpur, a nonacid form of unknown origin.

Citrus maxima (Burm.) Merr.

POMELO, PUMMELO

Rutaceae (Citrus family)

The pulp of the fruit is pale yellow to pink.

Description. Evergreen tree with long, stiff spines on branches and trunk, 6–14 m (20–46 ft) tall. Alternate, leathery leaves ovate to elliptic, 8–20 cm (3–8 in) long with broadly winged petiole. Fragrant white flowers are borne singly or in small clusters in axils of leaves. Fruits globose, oblate, or pyriform, 10–30 cm (4–12 in) in diameter with a thick, fragrant, yellow to greenish-yellow rind. Juicy, subacid to sweet, pale yellow to pink pulp divided into 10–18 segments. Fruits contain from few to several whitish seeds.

Origin and Distribution. Native to Southeast Asia. The pomelo was first referred to in Chinese literature around 2200 BC. By the end of the seventeenth century, trees were already being cultivated in Barbados and Jamaica. Today the pomelo is grown throughout the tropics and warm subtropical regions.

Food uses. Ripe fruits, which taste like a sweet grapefruit without the bitterness, are eaten fresh. Pieces of segments can be added to fruit salads or desserts. In the Philippines, pieces of fruit are dipped in salt before being eaten. In Assam, India, fruit segments are eaten with salt and hot chili peppers. The fruit produces a delicious juice. The peel is sometimes used to make marmalade or is candied or dipped in chocolate. It is also used in Chinese cooking, especially in a Cantonese sweet soup called *tong sui*. Oils derived from the peel are used industrially as a bitter aroma for sweets, ice cream, and bakery goods. The seeds provide an edible oil of high quality for human consumption.

Comments. The pomelo is the largest of all citrus fruits, reaching a weight of 1–2 kg (2.2–4.4 lbs). In parts of Malaysia, these large fruits are used as decorations on altars. In various parts of Asia, the fruit plays an important part in religious ceremonies and rituals. Pomelos are a good source of vitamin C and fiber.

Citrus medica L.

CITRON, FINGERED CITRON

Rutaceae (Citrus family)

The citron rind (left) is smooth or rough, while the rind of the variety fingered citron (right) shows ridges.

Description. Evergreen shrub or small tree 3–5 m (10–16 ft) tall, with long, stiff spines in axils of leaves. Alternate leaves ovate to elliptic, 10–16 cm (4–6 in) long with short, almost wingless petioles. Fragrant white or whitish-purple flowers are borne in small clusters. Yellow fruits highly variable in form and size, usually ovoid, 10–24 cm (4–9 in) long. Aromatic rind smooth or rough. Segmented pulp rather dry, pale yellow, fairly sweet. Contains numerous white seeds. One well-known variety, called the fingered citron or Buddha's hand, often produces split fruits with fingerlike protrusions.

Origin and Distribution. The exact origin of this plant is unknown. Probably native to Iraq, Iran, or possibly India. Seeds were found in excavations in Mesopotamia (today's Iraq) dating back to 4000 BC. Some authors also suggest a Southeast Asian origin. The citron was known in the Mediterranean region before 300 BC. In the sixteenth century, seeds were brought to the Americas by Spanish sailors. Today the tree is cultivated in tropical and subtropical regions around the world. The citron prefers a warm subtropical or tropical mountain climate with no frost.

Food uses. The fragrant but not bitter-tasting rind of the citron is used for making jams. The candied peel, called *succade*, is widely used in bakery goods like cakes, raisin bread, buns, and puddings. Pieces of candied peel are often coated with chocolate and eaten as a confection. In India and parts of Southeast Asia, the peel and pickled chunks of the fruit are eaten with rice. Pieces of the variety called fingered citron are used in rice dishes and curries in Southeast Asia. The sweetened juice is used to make lemonade. In Korea, the peel is used for making tea.

Comments. Essential oils from the peel and the flowers are used in the perfume and scent industry. In ancient times it was believed citron juice with wine was an effective antidote to poison. The highly fragrant fruits of the variety fingered citron (*C. medica* var. *sarcodactylis*) are often given as offerings on temple altars in China and other parts of Asia. In Israel, the citron is considered a Jewish symbol and used at religious festivities like the Feast of Tabernacles.

Citrus × *paradisi* Macfad.

GRAPEFRUIT

Rutaceae (Citrus family)

Grapefruits are a good source of vitamin C, the fiber pectin, and antioxidants.

Description. Evergreen, thorny tree reaching 6–10 m (20–33 ft). Ovate, alternate leaves 7–14 cm (2.8–5.5 in) long with slightly toothed margins. Hermaphroditic flowers, white with 4 petals, are borne singly or in small clusters in axils of leaves. Fruit round to oblate, 10–16 cm (4–6 in) in diameter, with smooth, greenish-yellow to yellow skin sometimes blushed with pink and dotted with oil glands. Very juicy, subacid to sweet pulp pale yellow, pink, or deep red, in 10–14 segments divided by bitter-tasting membranes. Fruits can be seedless or contain numerous white seeds.

Origin and Distribution. The grapefruit is a natural hybrid of the orange (*C. sinensis*, p. 75) and the pomelo (*C. maxima*, p. 71), both species of Asian origin. The tree was first described on the Caribbean island of Barbados by Rev. Griffith Hughes in 1750. He referred to it as "the forbidden fruit" of Barbados. In 1823, the first seeds were brought to Florida and from there the tree spread to almost all tropical and subtropical countries. Today the main producers of grapefruits are the United States, China, and South Africa.

Food uses. Grapefruits are commonly eaten fresh, cut in half, sprinkled with sugar, and the segments scooped out. The fruits produce an excellent juice that is sold fresh, bottled, or concentrated. The segments are used in fruit salads or for garnishing cakes and puddings. In Australia, marmalades and jellies are made from the pulp. Grapefruit juice can be made into gourmet vinegar.

In Costa Rica, emptied grapefruit halves are filled with pieces of cooked, sweetened pulp and condensed milk and served as a dessert called *toronja rellena*.

Comments. An aromatic oil that is extracted from the peel is used for flavoring soft drinks and sweets and also in aromatherapy. The bitter inner peel provides the flavanone glucoside naringin, which is used in the food industry to flavor bitter beverages, ice creams, and bitter chocolate. Grapefruit seeds contain en edible oil that consists mainly of unsaturated fats and tastes similar to olive oil.

Grapefruits are a good source of vitamin C, the fiber pectin, and antioxidants. This fruit is often promoted for weight loss in so-called grapefruit diets. It is believed to eliminate body fat because of its low glycemic index.

The grapefruit was called "shaddock" until the 1800s. Its current name refers to the grapelike clusters of round fruits on the tree.

Citrus reticulata Blanco

MANDARIN ORANGE

Rutaceae (Citrus family)

The Mandarin orange is native to tropical and subtropical regions of southeastern Asia, southern China, and the Philippines.

Description. Thorny evergreen tree with slender branches, 4–8 m (13–26 ft) tall. Lanceolate, alternate, dark green leaves with small rounded teeth along margins. White flowers are borne singly or in small clusters in the axils of leaves. Fruits oblate, orange, red-orange, or yellowish-green with a smooth or warty rind depending on variety. The peel is easily detached from the inner bright orange citrus segments, which are juicy and sweet. Fruits contain several seeds or none.

Origin and Distribution. The Mandarin orange is native to tropical and subtropical regions of southeastern Asia, southern China, and the Philippines. Mandarins were introduced into southern Europe at the beginning of the nineteenth century and to the Americas around 1840. The tree is widely grown throughout the tropics and parts of the subtropics as a dooryard tree or in commercial plantations.

Food uses. The fruits are commonly eaten out of hand or used in fruit salads and desserts. Fruit segments are often used to garnish ice cream, puddings, and cakes. Mandarin segments are sold as a canned product. They are also used in savory dishes like mixed salads, chicken salads, ham rolls, and Asian sweet-and-sour dishes. Fruits are made into juice and sweet sauces for desserts. The yellow-orange essential oil derived from the peel, which has an intensely sweet, citric aroma, is used for flavoring sweets, ice cream, pastries, chewing gum, liquors, and bakery products.

Comments. Mandarin oranges are a good source of vitamins C and A and minerals like calcium and brome. Mandarin oil is used in aromatherapy, therapeutic massage, and treatment of skin problems like acne. The essential oil is an important ingredient in the manufacture of perfumes, soap, and cosmetics. Different parts of the plant, including fruit, seeds, roots, and flowers, are used in traditional herbal medicine in China, Malaysia, and India.

By far, the largest world producer of Mandarins is China, followed by Spain, Brazil, and Japan. Mandarin cultivars are usually divided into three major classes: Satsuma, Clementine, and Mandarin. Clementines are the most important commercially.

In China, Mandarins are associated with good fortune and often seen in Chinese New Year celebrations, when they are given to friends and family members as a sign of prosperity.

Citrus sinensis (L.) Osbeck

ORANGE

Rutaceae (Citrus family)

The orange quickly gained popularity in Renaissance Europe, where it was cultivated by wealthy people in orangeries.

Description. Spiny evergreen tree, 6–14 m (20–46 ft) tall. Alternate, aromatic leaves elliptic to ovate, margins slightly toothed, 8–16 cm (3–6 in) long by 4–8 cm wide, petioles with or without wings. White, sweetly fragrant flowers are produced singly or in small clusters. Fruits are spherical to oblate, orange, yellow, or yellowish-green, 7–12 cm (2.75–5 in) in diameter. The orange, red, or yellow pulp is composed of numerous juice sacks grouped in 10–14 individual segments. Fruits are seedless or contain few to numerous whitish irregularly formed seeds.

Origin and Distribution. The species, which has been in cultivation for millennia, is unknown in the wild and probably native to a region ranging from northeastern India throughout Southeast Asia and north to southern China. It was carried to the Mediterranean region possibly by Italian traders after 1450 or by Portuguese navigators around 1500. Orange trees were planted along major trade routes to provide sailors with fresh fruits, essential for preventing scurvy caused by lack of vitamin C. The orange quickly gained popularity in Renaissance Europe, where it was cultivated by wealthy people in so-called orangeries. In the sixteenth century, the fruit was brought to the American continent by Spanish sailors. Today the plant is cultivated worldwide in tropical and subtropical regions.

Food uses. Oranges are usually eaten out of hand or made into juice. The fruit is used in the preparation of fruit salads, desserts, pie fillings, candies, and soft drinks. Orange slices are used to garnish salads and savory dishes.

Comments. The essential oil obtained from the peel is used as a flavoring agent in the production of candies, soft drinks, and other products in the food industry. Commercially, the orange is one of the most important fruits in the world. The main producers are Brazil and the United States, followed by India. Most fruits are exported in the form of frozen concentrate used in the production of orange juice. Many varieties exist. Two of the most important are 'Washington Naval' and 'Valencia', along with Blood Orange varieties like 'Sanguinello'.

Citrus × *tangelo* J.W. Ingram & H.E. Moore

TANGELO

Rutaceae (Citrus family)

Description. Small to medium-sized evergreen tree with rounded crown and dense foliage, 5–8 m (16–26 ft) tall. Alternate, dark green, ovate to lanceolate leaves 6–10 cm (2.4–4 in) long with small rounded teeth along the margins and minute oil glands. White flowers with 4 petals are borne singly or in small clusters in leaf axils. Deep orange, almost spherical fruits often with a pronounced neck at the base and loose peel, measure 6–12 cm (2.4–4.8 in) in diameter. The juicy orange pulp has a subacid to sweet, aromatic taste. Fruits contain a few whitish seeds or none at all.

Origin and Distribution. The tangelo is a hybrid of the Mandarin orange (*Citrus reticulata*, p. 74) and either the grapefruit (*Citrus* × *paradisi*, p. 73) or the pomelo (*Citrus maxima*, p. 71). It was first cultivated in Florida and southern California around 1897; today the tangelo is cultivated in tropical and subtropical climates.

Food uses. Ripe fruits are most commonly eaten out of hand or used in fruit salads. The pulp is also used to make juice, marmalades, desserts, and sauces. The segments are used to garnish desserts, cakes, and ice cream.

Comments. Important commercial varieties of the tangelo include the faintly necked 'Minneola', with a fine, subacid taste, 'Seminole', medium-sized, oblate fruits with a sweet juicy pulp, and 'Orlando', with a sweet flavor and large fruits with a distinct nipple.

Clausena lansium (Lour.) Skeels

WAMPEE

Rutaceae (Citrus family)

Description. Small evergreen tree with long, spreading branches, 4–6 m (13–20 ft) tall. Alternate, pinnate, dark green leaves 12–32 cm (5–13 in) long with 7–15 elliptic leaflets with wavy, toothed leaf margins. Fragrant white to greenish-yellow flowers are produced in long panicles at the tips of branches. Round to conical-oblong, yellowish fruits grow in pendent clusters. The thin and brittle rind contains numerous oil glands. Flesh yellow or transparent, juicy, grapelike, with a sweet to subacid, aromatic flavor. Fruits contain 1–5 seeds.

Origin and Distribution. The wampee grows naturally in southern China and northern Vietnam and Laos. It is commonly grown in Southeast Asia but rare elsewhere. The tree can withstand only very light frosts and grows best in subtropical and tropical climates.

Food uses. Fully ripe fruits, which are considered a delicacy in China and Vietnam, are eaten fresh or added to fruit salads and desserts. They are made into refreshing drinks and jellies and jams. In southern China, fruit pieces are used as an ingredient in savory dishes with meat and chicken. In Southeast Asia, a fermented, carbonated drink is made from wampee fruits.

Comments. Ripe fruits are a good source of vitamin C, containing 25 to 35 mg (0.0009–0.001 oz) ascorbic acid per 100 g (0.22 lbs) pulp. Mature trees can produce up to 50 kg (110 lbs) of fruits per year. The attractive tree is often cultivated as an ornamental and as a shade tree. Several varieties of the wampee are cultivated. The brown-skinned variety, 'Guy Sam', is often grown for its sweet, tangy aroma. Another commonly cultivated, sweet variety is 'Chi Hsin'.

Cnidoscolus aconitifolius (Miller) I.M. Johnston

CHAYA, TREE SPINACH

Euphorbiaceae (Spurge family)

Although chaya produces fruits, it is the leaves that people consume.

Description. Fast-growing evergreen shrub or small tree, 2–6 m (7–20 ft) tall, with succulent, semiwoody stems containing milky latex. Alternate, simple, deeply lobed palmate leaves 15–20 cm (6–8 in) wide with long, thin petioles. Small white male and female flowers borne on long pedicels. Round seedpods measure 2.5 cm (1 in) in diameter.

Origin and Distribution. Native to the Yucatán Peninsula of southeastern Mexico. Commonly cultivated as a dooryard plant in tropical regions of Central and South America. Chaya plants are cold-sensitive and require a moist to humid tropical climate.

Food uses. The foliage and tender shoots are boiled in water and used as a green vegetable similar to spinach. In Mexico, the leaves are eaten with tortillas and in soups and stews. A traditional Mexican dish is made of corn tortillas filled with chaya leaves, hard-boiled eggs, beans, cheese, and chili sauce. Boiled and cooled leaves are employed in mixed salads.

Comments. Chaya leaves and shoots are toxic when eaten raw because they contain hydrocyanic glucoside. Cooking and leaching the leaves and shoots makes chaya safe to eat. In traditional Mexican herbal medicine, a tea is prepared from chaya leaves and used to treat diabetes, kidney stones, and obesity.

Chaya leaves are tasty and very nutritious, containing two to three times more nutrients than comparable leafy vegetables such as spinach. They are high in protein, calcium, iron, phosphorous, thiamine, riboflavin, niacin, and vitamins A and C. The leaves could be a source of nutrition to populations that cannot afford expensive foods rich in these nutrients.

A United Sates Department of Agriculture study found that no other vegetable produced greater yields than chaya. The leaves can be harvested year-round, and up to 50% of the leaves of a single tree can be harvested at one time.

Coccoloba caracasana Meisn.

PAPATURRO

Polygonaceae (Buckwheat family)

Description. Small to medium-sized, often multistemmed evergreen tree, 6–18 m (20–60 ft) tall. Alternate, simple leaves broad-oblong, glabrous, leathery, 20–35 cm (8–14 in) long. Small, fragrant, greenish flowers are produced in long terminal and axillary spikes. Fruits are achenes with a whitish to translucent, sweet juicy pulp with a grapelike consistency. The outer, edible parts of the fruit consist of the former perianth, which becomes fleshy.

Origin and Distribution. Native to Mexico and Central America, where the tree occurs mainly along the Pacific coast, and in northern South America; it is rarely cultivated outside its natural range. The papaturro is strictly tropical, preferring a climate with a distinct dry season and growing on sandy soils, often along riverbanks. The tree is often cultivated for its beautiful foliage and as a shade tree.

Food uses. The sweet, somewhat insipid fleshy pulp surrounding the seed is usually eaten out of hand. During the dry season in Central America, one can often see children collecting the fruits from wild trees.

Comments. The wood is used for firewood and as fence poles. The fruits are usually not marketed but collected and eaten directly from naturally growing trees. The genus *Coccoloba* comprises more than 120 species native to Central and South America, Mexico, Florida, and the Antilles.

Coccoloba uvifera (L.) L.

SEAGRAPE

Polygonaceae (Buckwheat family)

Description. Small evergreen tree, often with several twisted trunks and stout branches, 6–12 m (20–40 ft) tall. Trees along ocean shorelines are usually smaller and shrubby. Round, very stiff, leathery leaves alternate, simple, 20–25 cm (8–10 in) in diameter. Leaves show a prominent red midvein beginning at base of the leaf. Dioecious, yellowish-white flowers are produced in long pendent spikes up to 25 cm (10 in) long. Fruits round, 1–2 cm (0.4–0.8 in) in diameter, with one seed. Fruits ripen at different intervals and will change color from light green to purple or dark red.

Origin and Distribution. The seagrape is native along the coasts of tropical America, including the Caribbean Islands and southern Florida. The tree is widely planted for its edible fruits and as an ornamental, especially along coastlines because of its high resistance to dry, salty coastal conditions.

Food uses. The slightly acidic tasting, grapelike fruits are eaten fresh from the tree or made into jelly and jams. The ripe fruits are fermented to produce seagrape wine.

Comments. The genus *Coccoloba* comprises 120–150 species, all native to tropical America. The hard but not termite-resistant wood of the seagrape is prized for cabinet making and as firewood. The bark and wood were commonly used to produce a red dye, also called West Indian kino. In traditional medicine, the very astringent decoction of bark and roots was used to treat diarrhea and throat infections.

The seagrape is very important in preventing erosion of sandy beaches and serves as a salt- and windbreak. The closely related species *C. caracasana* (p. 79) grows commonly along riverbanks in Central and northern South America and is valued for its fruits and as a shade tree.

Couepia polyandra (Kunth) Rose

OLOSAPO, SAPOTILLO

Chrysobalanaceae (Chrysobalanus family)

Description. Medium-sized deciduous tree, 10–20 m (33–66 ft) tall. Alternate, dark green, leathery leaves. Oblong to elliptic, entire blades 6–12 cm (2.4–4.8 in) long by 3–5 cm (1.2–2 in) wide with a characteristic whitish-gray tomentose underside. Hermaphroditic small white flowers are produced in terminal and axillary racemes 8–10 cm (3–4 in) long. Fruits are yellow-orange drupes 5–8 cm (2–3 in) long with a yellow to orange somewhat fibrous pulp and a single large seed; they lose their astringency when fully ripe and have an aromatic, sweet-sour to sweet taste.

Origin and Distribution. Native from southern Mexico and Belize south to Panama, where the tree grows in seasonally dry and premontane forests. The olosapo is occasionally cultivated as a dooryard tree within its natural range, especially close to the Pacific coast of Central America. A very local but popular fruit, rarely cultivated in other tropical regions.

Food uses. Fully ripe fruits, which have a taste and texture similar to the canistel (*Pouteria campechiana*, p. 193), are usually eaten fresh. Underripe fruits are sometimes eaten with salt and lime juice.

Comments. The tree is also known by the synonym *Hirtella polyandra*.

Couroupita guianensis Aubl.

CANNONBALL TREE

Lecythidaceae (Brazil nut family)

Description. Large, evergreen, cauliflorous tree 20–35 m (66–115 ft) tall. Alternate, simple, narrowly elliptic leaves, 20–25 cm (8–10 in) long by 8–10 cm (3–4 in) wide. Flowers and fruits are borne on numerous stalks up to 2 m (6.6 ft) long that emerge from the trunk and cover most of it in a dense tangle. Large, orange-red, strongly scented, bee-pollinated, very showy flowers, with 6 petals and numerous pink stamens, are attached to a white, fleshy disk that is bent upward. Large spherical brown fruits, measuring 20–30 cm (8–12 in) in diameter, hang like cannonballs on the sides of the trunk. Fruits contain up to 300 seeds embedded in a soft gelatinous pulp.

Origin and Distribution. Native to tropical lowland regions of the Amazon and Orinoco basin of northeastern South America and parts of Central America and the Caribbean. The tree often grows close to rivers or in seasonally flooded forests. Widely cultivated in the tropics as an eye-catching ornamental and botanical curiosity.

Food uses. The large fruits, which have a gelatinous consistency and a sour taste, are edible and occasionally eaten as fruit. The fruits were supposedly eaten for nourishment by shamans of South American tribes.

Comments. Leaves, flowers, and fruits play an important role in traditional tribal medicine of tropical South America. The leaves were used to cure skin diseases, and other plant parts like fruits and flowers possess antibacterial and antifungal properties. The wood is used in construction and furniture making.

The fruits have no apparent means of dispersal and were probably dispersed by now-extinct mammals like the giant ground sloth (*Megatherium* sp.).

Crescentia cujete L.

CALABASH TREE

Bignoniaceae (Trumpet creeper family)

Description. Small evergreen tree, 8–10 m (26–33 ft) tall, with a broad growth habit. Ovate, leathery leaves, 5–18 cm (2–7 in) long, borne in small clusters of 3–5. Greenish-yellow, bell-shaped flowers borne singly, directly on the stem and larger branches. Petals often have thin purple stripes. Large round or ovoid green fruits, 20–45 cm (8–18 in) wide, with hard, woody exocarp with smooth shiny surface. The soft white pulp turns almost black when fully ripe and contains numerous brown seeds.

Origin and Distribution. Probably native to southern Mexico, the Caribbean, and Central America. The tree originally spread in prehistoric times to South America. It is adapted to a wide range in temperature and precipitation, growing in tropical and subtropical perhumid climates or in regions with a distinct dry season. Often cultivated as an ornamental. Introduced into tropical Africa and Asia, where in some parts it has become naturalized.

Food uses. The very unripe, tender fruits are preserved in vinegar or candied. The edible seeds are occasionally roasted, salted, and eaten as a snack or used in a protein-rich drink.

Comments. The plant is best known for its hard, dry fruit shells, which have been used for millennia as vessels for liquids and as cups, bowls, plates, spoons, and musical instruments.

The closely related species *C. alata*, also native to Central America, is distinguished from *C. cujete* by its trifoliate leaves and smaller fruits.

Cucumis melo L.

MUSKMELON, CANTALOUPE

Cucurbitaceae (Cucumber family)

Fruit size, shape, color, and rind firmness vary greatly among melon types and cultivars.

Description. Annual herbaceous creeping or climbing plant. Monoecious or rarely hermaphroditic yellow flowers are borne in small clusters. Fruit size, shape, color, and rind firmness vary greatly among melon types and cultivars. Fruits usually spherical or ovoid, yellow with smooth, ridged, or corky skin. Firm, juicy flesh is orange, pink, white, or green. The central cavity contains numerous flat whitish seeds.

Origin and Distribution. The exact origin of the muskmelon is unclear. The plant is possibly native to Iran, Afghanistan, or subtropical, inter-Himalayan valleys of Pakistan or India, where nondomesticated forms exist. Some authors also suggest a sub-Saharan origin. Historical records show that muskmelons were cultivated in Egypt as early as 2400 BC. The melon grows naturally in semiarid, tropical, and subtropical conditions.

Food uses. Ripe fruits are seeded and eaten as fresh fruit or used in fruit salads or desserts. Unripe, green fruits of some varieties can be preserved by pickling. They are also eaten raw in salads or boiled as a vegetable.

Comments. *C. melo* melons are commonly divided into eight groups or varieties. Especially important commercially are the varieties *reticulatus* (netted muskmelon, cantaloupe), with corky netting on the skin and sweet, aromatic flesh, and the green, smooth-skinned variety *cantalupensis* (European cantaloupe), with larger, orange-fleshed fruits. Smooth yellow or greenish varieties of *C. melo* of the Inodorus group are often called honeydew melons. Melons in the Chito group (mango melon) have a cucumber-like texture. The fruits are eaten boiled or pickled. The largest producers of muskmelons are China, Turkey, and Iran.

Cucurbita argyrosperma K. Koch

AYOTE, PIPIÁN, CUSHAW

Cucurbitaceae (Cucumber family)

Description. Creeping or climbing annual herbaceous plant. Alternate leaves ovate to cordate, 20–40 cm (8–16 in) in diameter, dark green with occasional white spots and petioles up to 30 cm (12 in) long. Solitary, monoecious, yellow-orange female flowers are 7–13 cm (23–43 in) long. Male flowers measure 1–2 cm (0.4–0.8 in). Fruits variably shaped, but most often spherical or pyriform, 20–45 cm (8–18 in) long with yellowish-white firm flesh that turns orange-yellow with maturity. Fruits contain numerous flat, elliptical, whitish seeds.

Origin and Distribution. The ayote was probably domesticated in southern Mexico about 5000 BC. Today the fruit is commonly cultivated around the world in tropical and subtropical climates.

Food uses. Immature, green fruits are eaten raw or cooked as a vegetable. They are widely used in stews, soups, and meat dishes or simply as a side dish. In Mexico and Central America, diced, boiled fruits are often served as *picadillo*. Mature fruits are usually eaten cooked. They are also often used in desserts and other sweet dishes such as pie fillings.

The toasted or roasted seeds are salted and eaten as snacks or used in sauces like *mole verde*, made from tomatillos (*Physalis philadelphica*, p. 187), green chili peppers, vegetables, and spices. The ground seeds are also used as an ingredient in a meat dish called *pipián*, made with a spicy chili sauce.

Comments. The plant is also known by the synonym *C. mixta*. The name *ayote*, often used in Central America for this fruit, has its origin in the Nahuatl language of the Aztecs. In Nahuatl the word *ayotetl* means melon.

Cyclanthera brachystachya (Ser.) Cogn.

CUCHINITO, EXPLODING CUCUMBER

Cucurbitaceae (Cucumber family)

Description. Annual, herbaceous, 2–4 m (6–13 ft) tall, climbing with tendrils. Alternate, deeply lobed leaves 15–20 cm (6–8 in) long and 10–15 cm (4–6 in) wide. Small, yellow flowers monoecious. Male flowers in small racemes and female flowers solitary in axils of leaves. Light green fruits ovoid to elliptical, 4 to 5 cm (1.6–2 in) long, covered with long, soft spines. Fruits often strongly curved. When ripe, fruits burst open and expel the small, black seeds.

Origin and Distribution. Native to warm and temperate humid regions from Mexico to Ecuador. Grows at elevations from 800 to 3,500 m (2,600–11,500 ft). The plant is cultivated in home gardens in Central America and in the Andean region of South America. Often escapes from cultivation.

Food uses. Fully grown but still immature fruits are eaten raw in salads; they are also boiled, steamed, or fried as a vegetable. Young shoots and leaves are also eaten as a vegetable. Fruits are sometimes pickled.

Comments. *C. pedata* (caihua), a closely related species that is native to the Andean region from Colombia to Bolivia, is cultivated for its edible fruits. This species has longer, pale green fruits and a smooth skin. It is used as a vegetable similar to cuchinito. Seeded fruits of this plant are often stuffed with, rice, meat or vegetables.

Cynometra cauliflora L.

NAMNAM

Fabaceae (Bean family)

Description. Small, evergreen, multistemmed tree, 6–12 m (20–40 ft) tall. Evergreen, alternate, compound leaves with 2 asymmetrical leaflets, each 5–15 cm (2–6 in) long. Small, hermaphroditic, pinkish-white flowers are produced in dense inflorescences on the trunk and thick branches. Olive-green to greenish-yellow kidney-shaped fruits 5–10 cm (2–4 in) long by 3–6 cm (1.2–2.4 in) wide. Indehiscent fruits with irregular, rough surface and yellow-green, crisp, juicy flesh, containing one brown kidney-shaped seed. Ripe fruits have an applelike consistency and an aromatic, sweet to subacid taste.

Origin and Distribution. Native to the Malay Peninsula. Occasionally cultivated in Southeast Asia and India as a dooryard fruit tree. Very rare elsewhere in the tropics. The tree is adapted to a tropical monsoon climate with high precipitation and a short dry season.

Food uses. Ripe fruits are eaten out of hand or boiled to prepare chutneys, preserves, and pickles. They are cooked with sugar to make sweets and desserts. Slightly underripe, sour-tasting fruits are used in savory foods like curries and meat dishes. In certain regions of Southeast Asia, namnam fruits are used in the preparation of *sambal*, a spicy, chili-based sauce.

Comments. New flushes of bright pink leaves and a cauliflorous fruiting habit make the tree an attractive and exotic ornamental. In tropical Asia, the fruits are used in herbal folk medicine. The seed oil is believed to help cure skin diseases.

Cyphomandra betacea (Cav.) Sendtn.

TREE TOMATO, TAMARILLO

Solanaceae (Nightshade family)

The flesh is usually red, purple, orange-red, or yellow, succulent with a mildly sweet to subacid pulp.

Description. Small tree or shrub 3–5 m (10–16 ft) tall. Alternate, ovate leaves, soft, hairy, 12–35 cm (5–14 in) long by 5–13 cm (2–5.2 in) wide with prominent veins and a heart-shaped base. Pink or light purple flowers are borne in clusters at tips of branches. Pendent fruits egg-shaped with pointed tips, 5–10 cm (2–4 in) long with persistent calyx. Leathery skin purple, red, yellow, orange, or sometimes with dark longitudinal stripes. Flesh usually red, purple, orange-red, or yellow, succulent with a mildly sweet to subacid pulp surrounding numerous flat seeds. The flavor of this fruit is reminiscent of both the kiwi and a slightly underripe tomato.

Origin and Distribution. The tree tomato is native to the Andes of Colombia, Ecuador, Peru, Bolivia, and Chile. At the equator, it grows in a mountainous, subtropical climate at elevations between 1,500 and 3,000 m (5,000–10,000 ft); in subtropical countries, it grows at sea level and can withstand light frosts. The fruit is widely cultivated throughout the Andes of South America as well as in New Zealand and Portugal.

Food uses. This fruit is used in many sweet and savory dishes and recipes. Halved and sugared fruits are often scooped as a breakfast fruit. In South America, the pulp is blended with ice, sugar, and water or with milk to prepare delicious beverages. Peeled fruits are used raw in salads and boiled as a vegetable in a variety of savory dishes. Seeded and peeled fruits are used in chutneys, dips, sandwich spreads, curries, stews, pickles, jams, and sweet or savory sauces. In Ecuador, a spicy tree tomato sauce is made by blending the seeded pulp with onions, garlic, chilies, salt, and spices like coriander. The flesh is cooked together with apples to make filling for pies and strudels.

Comments. The tree tomato is sometimes sold under the name tamarillo. This artificial name was chosen by the New Zealand Tree Tomato Promotion Council in 1967 to promote the fruit internationally. It is a synthesis of the word *tomato* and the Spanish word *amarillo*, meaning "yellow." In Latin America, the fruit is known as *tomate de árbol*.

Davidsonia pruriens F. Muell.

DAVIDSON'S PLUM, OORAY

Cunoniaceae (Cunonia family)

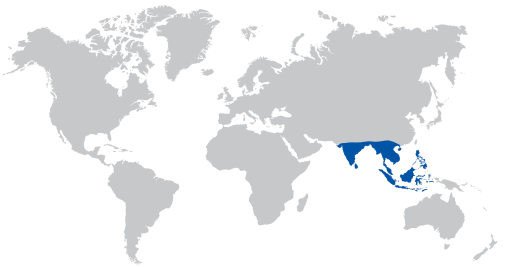
Fruits are produced in large clusters on branches and trunk.

Description. Evergreen, sparsely branched, very slender tree, 8–10 m (26–33 ft) tall, with leaves whorled at the tips of the branches. Alternate, compound, hairy leaves 60–80 cm (24–32 in) long with a winged rachis and leaflets 10–30 cm (4–12 in) long by 4–10 cm (1.6–4 in) wide, with irregularly toothed margins. New leaves are bright reddish-pink in color. Reddish-brown flowers are produced in pendulous clusters. Dark burgundy, fleshy, oval fruits 3–6 cm (1.2–2.4 in) long have 2 pyrenes containing a single seed each. Fruits are produced in large clusters on branches and trunk. The juicy pulp has an acidic taste.

Origin and Distribution. Native to tropical rainforests of Queensland in northeastern Australia south to New South Wales, where it grows from sea level to about 800 m (2,600 ft). A second, smaller variety called *D. pruriens* var. *jerseyana*, which is highly endangered in the wild, grows naturally in northeastern New South Wales. The tree is occasionally cultivated as a dooryard tree.

Food uses. The very acidic fruits are used to make jams, juices, and sauces for sweet and savory dishes. The juice is sometimes fermented to make a winelike beverage. The intensely colored, reddish-purple juice is used as food coloring in desserts, ice cream, and drinks.

Comments. The tree is not related to the plum (*Prunus* sp.) despite the similar appearance of the fruit. It is currently under study for its high antioxidant activity.



Dillenia indica L.

ELEPHANT APPLE

Dilleniaceae (Dillenia family)

Green globose fruits are formed by an aggregate of 15 overlapping carpels, each containing 5 seeds embedded in an edible, gelatinous pulp.

Description. Medium-sized evergreen tree, 10–15 m (33–50 ft) tall, with smooth, brown bark and spreading branches. Alternate, simple leaves oblong to elliptic, 25–35 cm (10–14 in) long by 12–20 cm (5–8 in) wide. Blades shiny green with serrated margins and corrugated surface with impressed veins. Large, showy, solitary white flowers with 5 fleshy petals and several yellow stamens and white pistils. Green globose fruits, 10–15 cm (4–6 in) in diameter, are formed by an aggregate of 15 overlapping carpels, each containing 5 seeds embedded in an edible, gelatinous pulp. Fully ripe fruits are yellowish-brown in color and have a sour to sweet-sour taste.

Origin and Distribution. Native in a range from India and Sri Lanka to Southeast Asia and north to Vietnam and southwestern China. Often planted as an attractive ornamental. Rarely grown outside its natural range.

Food uses. Especially in India the pulp of the fruit is used to make jams, fruit drinks, and vinegar. Underripe fruits are pickled or used in the preparation of savory dishes like curries and soups. The fleshy petals of the flower are added as a colorful ingredient to fruit and vegetable salads or cooked and eaten as a vegetable.

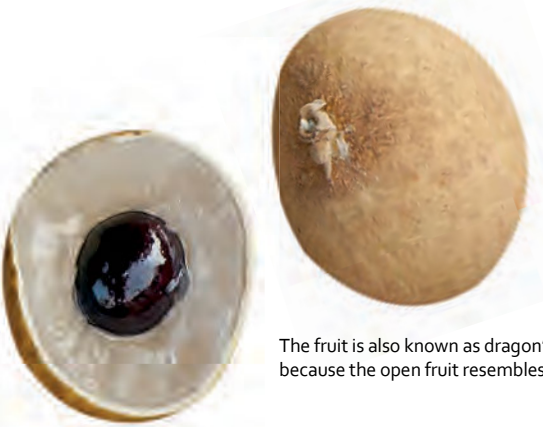
Comments. The fruits of several *Dillenia* species such as *D. pentagyna* and *D. aurea* are edible and used like the elephant apple. *D. suffruticosa*, locally called *simpoh ayer*, is a closely related species (with shrubby growth and large yellow flowers) native to tropical Southeast Asia. The tender young leaves of this tree are used in green salads.

The genus is named after the German botanist and professor Johann Jacob Dillenius (1687–1747), who published numerous botanical papers and is known for his botanical illustrations.

Dimocarpus longan Lour.

LONGAN

Sapindaceae (Soapberry family)



The fruit is also known as dragon's eye, because the open fruit resembles an eyeball.

Description. Small evergreen tree with a dense rounded crown, 8–10 m (26–33 ft) tall. Alternate, paripinnate leaves with 6–10 elliptic to lanceolate leaflets 12–18 cm (5–7 in) long. Pale yellow flowers are produced in erect terminal panicles. Globose fruits, 1.5–2.5 cm (0.6–1 in) wide, have brittle yellowish-brown skin and a soft, translucent, juicy flesh containing a single shiny black seed.

Origin and Distribution. Native to southern China and northern Myanmar, where the tree grows naturally in warm, subtropical lowlands and premontane forests. The longan can withstand light frosts but is not resistant to drought. It is widely cultivated in Asia and to a much lesser extent also in subtropical and tropical regions of Africa and the Americas as a fruit tree and also as an ornamental and shade tree.

Food uses. Ripe fruits, which have a sweet but less aromatic taste than the related lychee (*Litchi chinensis*, p. 139), are predominantly consumed fresh. The translucent flesh is used in fruit salads and desserts as well as in savory recipes like sweet-and-sour dishes and stir-fries. Fruits are preserved by canning in syrup or drying. Dried fruits, which have a leathery texture and turn blackish, are used to make refreshing drinks and aromatized teas. The seeded fruits are macerated in alcohol to produce a type of liqueur.

Comments. The fruit is also known as dragon's eye, because the opened fruit with its whitish, translucent flesh and shiny black central seed closely resembles an eyeball.

The longan is widely used in Chinese herbal medicine as a febrifuge and vermifuge and is regarded as an antidote for poison.

Diospyros blancoi A. DC.

MABOLO

Ebenaceae (Ebony family)

With its beautiful, aromatic foliage, this attractive tree is often grown as an ornamental.

Description. Erect evergreen tree with a pyramidal growth habit, 20–35 m (66–115 ft) tall. Alternate leaves very aromatic, oblong, glossy, 15–23 cm (6–9 in) long with pointed apex and silvery underside. Waxy white clustered male and solitary female flowers are borne on separate trees. Fruits oblate, 5–10 cm (2–4 in) in diameter with thin orange, brown, yellow, or purple-red skin densely covered in short, golden brown hairs. Pulp whitish, soft, mealy, with a taste reminiscent of an apple-banana blend.

Origin and Distribution. Native to the Philippines. With its beautiful, aromatic foliage, this attractive tree is grown in tropical Asia as a fruit tree, as a shade tree, and very often as an ornamental. Occasionally grown in Africa or America. The tree requires a humid tropical climate.

Food uses. Ripe fruits are eaten fresh. The flesh is often sprinkled with lime juice and eaten as dessert or served in fruit salads. Fruits are also fried or boiled and used as an ingredient in savory meat dishes and soups. Overripe fruits emit an unpleasant odor like rotten cheese. Before being eaten, these fruits must be peeled and chilled for a few hours to dissipate the odor.

Comments. Mabolo is considered a fairly good source of iron and calcium and a good source of vitamin B. A decoction of the bark is used in traditional Philippine herbal medicine to treat skin problems and cough.

Diospyros digyna Jacq.

BLACK SAPOTE

Ebenaceae (Ebony family)

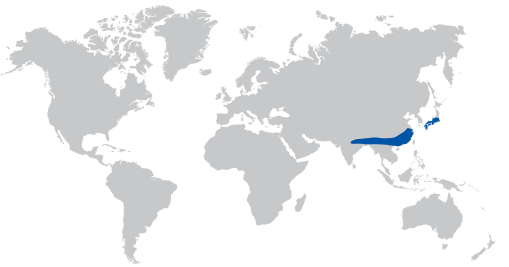
The pulp is dark brown to black, soft, and almost jamlike.

Description. Evergreen tree, 20–25 m (66–82 ft) tall with very dark bark. Elliptic leaves alternate, leathery, 12–30 cm (5–12 in) long, glossy. Flowers, borne singly or in small clusters in axils of leaves, are tubular, white with a sweet scent and a green calyx. Green or yellowish-green fruits round or oblate, 8–14 cm (3–5.5 in) wide with persisting 4-lobed calyx. Pulp dark brown to black, soft, almost jamlike with a sweet aroma. Fruits contain 1–10 brown seeds 1.5–2 cm (0.4–0.8 in) long.

Origin and Distribution. Native to the tropical lowlands of Central America and Southern Mexico. After their arrival in Central America, the Spaniards took seeds of the tree to their Asian colonies. It is now cultivated in the Philippines and on a small scale in many other tropical countries but never gained much popularity outside of Mexico.

Food uses. The seeded pulp, which has a puddinglike consistence and a sweet, somewhat peachlike taste, is eaten mainly as dessert. In Mexico, the pulp of the black sapote is mashed and mixed with wine or rum, cinnamon, and sugar and served as a dessert called *dulce de zapote*. It is also made into ice cream and marmalade. In the Philippines, the fruits are eaten with orange juice or milk. The pulp can be used for pie filling and cakes and is sometimes blended with pineapple juice for a fruit drink.

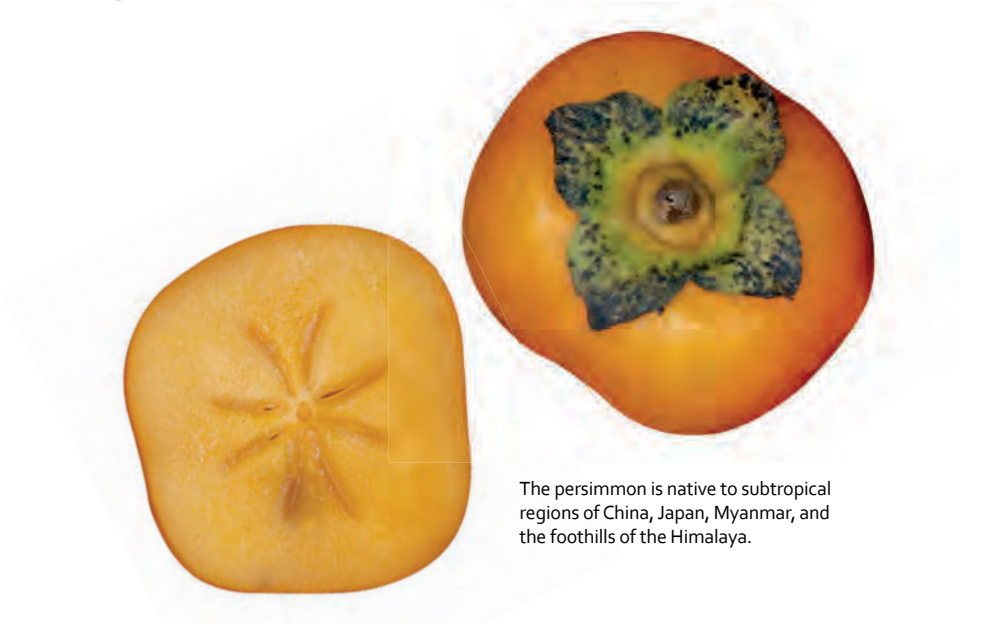
Comments. The fruits are rich in minerals and vitamin C, containing about twice as much ascorbic acid as an orange. The wood is used for making furniture and tool handles. The common name of black sapote is often confused with plants like sapote (*Pouteria sapota*, p. 196), in the family Sapotaceae, and white sapote (*Casimiroa edulis*), in the family Rutaceae.



Diospyros kaki Thunb.

JAPANESE PERSIMMON

Ebenaceae (Ebony family)



The persimmon is native to subtropical regions of China, Japan, Myanmar, and the foothills of the Himalaya.

Description. Small to medium-sized deciduous tree, 5–15 m (16–50 ft) tall. Alternate leaves elliptic to ovate, 8–24 cm (3–9.4 in) long by 6–10 cm (2.4–4 in) wide. The underside of the blades is covered in short brown hairs. Mostly dioecious but sometimes also hermaphroditic flowers creamy yellow, 2–2.5 cm (0.8–1 in) wide with 4 petals. Glossy bright orange to yellow, spherical to ovoid fruits with persistent dry calyx leaves. Flesh orange, reddish-brown, or yellow, gelatinous, juicy, with a sweet aromatic flavor.

Origin and Distribution. Native to subtropical regions of China, Japan, Myanmar, and the foothills of the Himalaya. The tree grows and fruits well in higher elevations in the tropics with a cool subtropical or warm temperate climate. Widely cultivated as an ornamental and fruit tree.

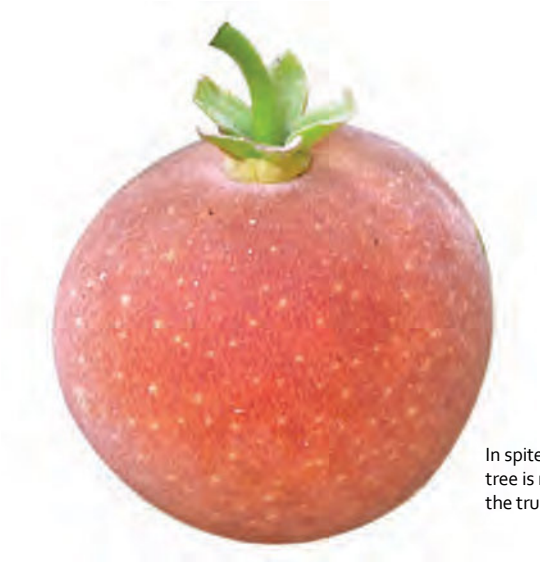
Food uses. Ripe fruits are commonly eaten out of hand. Slices are used in fruit salads and as toppings on cakes, desserts, and ice cream. The flesh is used as a filling for bakery goods or made into jams and marmalades. The flesh can also be pureed to make fruit sauces for desserts and ice cream. In semiarid regions of China, the Middle East, and Brazil, the fruits are dried for later consumption.

Comments. Persimmons are a good source of provitamin A and the minerals potassium and phosphorous. Hundreds of cultivars exist of *D. kaki*. The most important cultivars have nonastringent, seedless fruits with sweet, soft flesh.

Dovyalis hebecarpa (Gardner) Warb. × *D. abyssinica* (A. Rich.) Warb.

TROPICAL PEACH

Salicaceae (Willow family)



In spite of its common name, this tree is not even closely related to the true peach (*Prunus persica*).

Description. Vigorous evergreen shrub or small tree, 3–6 m (10–20 ft) tall, with long, drooping branches with few thorns, and a spreading crown. Alternate, glabrous, ovate-lanceolate leaves 6–8 cm (2.4–3.2 in) long with a wavy margin. Small, dioecious, greenish-white flowers are produced in clusters in the axils of leaves. Reddish-brown, globose fruits with numerous tiny white dots on the velvety skin. Several flat, white seeds are embedded in a juicy, subacid to sweet, orange-yellow pulp.

Origin and Distribution. The tropical peach is a hybrid of *D. hebecarpa* (ketembilla), native to southern India and Sri Lanka, and *D. abyssinica* (Abyssinian gooseberry), which grows naturally in East Africa. The natural hybrid described here probably originated in Florida in the early 1950s. This little-known plant thrives in tropical and subtropical climates, surviving light frosts.

Food uses. The fruits have a sweet-sour but somewhat astringent taste and are eaten fresh or made into preserves, syrup, juices, and jams. Fruits of *Dovyalis* can be used to make fruit wine.

Comments. In spite of the common name *tropical peach*, which relates to the taste, color, and texture of the fruit, the tree is not closely related to the peach (*Prunus persica*).

All mentioned species of *Dovyalis* are considered minor fruits, having never gained popularity as they are either too sour or too astringent.

Durio zibethinus Rumph. ex Murray

DURIAN

Malvaceae (Mallow family)

Description. Erect evergreen tree with rough, flaking bark, 30–45 m (100–150 ft) tall. Alternate leaves oblong to elliptic, 10–25 cm (4–10 in) long, leathery, glossy green from above and silvery or brownish underneath. Fragrant white to pale yellow flowers are borne in small clusters on branches and trunk. The flowers, which open at night, are pollinated mainly by nectarivorous bats. Yellow to yellow-green fruits round to oval, 20–30 cm (8–12 in) long by 15–25 cm (6–10 in) wide, with a thick rind covered in numerous sharp spines. Fruit divided into 5 compartments containing 1–7 seeds each, embedded in an orange, pinkish, or yellowish creamy pulp. Durian fruits are well known for producing a very strong odor.

Origin and Distribution. The durian tree is native to Indonesia and Malaysia. Commonly cultivated from India to Southeast Asia. In Africa and the American tropics, the tree is rarely grown except in some botanical gardens and rare-tree collections. The tree requires a strictly tropical climate with high annual rainfall.

Food uses. The ripe fruits are sold in markets whole or cut into segments. Durian flesh is most often eaten fresh or after chilling. It is often employed in desserts and in a wide variety of sweet edibles like candy, ice cream, milk shakes, and cakes. The flesh is used to prepare sweet or salted preserves. A popular dish from Sumatra called *sambal tempoyak* is made from fermented Durian pulp, coconut milk, spices, and spicy sambal sauce. In Malaysia, people cook rice with coconut milk and durian flesh to make a dish called *pulut durian*. Durian is served in many regions of Southeast Asia as a side dish with savory foods. Durian pulp is pressed into blocks that are commonly sold in local markets.

Like chestnuts, durian seeds are eaten roasted, boiled, or fried. Young leaves and flower petals are sometimes eaten as vegetables.

Durian fruits are well known for producing a very strong odor.

Comments. Probably no other fruit provokes such diverse reactions as the durian. Comments range from "exquisite" and the "king of fruits" to "disgusting." The very strong smell of the fruit has caused it to be banned from certain public places, including planes, trains, and hotels. The taste of a ripe durian has often been described as a blend of onion, garlic, almond, and cream cheese. Descriptions vary depending on ripeness and the degree of affection for the fruit.

The genus *Durian* comprises about 30 different species, of which 9 are grown for their edible fruits. Durians are a good source of carbohydrate, protein, vitamin C, and potassium.

Eriobotrya japonica (Thunb.) Lindl.

LOQUAT

Rosaceae (Rose family)

This tree was possibly introduced and naturalized in Japan in very early times.

Description. Large evergreen shrub or small tree, 5–7 m (16–23 ft) tall, with white, downy hairs on young branches. Alternate whorled leaves elliptical-lanceolate, leathery, glossy dark green on the upper side and brownish-pubescent on the underside. Fragrant white flowers 1–2 cm (0.4–0.8 in) wide are produced in terminal panicles. Yellow to orange oval, round, or pear-shaped fruits. Flesh white, orange, or yellow, subacid to fairly sweet, aromatic. Fruits contain several brown seeds.

Origin and Distribution. Native to mountainous, moist subtropical forests of southeastern China. The tree was possibly introduced and naturalized in Japan in very early times. Widely cultivated in many subtropical regions and at middle elevations of tropical regions. Propagated through seeds and, more commonly, through grafting. Cultivated for its fruits and as an ornamental, the tree grows in a wide variety of soils, but needs good drainage. The loquat, which can withstand frosts to –10 °C (14 °F), grows best in warm temperate and subtropical climates. In the tropics, it prefers cool mountain climates, usually at an elevation between 800 and 1,200 m (2,600–3,900 ft), with or without a dry season.

Food uses. Fully ripe loquats are eaten fresh or used in fruit salads. Because of their high pectin content, they are often made into jams and jellies. They are pickled and conserved in syrup or stewed to make desserts. Loquats are also made into preserves with spices like cloves and allspice and used to prepare chutneys and sauces. They are sometimes fermented to produce a fruit wine.

Comments. Loquats, which are low in calories, provide a good source of fiber, vitamin A, potassium, manganese, and copper. Japan, Israel, and Brazil are the main producers. Reportedly, there are more than 800 varieties of the loquat tree. The seeds of loquat fruits are slightly toxic because they contain cyanogenic glycosides like amygdalin.

Eugenia brasiliensis Lam.

GRUMICHAMA, BRAZILIAN CHERRY

Myrtaceae (Myrtle family)

Description. Small, erect, evergreen tree, 6–13 m (20–43 ft) tall. Opposite, oval, leathery, glossy leaves 9–15 cm (3.5–6 in) long by 3–5 cm (1.2–2 in) wide. White flowers are produced in axils of leaves with 4 petals and about 80–120 stamens with yellow anthers. Dark red, dark purple, or yellow globose fruits measure 1.5–2.5 cm (0.6–1 in) in diameter with persistent calyx leaves at apex. Juicy, dark red or white, subacid to sweet pulp with 1–4 gray seeds and a cherrylike flavor.

Origin and Distribution. Native to southeastern lowlands of Brazil and parts of Uruguay and Paraguay. The Grumichama is occasionally cultivated in tropical and subtropical America, but rarely elsewhere. It prefers a subtropical climate and can withstand light frosts. With its showy white flowers, glossy leaves, and dark red fruits, the tree is often grown as an ornamental.

Food uses. Ripe fruits are eaten out of hand or made into juices, jellies, and marmalade. Seeded fruits are sometimes added to fruit salads. A sauce made of boiled fruits and sugar is used for pie fillings and cakes.

Comments. Fruits are high in minerals like calcium and phosphorous. The wood is used in carpentry and turnery. The tree is also known by the synonym *E. dombeyi*.

Eugenia stipitata McVaugh

ARAZÁ, ARAÇÁ-BOI

Myrtaceae (Myrtle family)

These fruits are easily bruised and must be handled with care.

Description. Evergreen shrub or small tree, 4–6 m (13–20 ft) tall. Opposite leaves slightly pubescent, elliptic, 8–18 cm (3–7 in) long with prominent nerves. White, bee-pollinated flowers are produced singly or in small clusters of up to 4 flowers. Fruits are roundish, somewhat flattened, 5–10 cm (2–4 in) in diameter and 200–500 g (0.44–1.1 lbs) in weight, with up to 20 seeds. Ripe fruits have a thin, soft yellow skin with a creamy white, very juicy, subacid to acid, aromatic pulp. Fruits are easily bruised and must be handled with care.

Origin and Distribution. The arazá is native to the western Amazon region of South America, where it grows in the understory of humid lowland rainforests. The tree was partially domesticated by indigenous tribes and is still cultivated mainly in its native habitat. It is also grown to some extent in Central America.

Food uses. The aromatic, acidic-sweet pulp of the arazá is used to prepare fruit juices, ice cream, and jellies. The succulent flesh of the fruit is blended with ice, sugar, and water and sold in local markets as a refreshing drink. It can also be used as an exotic ingredient in desserts and cocktails and to make fruit wines and liquors.

Comments. The arazá contains up to 100 mg (0.004 oz) ascorbic acid per 100 g (0.22 lbs) pulp and is therefore an excellent source of vitamin C. Its high pulp content (up to 90%) makes the fruit ideal for industrial production of frozen pulp.

This delicious fruit is still relatively unknown to consumers and surely underestimated, and it deserves much more attention. It was only in the 1930s that this member of the Myrtle family became known to the scientific world after being collected by G. Klug in the Amazon rainforest close to Iquitos, Peru.

Eugenia uniflora L.

SURINAM CHERRY

Myrtaceae (Myrtle family)

As it ripes, the Surinam cherry changes from green (with yellow background) to bright red, scarlet, or almost black.

Description. Evergreen shrub or small tree, 5–7 m (16–23 ft) tall. Glossy leaves alternate, dark green with obovate to lanceolate blades 4–6 cm (1.6–2.4 in) long. Emerging leaves are bronze-colored. Flowers cream-white, about 1 cm in diameter with 4 recurved petals and 50–60 long white stamens. Fruits 2–4 cm (0.8–1.6 in) in diameter, oblate, with 6–8 prominent ridges. As they ripe, they change from green (with yellow background) to bright red, scarlet, or almost black. Pulp juicy with a subacid to sweet and sometimes slightly bitter or resinous taste.

Origin and Distribution. Native to eastern South America from Surinam and Guyana to southern Brazil, Uruguay, and Paraguay. Although today the Surinam cherry is grown on a small scale in many tropical and some subtropical countries, it is cultivated predominantly in tropical America.

Food uses. Suriman cherries, a good source of vitamin C, are most often eaten out of hand or as a dessert after sprinkling with sugar. To remove any resinous taste, it is advisable to chill the fruits for several hours before serving. The fruits are used in fruit salads or as a topping for cakes and ice cream as well as pie fillings and also made into dessert sauces. A refreshing juice can be made from ripe fruits. They are also used to make jams and jellies and sometimes preserved in syrup or alcohol. In Brazil, the juice is fermented to produce vinegar or wine. In Southeast Asia, underripe fruits are pickled or made into chutneys.

Comments. The Suriman cherry is grown as an ornamental or hedge plant in many regions of the world and has often been naturalized. In Bermuda, where it has grown out of control, it is considered invasive. The genus *Eugenia* consists of more than 1,000 species distributed in the tropics and subtropics.

Eugenia uvalha Cambess.

UVALHA

Myrtaceae (Myrtle family)

The uvalha is native to southern Brazil, where it occurs wild and in cultivation.

Description. Small, evergreen, shrubby tree growing 6–15 m (20–50 ft) in height. Opposite oval leaves with glossy green blades that produce a spicy smell when crushed. Flowers white with numerous white stamens. Fruits spherical to oblate, 8–12 cm (3–5 in) in diameter, soft to the touch with thin, pubescent orange-yellow skin. Pulp light orange, very juicy, acid to subacid and very fragrant.

Origin and Distribution. The uvalha is native to southern Brazil, where it occurs wild and in cultivation between 300 and 1,500 m (1,000–5,000 ft). It is virtually unknown outside its natural distribution. The tree, which is grown for its fruits and as an ornamental, requires a tropical to subtropical climate.

Food uses. The aromatic fruit is popular for making refreshing fruit drinks. The strained pulp is simply mixed with ice and sugar and served chilled. Uvalhas are sometimes made into jams and marmalade and used to flavor homemade ice cream and cake fillings.

Comments. The plant is also known by the synonym *E. pyriformis* var. *uvalha*. The genus *Eugenia* is a predominantly Neotropical genus with more than 1,000 species.

Eugenia victoriana Cuatrec.

GUAYABILLA, SUNDROP

Myrtaceae (Myrtle family)

Description. Evergreen shrub or small tree, usually less than 4 m (13 ft) tall. Leaves opposite, elliptical, 2–3 cm (0.8–1.2 in) wide by 8–12 cm (3–5 in) long with sunken veins and a pointed apex. Perfect flowers white, small, borne singly or in clusters of 2 or 3. Fruits are spheroid to ovate, usually of irregular shape, 7–12 cm (2.8–5 in) in diameter, with very thin, shiny yellow-orange skin. The pulp is bright orange and very juicy. Each fruit contains 2–4 seeds.

Origin and Distribution. Native to a small region of northwestern South America, where the plant grows in the wet coastal rainforests of the Colombian Chocó and northwestern Ecuador. This very uncommon fruit tree is rarely cultivated outside its natural range.

Food uses. The acidic but very aromatic pulp, with a taste reminiscent of passionfruit, is blended with water, ice, and sugar to make a delicious juice. The fruit is also made into preserves, jellies, and marmalade. In Colombia, it is used to flavor liquor.

Comments. The fruits have about twice the amount of vitamin C as an orange. The genus *Eugenia* contains several interesting, but relatively unknown fruit trees, including arazá (*E. stipitata*, p. 99), uvalha (*E. uvalha*, p. 101), and grumichama (*E. brasiliensis*, p. 98), all native to tropical South America.

Feronia limonia (L.) Swingle

WOOD APPLE, CURD FRUIT

Rutaceae (Citrus family)

Description. Deciduous tree with rough bark and sharp spines, 8–12 m (26–40 ft) tall. Alternate, pinnate leaves 8–14 cm (3–5.5 in) long, leathery, dark green with numerous small oil glands. Leaflets 25–38 mm (1–1.5 in) long with a distinct citrus smell when crushed. Reddish or greenish flowers are borne in small panicles. Fruit round or egg-shaped, with thick, hard, grayish-white rind. Dark brown, mealy pulp astringent, acid or sweetish, with numerous small white seeds scattered throughout.

Origin and Distribution. The tree is native to India and Sri Lanka. It grows naturally in tropical lowland forests with distinct dry and wet seasons. The plant is widely cultivated throughout its natural range and also on a lesser scale in Southeast Asia, but rarely elsewhere in the tropics.

Food uses. The hard shell of the fruit must be crushed with a stone or hammer to get to the pulp. The sweet or sweet-sour tasting fruit is scooped out and eaten fresh; or the pulp is made into chutneys, jellies, and jams.

In India, the sweetened pulp is used to make sherbets. The pulp is also mixed with coconut milk and palm syrup and made into beverages, desserts, and ice cream.

Comments. The unripe, astringent fruits are traditionally used in Indian folk medicine to treat diarrhea and dysentery. The ground bark is used in Myanmar and also occasionally in Thailand to produce a yellowish-white cosmetic paste called *thanaka*. The colorful paste is applied as a beauty symbol in different designs on the face and arms of girls and women.

The tree itself is very slow growing, needing at least 15 years to produce fruits and more than 35 years before the bark can be harvested for the production of *thanaka* paste.

Ficus auriculata Lour.

ELEPHANT EAR FIG, ROXBURGH FIG

Moraceae (Mulberry family)

Description. Dioecious evergreen tree with spreading branches and rough, grayish-brown bark, 8–14 m (26–46 ft) tall. Alternate, cordate to oval, simple leaves 20–50 cm (8–20 in) long by 15–30 cm (6–12 in) wide. Blades densely short pubescent on the underside. Cauliflorous flowers grouped in a synconium, typical for the genus *Ficus*, in which tiny flowers form an enlarged, fleshy, involuted inflorescence pollinated by certain species of wasps of the genus *Blastophaga*. Tiny seeds are produced on the inside wall of this hollow receptacle. Ripe fruits 6–10 cm (3–4 in) in diameter, round, flattened, reddish brown to coppery red with light green dots. The flesh of fully ripe fruits is soft and has a sweet taste.

Origin and Distribution. Native to northern India. Cultivated in tropical and subtropical regions of south Asia and Southeast Asia. Occasionally cultivated in Africa and the New World tropics.

Food uses. Ripe fruits are eaten fresh or dried. They are often made into marmalades and refreshing beverages. In India the fruits are also used in the preparation of savory dishes like curries and salads.

Comments. *F. auriculata* is used as a host tree for lac bugs of the genus *Laccifer*, which secrete a resinous pigment called seedlac that is then processed into shellac. The resin was used to coat musical instruments and furniture and was employed in the production of gramophone records prior to the 1940s. Leaves of the tree are valued as fodder for livestock.

Ficus carica L.

COMMON FIG

Moraceae (Mulberry family)

Description. Shrub or small deciduous tree 6–12 m (20–40 ft) tall, with spreading branches. Leaves, branches, and unripe fruit contain a milky sap. Alternate, deeply divided palmate leaves with a rough upper surface. Blades 20–28 cm (8–11 in) in diameter, with 3–7 distinct lobes. Tiny flowers cover the inside walls of a fleshy, hollow receptacle with a small opening at the apex; this is commonly considered a fruit but is technically a synconium. The common fig is parthenogenic, requiring no pollination, but most other fig species are fertilized through highly specialized fig wasps (*Blastophaga* sp.). Ripe figs are yellowish-green, coppery, or dark purple in color, obovoid or pear-shaped, and contain numerous tiny seeds. The juicy, sweet flesh can be yellowish, pink, or purple in color.

Origin and Distribution. The common fig is native to western Asia. The tree, one of the first species cultivated by humans, was dispersed throughout the Mediterranean region and northern Africa thousands of years ago and was commonly grown in ancient Rome and Greece. Fig remnants were found in excavations in the town of Gilgal in the Jordan Valley dating back to 9300 BC. Figs are grown in subtropical and tropical regions with a semiarid climate. In the tropics the tree grows best between 800 and 2,000 m (2,600–6,500 ft) elevation.

Food uses. Figs are eaten fresh, dried, or canned in syrup. The fruits are sometimes candied or made into jam and marmalade. Stewed fruits are used in pies, cakes, and other bakery products. Figs are often served for dessert or as a topping on ice cream. Fruit extracts are used commercially to flavor liqueurs and tobacco.

Comments. Figs are nutritious fruits and a good source of fiber and an excellent source of calcium, containing up to 164 mg (0.006 oz) per 100 g (0.22 lbs) dried fruit. They are also rich in antioxidants and minerals, including magnesium, potassium, iron, and phosphorous. There are hundreds of cultivated varieties. The most popular are 'Brown Turkey', with copper-colored fruits, best adapted to tropical climates, and 'Celeste', with purplish-brown fruits. Turkey and Egypt are the main producers of common figs.

Ficus racemosa L.

GOOLAR'S FIG, CLUSTER FIG

Moraceae (Mulberry family)

Description. Medium-sized to large deciduous tree, 15–25 m (50–82 ft) tall. Alternate leaves ovate to elliptic, glabrous, 15–25 cm (6–10 in) long. Pyriform fruits 4–6 cm (1.6–2.4 in) in diameter, red or orange when ripe. Fruits are borne in large, spectacular clusters along the leafless branches and on the trunk. The fruits and seeds are dispersed by birds and by mammals such as monkeys and bats.

Origin and Distribution. Native from India to Southeast Asia. The tree is considered sacred in India and thus often planted near homes, temples, and monasteries. It is often cultivated for its edible fruits and as a shade tree. The tree grows naturally in seasonally dry forests or riparian habitats in tropical or warm subtropical climates from sea level up to 1,800 m (5,900 ft).

Food uses. Ripe fruits are eaten out of hand. In India, green fruits are halved and pickled in vinegar.

Comments. The cluster fig is of importance in traditional Indian herbal medicine. Extracts of the bark are used to treat dysentery, inflammation, and diabetes. Immature, astringent fruits are used to alleviate cough and sore throat.

Flacourtia indica (Burm. f.) Merr.

GOVERNOR'S PLUM

Salicaceae (Willow family)

Description. Small, spiny tree or shrub 3–10 m (10–33 ft) tall, with drooping branches. Alternate, glossy leaves obovate, 3–8 cm (1.2–3 in) long with finely toothed margins. Axillary, yellowish-white, insect-pollinated male and female flowers are borne on separate trees. Spherical fruits 1.5–3 cm (0.6–1.2 in) in diameter with red-purple skin and yellowish, firm, subacid to acid, somewhat astringent flesh, with 5–10 flat seeds.

Origin and Distribution. Native to Madagascar, tropical Africa, India, and Southeast Asia. The tree is not well known outside its natural range and rarely planted. The governor's plum requires a tropical or warm subtropical, dry or humid climate.

Food uses. Fully ripe fruits are less astringent and usually eaten out of hand. They are also made into jams and jellies and used to flavor yogurt and ice cream. The juice is sometimes fermented to make wine.

Comments. The name of the genus honors Étienne de Flacourt, French governor of Madagascar from 1648 to 1660. The flowers of the governor's plum are a good food source for honey bees. An infusion of the bark is used in traditional African medicine to treat throat infections.

Flacourtia inermis Roxb.

MARTINIQUE PLUM, LOUVI

Salicaceae (Willow family)

Description. Small, evergreen, thornless tree, 6–10 m (20–33 ft) tall. Alternate leaves, 10–25 cm (4–10 in) long, glossy, bright red when emerging. Green, petalless flowers with yellow stamens are borne in small axillary clusters. Cherrylike, bright red to dark red fruits measure 2–3 cm (0.8–1.2 in) in diameter. The juicy, subacid to acid flesh contains 7–10 seeds.

Origin and Distribution. The exact origin is unknown. Probably native to tropical Southeast Asia. The louvi is considered a minor fruit in Asia and grown mostly as a dooryard tree (it is highly valued as an ornamental). Rarely cultivated outside tropical Asia. It requires a humid tropical climate. Under these conditions, a single tree can produce more than 200 kg (440 lbs) of fruits per year.

Food uses. Fully ripe fruits are eaten raw but usually made into jams and jellies, chutneys, and pickles. The fruits are commonly boiled and the strained and sweetened juice served chilled as a refreshing beverage.

Comments. The paniala (*F. jangomas*), a closely related species native to India, is grown for its aromatic, dark red to almost black fruits, which are sweeter than the louvi. These are eaten out of hand, made into juice, and also used in desserts, marmalades, and pickles. The ramontchi (*F. ramontchi*), native to tropical Africa and Asia, has dark red, very astringent fruits used mainly to make jellies.

Fortunella margarita (Lour.) Swingle

OVAL KUMQUAT

Rutaceae (Citrus family)

In Vietnam, entire fruits are candied and sold as sweets by roadside vendors.

Description. Slow-growing, evergreen shrub or small tree, 3–6 m (10–20 ft) tall, usually with only a few spines. Alternate, lanceolate leaves 4–10 cm (1.6–4 in) long with finely toothed margins. Fragrant white, hermaphroditic, 5-petaled flowers are borne singly or in small clusters in leaf axils. Orange-yellow oval berries, 2–3 cm (0.8–1.2 in) long with thin, sweet-tasting skin dotted with oil glands. Segmented, orange, not very juicy pulp with sour-sweet taste and a hint of bitterness.

Origin and Distribution. Probably native to southern China, but cultivated for centuries and naturalized in parts of Southeast Asia. The plant is grown throughout the tropics and subtropics. Some varieties can withstand frost to –10 °C (14 °F). Often cultivated as an ornamental or potted indoor plant in temperate regions.

Food uses. Ripe kumquats are eaten whole as a fruit snack. They are commonly made into marmalades, jellies, and aromatic chutneys. The fruits are used as garnish for desserts, ice cream, and cocktails. They also serve as an exotic ingredient in many savory meat and vegetarian dishes. Fruits are canned in syrup and made into sweet or sour pickles. Kumquats are also used to produce liqueurs and fruit wine. In Vietnam, entire fruits are candied and sold as sweets by roadside vendors.

Comments. Generally, the genus *Fortunella* is divided into 6 species, all of which produce edible fruits, but some authors group all into one species called *Citrus japonica*, with 6 varieties.

Another important species is the round kumquat (*F. japonica*), which has fruits with a sweet rind and a sour-tasting pulp. The plant is often cultivated as an indoor plant and as a bonsai. *F. obovata* (Fukushu kumquat) produces round, orange, sweet-tasting fruits that are often made into marmalade or jellies.

The genus is named in honor of Robert Fortune (1812–1880), a Scottish botanist and plant collector best known for introducing the tea plant (*Camellia sinensis*, p. 280) to Darjeeling, India, from China.

Garcinia atroviridis Griff. ex T. Anderson

ASAM GELUGOR

Clusiaceae (St. John's wort famliy)

Description. Evergreen tree, 15–22 m (50–72 ft) tall, with erect, pyramidal growth habit and drooping branches. Opposite, elliptic leaves leathery, dark green, shiny, 16–24 cm (6–9.5 in) long with long pointed tips. Dark red flowers with 4 fleshy petals. Yellow-orange fruits 7–11 cm (2.8–4.3 in) in diameter, round with flattened apex, thin skinned with deep longitudinal grooves. Flesh soft and juicy but very sour. Fruits contain several elongated brownish seeds.

Origin and Distribution. Native to southern Thailand, parts of Vietnam, Malaysia, and Singapore, where it grows wild in evergreen, tropical lowland dipterocarp rainforests. The tree is occasionally cultivated as a dooryard tree throughout Southeast Asia. Very rarely grown in tropical Africa or America.

Food uses. The ripe, very sour fruits are thinly sliced, then sun-dried until they shrivel and turn brown. These slices are commonly called *asam keping*, meaning "sour slices" in Indonesian. They are used to add acidity and flavor to a variety of typical Southeast Asian dishes, especially fish curries and soups. The fruit is sometimes used to replace similar-tasting tamarind (*Tamarindus indica*) in Asian dishes. Asam gelugor fruits are popular as a sour-tasting ingredient in fruit or vegetable salads. The fruits are also stewed with sugar and served as dessert.

Comments. In Thailand, the fruit, which contains malic acid, tartaric acid, hydroxycitric acid, and a variety of bioactive compounds like flavonoids, is used as a traditional herbal medicine for losing weight and excess fat as it suppresses the glycogen process (thereby converting fat to energy).

Garcinia brasiliensis Mart.

BACUPARI, ACHACHAIRÚ

Clusiaceae (St. John's wort family)

Description. Evergreen tree, 5–8 m (16–26 ft) tall, with long, stiff spreading branches. All plant parts contain yellow latex. Opposite, simple, elliptical to oblong leaves 10–20 cm (4–8 in) long by 5–10 cm (2–4 in) wide with shiny, somewhat leathery surface and wavy margins. Cream-colored, sweetly fragrant flowers with fleshy petals are borne in axillary clusters. Yellow to yellowish-orange, ovoid, thick-skinned fruits, 3–4 cm (1.2–1.6 in) long, contain a juicy, subacid to sweet, white to translucent pulp and 1 or 2 brown seeds.

Origin and Distribution. Native to southeastern Brazil, northern Argentina, Paraguay, and parts of Bolivia. The tree grows in lowland rainforests in tropical and warm subtropical climates. Occasionally cultivated as a fruit tree in tropical America, rare elsewhere.

Food uses. Ripe fruits, which have an excellent, aromatic, sour-sweet or sweet taste, are mostly eaten fresh. The aril-like, seeded pulp is sometimes served chilled as a dessert or made into sorbets. The aromatic pulp is made into a sauce served with seafood. A refreshing drink is made from the pulp blended with ice, sugar, and mint.

Comments. The tree is also known under the synonym *Rheedia brasiliensis*. The genus name *Rheedia* was formerly used for all Neotropical *Garcinia* species. The taxonomy of *Garcinia* species in tropical America is not always clear and requires further research.

Garcinia gummi-gutta Roxb.

GAMBOOGE

Clusiaceae (St. John's wort family)

The sour-tasting segments of fully ripe fruits are sliced and sun-dried and then smoked and rubbed with salt and oil.

Description. Medium-sized evergreen tree, 8 to 20 m (26–66 ft), with dense rounded crown and smooth gray bark. Opposite leaves glabrous, leathery, 12–20 cm (5–8 in) long by 6–10 cm (2.4–4 in) wide. Dioecious flowers with 4 red or yellow petals. Male flowers in clusters of 5–18; female flowers single or in small clusters. Round fruits 5–10 cm (2–4 in) in diameter, with flattened apex and deep longitudinal grooves dividing the exocarp into 6–8 segments. Ripe fruits are yellow or reddish-green to red in color. Normally, each segment contains a single brown seed. The juicy flesh of the fruit has a very sour taste.

Origin and Distribution. Native to tropical and subtropical regions of India, Nepal, Sri Lanka, and Bangladesh. Cultivated in Southeast Asia and occasionally in tropical Africa. Very rare in tropical America and elsewhere. The tree grows naturally in moist to wet tropical and subtropical forests between sea level and 2,000 m (6,500 ft).

Food uses. The sour-tasting segments of fully ripe fruits are sliced and sun-dried and then smoked and rubbed with salt and oil. Through this process the fruits shrivel and turn dark brown or almost black. Such treated fruits are used as a condiment to add flavor and acidity to soups and especially to seafood like fish curries and prawn dishes. The fruit, also known as Malabar tamarind or *kudampuli* in India, is an essential ingredient in the Kerala fish curry of the coastal state of Kerala in southern India. Fat extracted from the seeds is locally known as *uppage tuppa* and used as vegetable butter.

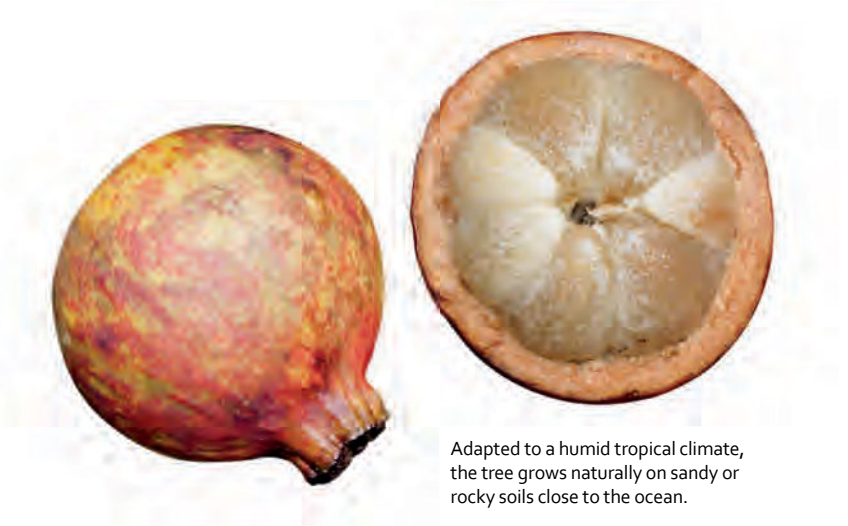
Comments. The fruit juice is believed to reduce excess weight by eliminating body fat. In India, fruit extracts have been used for centuries as a dietary supplement for weight reduction. The fruit is used in a very similar way to the closely related asam gelugor (*G. atroviridis*, p. 110). The gambooge has recently become a focal point for western herbal medicine and manufacturers of weight loss products.

The wood is used in construction and furniture making. The tree is named after its brown to orange resin, known as *gamboge*, which is obtained from several different *Garcinia* species, including *G. morella* and *G. elliptica*. The dried and powdered resin has a bright yellow color and is used as a pigment by artists, in industry, and for dyeing the robes of Hindu monks.

Garcinia hombroniana Pierre

SEASHORE MANGOSTEEN

Clusiaceae (St. John's wort family)



Adapted to a humid tropical climate, the tree grows naturally on sandy or rocky soils close to the ocean.

Description. Medium-sized evergreen tree with erect growth habit and dense crown, 5–10 m (16–33 ft) tall. All plant parts contain white latex. Opposite, elliptic leaves 16–24 cm (6–9.5 in) long by 8–12 cm (3–5 in) wide, dark glossy green. Whitish flowers with 4 petals are produced at the tips of branchlets. Fruits dark pink, reddish-pink, or red, spherical or beaked, 4–5 cm (1.6–2 in) in diameter with 4 persistent green sepals. Orange pulp divided into several segments with 1 flat seed per segment.

Origin and Distribution. Native from Thailand, Cambodia, and Vietnam south to Malaysia and Indonesia. Adapted to a humid tropical climate, the tree grows naturally on sandy or rocky soils close to the ocean. Very rarely cultivated outside its natural geographic range.

Food uses. The ripe fruits have a very aromatic, sour-sweet taste but little pulp and are eaten fresh or made into juice or jams and jellies.

Comments. The seashore mangosteen is very closely related to the purple mangosteen (*G. mangostana*, p. 118) and considered by some authors to be one of its progenitors. The tree is sometimes used as rootstock for grafting mangosteen cultivars.

With its symmetrical growth and beautiful foliage, edible, colorful fruit, drought tolerance, and salt resistance, the seashore mangosteen makes an excellent ornamental tree, especially in coastal conditions.

It is named in honor of Jacques B. Hombron (1798–1852), a French naturalist and naval surgeon who discovered and described several plant and animal species.

Garcinia intermedia (Pittier) Hammel

LEMON DROP MANGOSTEEN

Clusiaceae (St. John's wort family)

Description. Small evergreen tree, 5–8 m (16–26 ft) tall, often with almost horizontal branches. Opposite leaves lanceolate to oblong, 7–14 cm (2.8–5.5 in) long by 2–5 cm (0.8–2 in) wide. Small white perfect flowers with 4 petals are borne in clusters of 1–15 in the axils of leaves. Fruits spherical to ovate, 2–2.5 cm (0.8–1 in) in diameter and with thin orange or yellow skin. Juicy pulp subacid to sweet, white or translucent with 1 or 2 seeds.

Origin and Distribution. This species is native to southern Mexico and Central America and possibly to northwestern South America. It requires a humid tropical climate. The tree is occasionally cultivated as an ornamental or fruit tree in Asia and Africa.

Food uses. The fruits are commonly eaten fresh. The pulp has an agreeable sweet-sour flavor, but the skin is somewhat astringent.

Comments. *G. intermedia* is also known by the synonym *Rheedia edulis*. The genus *Garcinia* comprises more than 100 species. Most fruit trees of the genus *Garcinia*, including the purple mangosteen (*G. mangostana*, p. 118), are of Southeast Asia origin.

Fruits spherical to ovate, with thin orange or yellow skin.

Garcinia livingstonei T. Anderson

IMBE, AFRICAN MANGOSTEEN

Clusiaceae (St. John's wort family)

Description. Small to medium-sized, slow-growing tree, 8–18 m (26–59 ft) tall, with stiff, spreading branches. All plant parts contain yellow latex. Evergreen, opposite leaves lanceolate to elliptic, 7–14 cm (2.8–5.5 in) long, dark green and glabrous. Dioecious, sweetly fragrant, greenish-white to yellow flowers are produced in small clusters on branches and trunk. Globose to ovoid, orange or reddish fruits 2–4 cm (0.8–1.6 in) long with thin, smooth skin and yellow-orange translucent pulp.

Origin and Distribution. Native to tropical Africa from northern South Africa north to Somalia and Ethiopia, Guinea, and Ivory Coast. The tree prefers seasonally dry forests and savannas with annual precipitation between 400 and 1,800 mm (16–71 in). Often found in open woodlands and riparian habitats. Cultivated as an ornamental. Occasionally grown as a fruit tree in India.

Food uses. Ripe fruits, which have a refreshing sweet-sour taste, are usually eaten out of hand. The pulp is used to make desserts, ice cream, and sweets. In East Africa, the fruits are fermented to produce an alcoholic, winelike beverage.

Comments. The genus is named in honor of Laurent Garcin (1683–1751), a French naturalist and botanist who lived and worked in India. The imbe is the most important of about 15 African *Garcinia* species with edible fruits.

Garcinia madruno (Kunth) Hammel

CHARICHUELO

Clusiaceae (St. John's wort family)

Description. Erect evergreen tree with dense foliage, 10–20 m (33–66 ft) tall. All plant parts produce a sticky yellow latex when cut. Elliptic to obovate leaves opposite, 10–20 cm (4–8 in) long, with pointed or round apex. Fragrant, dioecious flowers with 4 recurved, pale yellow petals and 20–30 yellow stamens. Fruits 5–8 cm (2–3 in) long, globose or ellipsoid, sometimes with a prominent nipple and a thick, rough and warty yellow rind. Pulp translucent to whitish, juicy, sweet to subacid with a slight citrus taste. Fruits contain 1–3 brown seeds, each about 2 cm (0.8 in) long.

Origin and Distribution. The tree is native to tropical Central and South America from Costa Rica south to Bolivia and Brazil. It is rarely cultivated outside its natural range, although trees were introduced into the Philippines. The tree requires a humid tropical climate for optimal growth.

Food uses. The fruits are usually consumed fresh and sometimes made into marmalades or jellies. In Colombia the fruits are made into a refreshing drink.

Comments. *G. madruno* was formerly also known under the synonym *Rheedia madruno*. Today all Old World *Garcinia* and New World *Rheedia* species are placed in genus *Garcinia*.

The yellow latex is used in traditional herbal medicine of Costa Rica and Panama to treat ulcers and sores. The genus contains important fruit trees, including the purple mangosteen (*G. mangostana*, p. 118) and the mamey (*Mammea americana*, p. 146).

Garcinia magnifolia (Pittier) Hammel

MADRONO, GIANT LEAF MADRONO

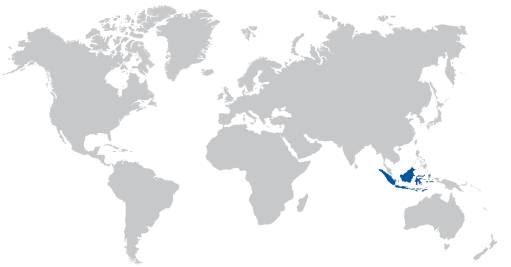
Clusiaceae (St. John's wort family)

Description. Evergreen tree with dense foliage and a pyramidal growth habit, 10–20 m (33–66 ft) tall. All plant parts contain a yellow to whitish-green latex. Large, simple, opposite leaves 30–60 cm (12–24 in) long by 12–15 cm (5–6 in) wide with leathery, glabrous blades. Pink flowers with white stamens are produced in small clusters in the axils of the leaves or on smaller branches. Yellow to yellow-orange, near spherical fruits, 3–4 cm (1.2–1.6 in) wide, contain several light brown seeds enclosed in a soft, white aril.

Origin and Distribution. Native and endemic from southern Costa Rica and Panama to the Chocó region of northwestern Colombia. The tree grows in humid tropical lowland and premontane rainforests. Occasionally cultivated as a fruit tree in its native region. The tree is little known elsewhere.

Food uses. The ripe fruits, which have an agreeable, subacid, aromatic taste, are valued as a fresh fruit. In Colombia, the fruits can occasionally be found in local markets. The pulp is used in fruit salads and as garnish on ice cream and desserts.

Comments. With its large, beautiful dark green leaves and dense clusters of contrasting yellow-orange fruits, the tree is sometimes cultivated as an ornamental. In the wild, large birds and mammals like monkeys and bats eat the fruit and disperse the seeds.



Garcinia mangostana L.

PURPLE MANGOSTEEN

Clusiaceae (St. John's wort family)

Fruits globose with smooth, thick, dark purple rind. A green to reddish calyx persist on ripe fruit.

Description. Slow-growing evergreen tree with a dense, pyramidal crown, 8–25 m (26–82 ft) tall. Opposite leaves thick, leathery, elliptic with short petioles. Blades 10–25 cm (4–10 in) long with a prominent midrib. Flowers male or hermaphrodite, 4–6 cm (1.6–2.4 in) wide with fleshy, yellowish-red petals. Hermaphrodite flowers single or in pairs, yellowish-green to red, at tips of branchlets. Fruits 4–8 cm (1.6–3.2 in) in diameter, globose with smooth, thick, dark purple rind and a green to reddish calyx persisting on ripe fruit. White, soft and juicy, very aromatic pulp consists of 4–8 wedge-shaped segments (arils) surrounding 1–5 seeds.

Origin and Distribution. Probably native to the Sunda Islands and the Moluccas of Indonesia. The mangosteen is widely cultivated in the tropics and especially in Southeast Asia, where it is planted as a fruit tree and as an ornamental. The tree thrives only in an ultratropical climate with well-drained soils and evenly distributed precipitation throughout the year.

Food uses. The mangosteen is sometimes called the "queen of tropical fruits" because of its exquisite, subacid to sweet mild flavor. The fruits are primarily consumed fresh but are also sold frozen and canned. Seedless segments are used as a topping for ice cream and sherbets. Fresh fruits are used to prepare fruit juices and jellies. The seeds are sometimes eaten boiled or roasted.

Comments. The astringent rind of the fruit, which is rich in tannins, has been used widely in traditional Asian herbal medicine to treat diarrhea and dysentry, among many other illnesses.

Major producing countries of mangosteens are Thailand, Malaysia, and Indonesia. The mangosteen is the national fruit of Thailand.

The genus is named after the French priest and explorer Laurent Garcin (1683–1751).

Garcinia xanthochymus Hook. f.

YELLOW MANGOSTEEN, GAMBOGE

Clusiaceae (St. John's wort family)

Description. Erect, medium-sized evergreen tree with a pyramidal crown, 8–15 m (26–50 ft) tall. Opposite leaves oblong to lanceolate, 12–40 cm (5–16 in) long by 5–12 cm (2–5 in) wide. Whitish monoecious or hermaphroditic flowers are produced in small clusters of 4–10. Spherical yellow fruits 5–10 cm (2–4 in) in diameter, with persistent sepals and a pointed apex. Pulp juicy, yellow, aromatic, subacid to acid with 1–3 large, elongated brown seeds. Trunk, leaves, and fruits contain a white latex.

Origin and Distribution. The yellow mangosteen grows naturally in India, Sri Lanka, Bangladesh, Myanmar, Thailand, and Malaysia. The tree requires a humid tropical to warm subtropical climate and is rarely grown outside tropical Asia except in botanical gardens and rare plant collections.

Food uses. Ripe fruits taste aromatic though somewhat sour. They are used mainly to make jellies, jams, and sweets or as a substitute for tamarind (*Tamarindus indica*, p. 233) in curries and other typical Asian dishes. The fruits are sometimes fermented to produce vinegar.

Comments. This species is also known by the synonyms *G. tinctoria* and *Xanthochymus tinctorius*. The yellow mangosteen is used as a rootstock for grafting purple mangosteen (*G. mangostana*). Formerly, a bright yellow dye was extracted from the trunk and the fruits.

Genipa americana L.

GENIPAP

Rubiaceae (Coffee family)

The whitish flesh encloses a central cavity filled with brown granular pulp containing numerous flat brown or yellowish seeds.

Description. Medium-sized evergreen or deciduous tree with spreading branches and a straight, slender trunk, 15–30 m (50–100 ft) tall. Opposite leaves oblong-obovate, glossy dark green, 20–35 cm (8–14 in) long by 10–20 cm (4–8 in) wide with entire margins and prominent midribs. White or pale yellow flowers have a 5-lobed corolla 5 cm (2 in) wide and are produced in short terminal clusters. Fruits are elliptic or round, thick-skinned berries 5–8 cm (2–3 in) in diameter. The whitish flesh encloses a central cavity filled with brown granular pulp containing numerous flat brown or yellowish seeds.

Origin and Distribution. The genipap is native to tropical America from southern Mexico and the Caribbean islands south to Bolivia, Brazil, Paraguay, and northern Argentina. The tree is rarely cultivated outside its natural range, with the exception of the Philippines, where it is occasionally grown.

Food uses. The fully ripe fruit, which has a subacid flavor similar to that of dried apples, is used to make a refreshing drink by blending the fruit with ice and water. The juice is sometimes served slightly fermented. In the Philippines, it is used to make sherbets, ice cream, and jellies. In Brazil, a soft drink called *genipapada* is made from the ripe fruits. On some Caribbean islands, where the fruit is locally called marmalade box, the juice is fermented and made into an alcoholic beverage called *licor de genipao*.

Comments. The clear juice of underripe fruits oxidizes on contact with air, turning dark blue and then black. The black dye was used along with the bright red color obtained from annatto seeds (*Bixa orellana*, p. 277) by indigenous Americans as a tattoolike body paint. The juice of the fruit has an astringent effect and antibiotic properties. A tea made from the dried fruit has been used to treat bronchitis and jaundice in herbal medicine.

Glycosmis pentaphylla (Retz.) DC.

ORANGEBERRY, GIN BERRY

Rutaceae (Citrus family)

Description. Small thornless tree or large shrub with alternate, simple, lanceolate to elliptic leaves, 3–5 m (10–16 ft) tall. Tiny, bell-shaped, white hermaphrodite flowers with 5 petals are produced in small clusters. Translucent pink fruits are round, distally flattened berries measuring 0.5–1 cm (0.2–0.4 in) in diameter.

Origin and Distribution. Native from India and Sri Lanka to Southeast Asia and parts of northern Australia. The tree is occasionally cultivated for its fruits or as an ornamental but rarely outside its natural range. The plant requires a humid tropical climate with or without a dry season, or a warm subtropical climate.

Food uses. The ripe fruits have a somewhat spicy, ginlike aroma. They are usually eaten fresh or as an aromatic snack. Since trees never produce large numbers of fruits, the fruit is most often eaten out of hand.

Comments. This little-known fruit has come to notice because of its antioxidant properties and its possible effectiveness in helping to slow the progress of degenerative diseases.

The genus *Glycosmis*, native to Southeast Asia, Oceania, and Australia, contains a large number of very closely related shrubs and trees, of which several are cultivated as ornamentals.

Gnetum gnemon L.

GNETUM, MELINJO

Gnetaceae (Gnetum family)

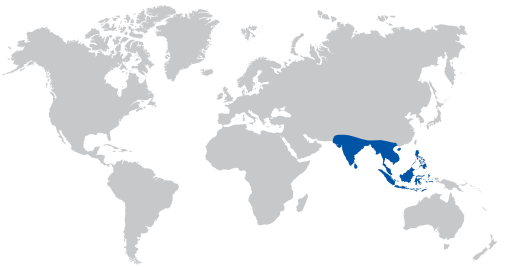
Description. Slender evergreen tree, 12–18 m (40–60 ft) tall, with whorled branches. Opposite, leathery, shiny leaves elliptic, 12–22 cm (5–9 in) long by 8–12 cm (3–5 in) wide. Monoecious, catkinlike flowers produce clusters of orange-red to red fruitlike strobili, which turn purple when fully ripe. The ellipsoid, fruitlike strobilus is 2–4 cm (0.8–1.6 in) long and contains a large nutlike seed.

Origin and Distribution. Native to dipterocarp forests of Southeast Asia and to the islands of the southwestern Pacific Ocean. The melinjo grows in the understory of rainforests and requires a warm, humid climate.

Food uses. The nutritious though slightly bitter-tasting seeds are eaten roasted or ground into a flour that is made into popular fried crackers called *emping* in Indonesia. The seeds are also used in traditional dishes like sour soups as well as in vegetable and meat curries throughout the region.

The young fruits, leaves, and flowers are eaten raw, boiled, or roasted. The seeds are often cooked and preserved as cakes, which are then processed into salted or sweet snacks.

Comments. The gymnosperm genus of *Gnetum* comprises 30–35 species of shrubs, trees, and lianas native to tropical regions of Asia, Africa, and America.



Grewia asiatica L.

PHALSA

Malvaceae (Mallow family)

Description. Small deciduous tree or large shrub with drooping branches and branchlets covered with fine hairs, 4–8 m (13–26 ft) tall. Alternate, cordate to ovate leaves, 14–20 cm (5.5–8 in) long by 8–12 cm (3–5 in) wide, with underside covered in soft short white hairs. Small yellow flowers are produced in cymes in the axils of leaves. Fruits dark purplish to reddish-black, 1–1.5 cm (0.4–0.6 in) in diameter, with a soft, fibrous flesh that has a pleasant, aromatic, subacid taste. Fruits contain 1 or 2 hard seeds.

Origin and Distribution. Native from India and Sri Lanka to Southeast Asia. The phalsa grows in tropical and warm subtropical climates, often with a distinct dry season, and can withstand occasional light frosts. Widely cultivated within its natural range, but quite uncommon elsewhere. In the Philippines and in parts of Australia, where the plant has been introduced and naturalized, it is considered an invasive species.

Food uses. The ripe fruits are eaten out of hand or made into sweet desserts or cooked with sugar to make a syruplike sauce. In India and Pakistan, the fruits are commonly made into juice that also contains a sweetener and ice. The fruit pulp is also used to make sherbets and ice cream.

Comments. The genus is named in honor of the English botanist and plant anatomist Nehemiah Grew (1641–1712). The unripe fruits are used in herbal medicine to treat inflammation and respiratory diseases.

Grias peruviana Miers

PITON, SACHA MANGO

Lecythidaceae (Brazil nut family)

Description. Evergreen tree with cauliflorous growth habit, 20–30 m (66–100 ft) tall. Alternate, entire, elliptic leaves 14–22 cm (5.5–8.6 in) long. Pale yellow, fragrant, symmetrical flowers with 4 petals and red stamens are produced on long, thin, woody stalks emerging from the trunk or directly on the trunk. Ovoid, light brown fruits, 15–20 cm (6–8 in) long with a tough orange flesh containing a single brown seed.

Origin and Distribution. Native to the northwestern Amazon region of Colombia, Ecuador, Peru, and parts of Bolivia. The tree grows in wet lowland rainforest of the upper Amazon tributaries. It forms dense groves in seasonally flooded forests and along rivers. The tree is rarely cultivated outside its natural range, but the fruits are sold in local markets in the Amazon region, especially around Iquitos.

Food uses. The aromatic, crisp flesh has a texture similar to carrots and is eaten out of hand as a snack. In the Amazon region, the peeled fruits are boiled or roasted and served with rice or cassava as a popular dessert. In parts of the Amazon, an edible oil is extracted from the fruits.

Comments. The fruit is rich in phenolic compounds that have shown strong antioxidant activity in laboratory trials. The bark of the tree is used by indigenous tribes in South America to induce vomiting. Some rainforest tribes traditionally encourage young girls to chew the flowers of the piton tree. It's believed that keeping flowers in the mouth for long periods permanently imparts scent to the girl's saliva, which in turn imparts flavor to *chicha*, a fermented alcoholic beverage made by women from chewed manioc or cassava root.

With its beautiful, cauliflorous flowers, the sacha mango tree has potential as an ornamental plant in tropical landscaping. The word *sacha*, often used in South America to describe various native plants, means "wild" in the Quechua language.

Herrania nitida (Poepp.) R. E. Schult.

CACAHUILLO, CACAO DE MONTE

Malvaceae (Mallow family)

Description. Small, slender, evergreen tree, 3–5 m (10–16 ft) tall. Alternate, palmately compound, long petiolate, light green, glabrous leaves with 7–9 entire leaflets, of which the central leaflet is 25–45 cm (10–18 in) long and the lateral ones are much smaller. Small, cauliflorous, red to scarlet flowers with yellow-red sepals and 5 broadly ovate petals are often grouped at the basal part of the trunk. Ovoid, green, longitudinally ribbed fruits, 10–12 cm (4–5 in) long by 5 to 7 cm (2–3 in) wide, have irritating hairs on the ridges. The white, soft, aromatic pulp encloses 30–40 roughly triangular, flattened seeds.

Origin and Distribution. Native to the western regions of the Amazon lowlands of Brazil, Colombia, Ecuador, Peru, and Bolivia. The tree grows in the understory of humid lowland rainforests. Fruits are almost exclusively collected from wild trees. Rarely known outside its natural range.

Food uses. Ripe fruits are cut open and the sweet-sour, delicious pulp is eaten fresh. The pulp is suitable for making milk shakes, sherbets, and ice cream. The seeds can be roasted to make a type of chocolate.

Comments. The principal importance of the genus *Herrania*, closely related to the cacao (*Theobroma cacao*, p. 308), lies in its potential as a source of germ plasm in a possible hybridization program with the cultivated species of cacao. The genus was named in honor of Pedro A. Herran (1800–1872), president of New Granada (Colombia) from 1841 to 1845.

The seeds of the closely related *H. purpurea* (p. 126) are used by the Bribri Indians of Central America to prepare a bitter drink similar to chocolate. In some parts of South America, the seeds of *Herrania* are used to improve the flavor of chocolate made from seeds of *Theobroma cacao*.

Herrania purpurea (Pittier) R. E. Schult.

MONKEY CACAO

Malvaceae (Mallow family)

H. purpurea is a close relative of cacao (*Theobroma cacao*, p. 308). The fruits are supposedly favored by wild monkeys.

Description. Small, slender, evergreen tree, 3–6 m (10–20 ft) tall. Glossy green leaves palmately compound with 5 obovate to elliptic leaflets 18–24 cm (7–9.4 in) long. Purplish-pink flowers with 5 recurved petals and several long, pink, threadlike petal-lamina that exceed the length of the flower. Flowers are borne directly on the trunk. Yellow fruits reminiscent of cacao fruits but only 8–12 cm (3–5 in) long by 4–8 cm (1.6–3.2 in) wide. Exocarp deeply lobed and covered in fine, irritating hairs. Fruits contain several triangular seeds 1 cm (0.4 in) long surrounded by a white, juicy, mucilaginous pulp with a sweet-sour and very aromatic flavor.

Origin and Distribution. Native to a region from Nicaragua and Costa Rica to Colombia and Venezuela in northern South America, where the tree grows wild in the understory of primary tropical rainforests. The monkey cacao is rarely cultivated but can sometimes be found in collections of rare tropical trees. It requires year-round high humidity and grows only under tropical conditions.

Food uses. This fruit has a delicious, refreshing taste and can be eaten out of hand by sucking the pulp off the seeds. The seeds were used by indigenous people of Central and South America to prepare a drink similar to cacao. Chocolate made from the roasted seeds of *H. purpurea* is said to be of superior quality.

Comments. *H. purpurea* is a close relative of cacao (*Theobroma cacao*). The fruits are supposedly favored by wild monkeys. The fruits of *H. umbratica*, a related tree species native to the Amazon lowlands of Colombia, are also called monkey cacao.

Hibiscus sabdariffa L.

ROSELLE

Malvaceae (Mallow family)

Description. Annual bushy shrub with smooth, reddish stems. Alternate simple or deeply lobed leaves with distinctive red veins, 7–13 cm (2.8–5 in) long. Flowers borne singly in axils of leaves, 10–13 cm (4–5 in) in diameter, yellow with dark red center. Mature flowers start developing the characteristic dark red calyx, comprising 5 large sepals and 8–12 thin bracts at the base. These become fleshy and crisp and enclose the seed capsule in the center. The thick calyx leaves are the edible part of the inflorescence and taste acidic.

Origin and Distribution. Native from India and Sri Lanka to Malaysia. Today the roselle is grown in tropical and some subtropical regions around the world.

Food uses. The calyxes can be eaten fresh in fruit salads. More often, the calyxes, which are high in pectin, are boiled and made into a sauce (tastes similar to cranberry sauce) that is used as a topping for puddings, cakes, and ice cream. The stewed calyxes are used to make jams, marmalades, relishes, and chutneys. In Mexico and Central American countries, where the plant is called *flor de Jamaica*, a cooling beverage is made from the calyxes. In Africa and Jamaica, the roselle calyxes are boiled with ginger and then served ice cold with rum as a drink that is especially popular around Christmastime. Dried calyxes are consumed as a herbal tea. In tropical Africa the stewed calyces are often served with mashed peanuts as a side dish.

The green, acidic-tasting leaves can be eaten raw in salads or cooked like spinach. In some Asian countries, the leaves form part of spicy curry dishes. The seeds contain oil that can be used for human consumption.

Comments. Roselle calyxes are rich in vitamin C and anthocyanins. The plant is currently being exported to North America and Europe, where the deep red calyxes are used to produce natural food colorings and flavorings for liqueurs. The dried calyxes are sold in health stores as an herbal tea rich in ascorbic acid and acting as a mild laxative. The largest producers of roselle calyxes are China and Thailand.

Hylocereus megalanthus
(K. Schum. ex Vaupel) Ralf Bauer

YELLOW PITAHAYA

Cactaceae (Cactus family)

This cactus, with its spectacular flowers, is commonly grown as an ornamental.

Description. Hemiepiphytic, fast-growing cactus with climbing or crawling growth habit. Stems 3-ribbed with white areoles with 2 or 3 spines, each 2–4 mm (0.08–0.16 in) long. Very large fragrant flowers, 30–40 cm (12–16 in) long, with small bracts, recurved linear sepals, showy petals, and yellow stamens and stigma. The flowers open at night and are pollinated mainly by nectar-feeding bats. Spiny yellow fruits ovoid, 8–10 cm (3–4 in) long with white flesh and tiny black seeds. Fruits have a pleasant subacid to sweet taste.

Origin and Distribution. Native to parts of northern and eastern South America from Venezuela and Colombia to Peru and Bolivia. The plant grows naturally on trees or on rocks in tropical dry forests. Cultivated on a small scale for its fruit throughout the humid and dry tropics. This cactus, with its spectacular flowers, is commonly grown as an ornamental.

Food uses. The fruits, which some consider superior to those of other *Hylocereus* species, are eaten out of hand after the spines are removed. Fully ripe fruits are blended with water, ice, and sugar for a refreshing fruit drink. Yellow pitahayas are sliced and added to fruit salads or used as an exotic garnish on ice cream and desserts.

Comments. This species is also known by the synonym *Selenicereus megalanthus*. It is believed that the yellow pitahaya might be a natural hybrid between *Hylocereus* and *Selenicereus*.

Hylocereus undatus (Haw.) Britton & Rose

RED PITAHAYA, DRAGONFRUIT

Cactaceae (Cactus family)

Description. Epiphytic or hemiepiphytic cactus climbing with aerial roots. Stems are 3-sided, fleshy, with thorny margins and 2–5 dark spines on each areole. Very large, fragrant, bell-shaped flowers 20–25 cm (8–10 in) long with snow-white petals and numerous cream-colored stamens. The nocturnal flowers are pollinated by bats. Nonspiny, bright magenta-colored fruits ovate to globose, 6–12 cm (2.4–4.8 in) in diameter with whitish, sweet to sweet-sour, juicy flesh and numerous tiny black seeds.

Origin and Distribution. Although its exact origin is unknown, the plant is probably native to the Pacific lowlands, from southern Mexico to Costa Rica. It grows naturally as an epiphyte on trees or as a lithophyte on rocks, in tropical dry forests and arid coastal areas. Cultivated throughout the tropics. The fruit is very popular in Southeast Asia, where it is known as dragonfruit.

Food uses. Chilled fruits are cut into slices and consumed fresh. The flesh is often blended with water, ice, and sugar to make a refreshing fruit drink. Fruit slices are used in fruit salads or as garnish for desserts, ice cream, and cocktails. Entire fruits are boiled with sugar to make a thick syrup for desserts and sweets. Unopened flower buds are cooked and eaten as a vegetable. The reddish-purple juice of species with red pulp is used as a natural food coloring.

Comments. The fruits of several similar *Hylocereus* species are called pitahaya or pitaya. A similar, often cultivated species is dragonfruit or purple pitahaya (*H. costaricensis*), native to tropical Central America. It is distinguished from the red pitahaya by its red fruits with magenta colored flesh. Another red-fleshed, cultivated species is *H. guatemalensis*. *H. megalanthus* has spiny yellow fruits.

Hymenaea courbaril L.

JATOBÁ, WEST INDIAN LOCUST TREE

Fabaceae (Bean family)

The reddish-brown, indehiscent fruit pod has a very hard, thick exocarp.

Description. Very large, deciduous tree, 30–45 m (100–150 ft) tall, with thick trunks up to 2 m wide. Alternate, compound leaves with 2 characteristically paired, asymmetrical leaflets. These are 6–10 cm (2.4–4 in) long, glossy, leathery, with petioles 1–2 cm (0.4–0.8 in) long. Flowers with 5 reddish-brown and green sepals, white petals, and long, emerging stamens, produced in mostly terminal racemes. Reddish-brown, indehiscent fruit pods, 10–15 cm (4–6 in) long, with a very hard, thick exocarp and 3–6 ovoid, blackish-brown seeds embedded in a light green, powdery pulp.

Origin and Distribution. Native to tropical lowlands of Central America, the Caribbean, and South America. The tree grows naturally in seasonally dry forests as well as rainforests with a short dry season. Occasionally cultivated as an ornamental.

Food uses. The hydrated, pastelike pulp, although having a strong, disagreeable smell, is edible, tastes sweet, and is often mixed with milk and sugar to make nutritious drinks. Beverages made from the pulp have long been used as tonics and natural energy drinks.

Comments. The pulp contains about 5.9% protein, 2.2% fat, and 75% carbohydrate. The bark contains a yellow or reddish-brown resinlike sap, used for producing varnishes, as incense, and as herbal medicine. The resin is used in traditional medicine as a fungicide and for treating diseases of the respiratory tract, among many other uses. The hard, reddish-brown, very valuable wood is used for making furniture, artwork, and musical instruments.

Inga edulis Mart.

GUABA, ICE CREAM BEAN

Mimosaceae (Mimosa family)

Description. Short-trunked, medium-sized evergreen tree 15–20 m (50–66 ft) tall, with a spreading, umbrella-shaped crown. Alternate, pinnate leaves, 20–25 cm (8–10 in) long, are covered in short brown hairs. Each leaf consists of 4–6 pairs of opposite, oval leaflets. The broadened rachis contains a nectary gland between each pair of leaflets. Showy white flowers are borne in axillary spikes with large numbers of long white stamens. Cylindrical, often twisted, ribbed pods up to 1 m (3.3 ft) long by 3–5 cm (1.2–2 in) wide. Beanlike green seeds are embedded in a sweet, spongy white pulp.

Origin and Distribution. The tree is native to riparian habitats of the Amazon lowlands of Brazil, Bolivia, Colombia, Ecuador, and Peru. *I. edulis* is often grown as a fruit or shade tree in tropical regions of Central and South America. Occasionally grown in tropical Africa and Asia.

Food uses. The long fruits are split open and the soft, cottonlike pulp is usually eaten out of hand. The fruits are sometimes sold in local markets in tropical America.

Comments. Several species of *Inga* are cultivated as ornamentals for their beautiful flowers and dark green foliage. *I. edulis* and *I. oerstediana* are often planted in coffee and cacao plantations as shade trees and for soil protection. *Inga* trees live in symbiosis with nitrogen-fixing bacteria of the genus *Rhizobium*, which exist in nodules on the roots and help to improve the content of plant-available nitrogen in the soil.

Various species of *Inga* are harvested for their sweet pulp. The tree provides excellent firewood that burns readily and is almost smokeless.

Inga spectabilis (Vahl) Willd.

GUAMA MACHETE

Mimosaceae (Mimosa family)

This fruit is often sold in Latin American markets or at roadside stands.

Description. Evergreen tree 8–16 m (26–52 ft) tall, with young branches sharply 4-sided. Alternate, compound, dark green leaves, 20–30 cm (8–12 in) long by 10–20 cm (4–8 in) wide with 2 pairs of elliptic leaflets. There is a cuplike, brown nectary at the base of each pair of leaflets. Showy white flowers, about 10 cm (4 in) wide with long white stamens, are produced in terminal spikes. Green, often curved pods 60–70 cm (24–28 in) long by 6–9 cm (2.4–3.5 in) wide with shiny blackish-green, beanlike seeds embedded in a creamy to juicy white pulp. The pulp has an agreeable fruity, subacid to sweet taste.

Origin and Distribution. Native to tropical regions of South and Central America. The tree grows naturally in humid lowland and premontane forests as well as in disturbed areas such as those along roads. Often grown as a dooryard and shade tree. Occasionally cultivated in Africa and Asia.

Food uses. The pulp of ripe fruits is eaten out of hand or made into milk shakes and juices. Also used to flavor desserts and ice cream. Usually, the fruits are opened with a knife and the sweet pulp sucked from the seeds. Fruits are often sold in Latin American markets or at roadside stands.

Comments. The genus *Inga* consists of more than 200 species, all native to the Neotropics. The fruits are commonly called *guaba* in most of Spanish-speaking Latin America.

Inocarpus fagifer (Parkinson) Fosberg

TAHITIAN CHESTNUT

Fabaceae (Bean family)

Description. Medium-sized evergreen tree with spirally arranged branches, 15–25 m (50–80 ft) tall. Alternate, simple, oblong leathery leaves with pointed apex, 15–40 cm (6–16 in) long. White or light yellow flowers are borne in small clusters along branches. Fruits irregularly shaped or ovoid, somewhat flattened, 10–13 cm (4–5.2 in) in diameter. The skin is smooth, light green at first then orange-brown when fully ripe. The kidney-shaped seed kernel is surrounded by a fibrous shell.

Origin and Distribution. The species is indigenous to the Solomon Islands, Fiji, Vanuatu, and Papua New Guinea. Introduced into regions of Southeast Asia and often naturalized. Very rarely cultivated in Africa or tropical America.

The tree requires a humid tropical climate with rainfall distributed uniformly throughout the year. The Tahitian chestnut, which can withstand temporal flooding, grows on a wide variety of soils, is tolerant of salt, and prefers sunny locations.

Food uses. The edible kernel contains about 5% protein and 22% carbohydrate and is an important indigenous food in the South Pacific region. The seeds, which are inedible when raw, are boiled and then roasted, grilled, or baked. The national dish of Vanuatu, called *lap lap*, is made by wrapping mashed Tahitian chestnuts together with meat, chicken, or fish in banana leaves, then cooking in an underground oven. The boiled seeds are sometimes mashed to produce a kind of pudding.

Comments. All parts of the tree have been used in traditional medicine; for example, the juice of the mesocarp of green fruits was used in Tonga to treat insect bites and burns. The trunk is used for making canoes on the Solomon Islands. The wood makes excellent firewood. Green wood is burned to dry copra (*Cocos nucifera*, p. 249).

The tree is occasionally used in agroforestry projects to prevent soil erosion and as a shade tree in cacao plantations.

Jatropha curcas L.

BARBADOS NUT

Euphorbiaceae (Spurge family)

Description. Semideciduous shrub or small tree, 4–6 m (13–20 ft) tall, with milky latex. Alternate, ovate, pale green leaves deeply 3–5 lobed, 10–35 cm (4–14 in) long by 10–35 cm (4–14 in) wide. Yellowish-green, bell-shaped monoecious flowers are produced in cymes. Fruits are round 3-valved capsules, 3 to 4 cm (1.2–1.6 in) long, containing 2–3 black seeds 2 cm (0.8 in) long.

Origin and Distribution. Probably native to Central America and Mexico. The drought-resistant plant is cultivated throughout the tropics and warm subtropics. Often escaped from cultivation and naturalized.

Food uses. Although raw seeds are highly toxic to humans, in the state of Veracruz, Mexico, the boiled and roasted seeds are favored as snacks. It is unclear whether their nonpoisonous quality is due to a nontoxic variety of *J. curcas* in Central America and Mexico, or to a detoxifying effect of cooking. The young leaves are eaten steamed or stewed.

Comments. Seeds contain 25–40% oil and toxalbumin (curcin), which is highly poisonous to humans. The consumption of raw seeds can be potentially fatal. The oil-rich seeds were traditionally used for illumination and the production of soap; today they are processed primarily to make biodiesel.

Lacmellea edulis H. Karst.

SWEET MILK TREE

Apocynaceae (Dogbane family)

The orange, juicy pulp of ripe fruits has a very sweet taste.

Description. Small evergreen shrub or tree, 5–8 m (16–26 ft) tall. All plant parts contain a white, sweet-tasting latex. Opposite, entire, elliptic to lanceolate leaves with wavy margins 8–14 cm (3–5.5 in) long by 2–3 cm (0.8–1.2 in) wide. White, tubular flowers with 5-pointed corolla. Spherical yellow fruits with a pointed tip measure 2–4 cm (0.8–1.6 in) in diameter. The orange, juicy pulp of ripe fruits has a very sweet taste.

Origin and Distribution. Native to tropical America, where the plant grows in tropical lowland rainforests. The tree is occasionally cultivated for its fruit or as an ornamental.

Food uses. The sweet fruits are eaten out of hand, often collected from wild trees. The milky sap of the plant, which tastes sweet, is also eaten and was extensively used as food by indigenous people of Colombia and Venezuela.

Comments. The name of the genus, *Lacmellea*, from the Latin *lac* for milk and *mel* for honey, refers to the sweet latex of the plant. Many other species in the Apocynaceae family contain inedible or even toxic latex.

Lansium domesticum Corrêa

LANGSAT

Meliaceae (Mahogany family)

Ovoid fruits in clusters of 2–30 fruits with pale brown to pale yellow, thick, leathery skin with milky latex.

Description. Evergreen, single-stemmed, medium-sized tree, growing 15–25 m (50–80 ft), with brown, furrowed bark. Compound leaves pinnate, 20–50 cm (8–20 in) long with 5–7 alternate leaflets, 10–20 cm (4–8 in) long, elliptic to obovate with pointed apices and prominent midribs. Pale yellow hermaphrodite flowers are borne in simple or branched racemes with up to 30 blossoms, on the trunk and on thicker branches. Ovoid fruits in clusters of 2–30 fruits with pale brown to pale yellow, thick, leathery skin with milky latex. Pulp divided into 5 or 6 segments, translucent, juicy, subacid to sweet in taste, reminiscent of grapes and grapefruits. Fruits contain several green seeds that have a very bitter taste.

Origin and Distribution. The langsat is native to Malaysia, where it often grows wild along riverbanks. The tree, which is popular throughout Southeast Asia, is commonly cultivated in gardens and plantations. Langsat trees require a humid tropical climate and grow from sea level to 800 m (2,600 ft).

Food uses. Varieties with a high latex content must be dipped in boiling water to remove the latex. Peeled and seeded fruits are served as dessert or cooked in various dishes. Langsat fruits are canned in syrup.

Comments. The popularity of the langsat is somewhat hindered by the long time it takes for trees to begin to bear fruit. Trees grown from seed can take 10–30 years to start bearing fruit. Air layering or grafting produces faster-producing trees.

Several cultivars of the langsat exist. The 'Duku' variety has large fruits 3–5 cm (1.2–2 in) in diameter with little or no latex and a sweet, aromatic pulp. The 'Longkong' variety from Thailand has smaller fruits, 3 cm (1.2 in) wide, with leathery skin, sweet pulp, no latex, and few or no seeds. The main producers of langsat fruits are Thailand, Indonesia, and Malaysia.

Lecythis zabucajo Aubl.

PARADISE NUT, SAPUCAIA

Lecythidaceae (Brazil nut family)

Fruits are dark brown, hard woody capsules with a lid that falls off at maturity.

Description. Evergreen tree with arching branches, 25–40 m (80–130 ft) tall. Alternate, simple, glabrous leaves, 5–15 cm (2–6 in) long by 3–7 cm (1.2–2.8 in) wide, elliptic to obovate to oblong-lanceolate. White, purple-tinged, or purple flowers with 6 petals and numerous stamens are produced in terminal panicles. Fruits are dark brown, hard woody capsules with a lid that falls off at maturity. Fruits contain 10–40 oval purple seeds, 5–7 cm (2–2.8 in) long, with longitudinal ridges and a cream-colored, edible aril.

Origin and Distribution. Native to humid tropical regions of northern South America from Colombia and Venezuela south to Brazil and Peru. It grows as a canopy tree in evergreen lowland rainforests. The tree is rarely cultivated as a fruit tree except in small plantations in Brazil, despite its superior-quality seeds.

Food uses. The nutritious seeds are eaten raw or roasted. The taste is said to be equal or even superior to the Brazil nut (*Bertholletia excelsa*, p. 40), which belongs to the same family. The seeds are also used for bakery goods and as garnish on desserts and ice cream. The aril is edible and tastes like licorice.

Comments. The tasty and nutritious paradise nut has a lot of potential for commercial production and for sustainable usage of tropical rainforests. In the wild, the arils with attached seeds are sought by different bat species, in particular the greater spear-nosed bat (*Phyllostomus hastatus*), the main seed disperser. The hard shells of the paradise nut are also opened by agoutis and squirrels.

Licania platypus (Hemsl.) Fritsch

SANSAPOTE

Chrysobalanaceae (Chrysobalanus family)

The flavor and texture of the flesh are similar to pumpkin pie filling.

Description. Large evergreen tree with a dense rounded crown, 30–50 m (100–165 ft) tall. Alternate, glossy dark green leaves elliptic to lanceolate, 12–28 cm (5–11 in) long by 3–8 cm (1.2–3 in) wide. New leaves are attractively purple-red in color. Small white, sweetly fragrant flowers are borne in terminal pyramidal panicles. Fruits ovoid, pyriform, or of irregular shape with a rough brown skin and fibrous, soft, orange-yellow to dark yellow, sweet pulp. The flavor and texture of the flesh are similar to pumpkin pie filling. Fruits contain a single round to oblong, large brown seed.

Origin and Distribution. The sansapote grows naturally in southern Mexico, throughout most of Central America and in northern Colombia. The tree is often planted as an ornamental and shade tree because of its beautiful, dense foliage and fragrant flowers but is very rarely cultivated outside its natural range. The sansapote grows in tropical climates under dry or humid conditions.

Food uses. Fully ripe fruits are eaten fresh by scooping the soft flesh with a spoon.

Comments. Although the fruit has a sweet, agreeable flavor, its appeal is often diminished by the high content of fiber and by insect damage to the developing fruit. The reddish, heavy heartwood is of good quality and used in furniture making and construction.

Litchi chinensis Sonner

LYCHEE

Sapindaceae (Soapberry family)

Description. Evergreen tree with a dense rounded crown, 12–30 m (40–100 ft) tall. Alternate, pinnately compound leaves 10–20 cm (4–8 in) long with 4–8 leaflets that are 4–8 cm (1.6–3 in) long, elliptic to lanceolate, and glossy dark green. Small, fragrant yellowish, white, or greenish flowers are borne in terminal panicles. Red or pink fruits round, ovoid, or heart-shaped, about 3–4 cm (1.2–1.6 in) long by 2.5 cm (1 in) wide, with a warty, rough, leathery skin. Sweet, aromatic, translucent to white flesh contains a single shiny dark brown seed.

Origin and Distribution. Native to southern China, where the lychee has been cultivated for at least 3,000 years. The tree was praised and pictured in Chinese literature, with the earliest known record in AD 1059. Extensively cultivated throughout tropical and subtropical Asia, especially in China and northern India. More recently also grown on a commercial scale in the southern United States, Mexico, South Africa, Brazil, and Australia. The tree requires a warm subtropical or cool tropical climate without frost and with high rainfall during the summer months.

Food uses. Lychees are usually eaten fresh. The flesh can be used in fruit salads and in a great variety of desserts. Peeled and seeded fruits are sometimes filled with cream cheese or ice cream. They are also used in savory beef and chicken dishes. In Asia, lychees are made into pickles, sauces, jellies, and even wine. Seeded lychees are blended with cream, sugar, and lime juice to make a delicious sherbet. For export the seeded fruits are canned in syrup. Dried lychees, often called litchi nuts, are used like raisins.

Comments. Lychees contain about 72 mg (0.003 oz) vitamin C per 100 g (0.22 lbs) flesh. They are also a good source of polyphenols. The more than 40 cultivars differ mainly in skin color and also in texture, fragrance, flavor, form of the seed, and even color of the flesh. The hard wood is used in construction and furniture manufacturing.

Litsea garciae Vidal

ENGKALA

Lauraceae (Laurel family)

Description. Medium-sized to large evergreen tree, 12–24 m (39–79 ft) tall, with an open crown consisting of horizontal branches. Alternate, glabrous leaves with stout petioles. Blades elliptic to ovate, 25–40 cm (10–16 in) long by 6–20 cm (2.4–8 in) wide. Small flowers are produced in axillary umbels. Pale pink to dark pink fruits are compressed, globose berries 3–4 cm (1.2– 1.6 in) wide, seated on a fleshy, yellowish, cup-shaped perianth receptacle. Fruits have soft creamy white flesh and contain a single round seed.

Origin and Distribution. Native to Borneo, the Philippines, and probably the Malay Peninsula and parts of Indonesia. The tree grows wild in evergreen, broad-leaved dipterocarp rainforests, often close to rivers and lakes. The engkala tree requires a climate with year-round high temperature and evenly distributed rainfalls. The engkala is occasionally cultivated in Southeast Asia but virtually unknown as a fruit tree anywhere else.

Food uses. Ripe fruits have an exquisite, delicate taste very similar to the avocado (*Persea americana*, p. 183), also placed in the family Lauraceae. The fruits are eaten fresh, sometimes sprinkled with lime juice and salt, or used in salads. They are used very much like avocado to accompany savory dishes. In the Philippines, pieces of the flesh are steamed with rice.

Comments. The seed oil was formerly used to make soap and candles. The genus *Litsea* consists of more than 400 species native to the tropics and subtropics of Asia, Australasia, and the Americas.

The engkala is an underappreciated fruit, and the plant deserves more attention as an easy-to-grow tropical fruit tree producing tasty, nutritious fruits and as an exotic ornamental.

Luffa aegyptiaca Mill.

SMOOTH LUFFA, LOOFAH

Cucurbitaceae (Cucumber family)

Description. Vigorous annual vine climbing up to 10 m (33 ft), with branched tendrils. Alternate, deeply to moderately lobed leaves with rough surface. Monoecious yellow flowers, measuring 4–5 cm (1.6–2 in) in diameter, are borne in racemes in the axils of leaves. The flowers are pollinated by insects. Fruits elongated to cylindrical, 40–60 cm (16–24 in) long with smooth green surface and longitudinal veins. The light green, crisp flesh is the edible endocarp tissue. Ripe fruits develop a bitter taste and a strong, fibrous xylem tissue with several hollow compartments that contain numerous flat black seeds.

Origin and Distribution. Probably native to tropical Asia. The exact origin is unknown. In India, wild, bitter varieties of luffa occur in the wild. The plant spread very early through the Middle East to Africa. Today it is grown throughout the tropics, often as a dooryard plant. It requires a tropical or warm subtropical climate.

Food uses. Immature fruits in which the fibrous xylem tissue is undeveloped are tender, with a mildly sweet, delicate flavor similar to zucchini or okra. Luffas are usually consumed boiled or fried. They are eaten in tropical Asia and Africa as a vegetable in a variety of dishes, including soups, stir-fries, meat dishes, and curries. In India, the unripe luffa is commonly eaten with peanuts or beans.

Comments. Mature luffa fruits have a tough, fibrous, spongelike xylem tissue, used primarily for bath and kitchen sponges but also for soles of beach sandals, filters, insulation, and packing materials. To obtain the tissue, ripe fruits are submerged in water for several weeks. During this process the pulp and other soft tissues rot and disintegrate. The sponges are then washed, dried in the sun, and sometimes bleached.

A closely related species from tropical Asia, the angular luffa (*L. acutangula*), is also cultivated as a vegetable and for its fibrous tissue.

Lupinus mutabilis Sweet

ANDEAN LUPINE, CHOCHO

Fabaceae (Bean family)

Description. Erect, leguminous, herbaceous plant reaching 2 m (6.6 ft) in height. Alternate, palmately compound leaves are densely covered in soft, silvery hairs. Purple, self-pollinated flowers in showy, erect racemes. Fruits laterally compressed, hairy pods, 7–12 cm (2.8–5 in) long, containing 3–6 flat white seeds.

Origin and Distribution. Native to the Andes mountain range of Peru, Bolivia, and Ecuador, where the plant grows at elevations between 1,000 and 4,000 m (3,300–13,000 ft). The Andean lupine is an ancient food plant that has been in cultivation in the central Andes for millennia. Rarely cultivated as a food plant outside its natural range.

Food uses. The seeds of some cultivars contain toxic, water-soluble alkaloids. Immersing them in water for several days and boiling renders them safe to eat. In the Andean cultures, the seeds are traditionally used in soups and stews, often mixed with corn (*Zea mays*, p. 241). Locally the seeds are used for baking bread and making sweet desserts. In some parts of the Andes, a nutritious drink is prepared from the ground seeds. Oil extracted from the seeds is used as a cooking oil.

Comments. The seeds contain about 20% fat and 45% protein, a good source of the essential amino acid lysine. Having close to 420 calories per 100 grams (0.22 lbs) dry weight makes the seed an important caloric energy source for the Andean population. The nitrogen-fixing Andean lupine is often grown in cycles with other crops like corn or potatoes to improve fertility of marginal soils.

Macadamia integrifolia Maiden & Betche

MACADAMIA NUT

Proteaceae (Protea family)

The fruits, although commonly called nuts, are botanically follicles.

Description. Medium-sized evergreen tree with broad growth habit, 10–20 m (33–66 ft) tall. Simple, whorled leaves 7–18 cm (2.8–7 in) long, oblong-obovate, with spinelike, sharply toothed margins. White, pinkish or cream-colored flowers are produced in pendent racemes 30–40 (12–16 in) cm long. Green, globose, dry dehiscent fruits 1.5–4 cm (0.6–1.6 in) wide, splitting open when ripe and exposing a creamy white seed kernel surrounded by a very hard, brown, and smooth seed coat. The fruits, although commonly called nuts, are botanically follicles.

Origin and Distribution. Native to the northeastern state of Queensland in Australia. The tree grows naturally in subtropical to tropical, seasonally dry lowland forests. Widely cultivated in tropical and subtropical countries.

Food uses. Seeds are eaten raw or roasted as sweet or salted snacks. They are a common ingredient in sweets and bakery goods. The seeds are also used in recipes for savory dishes and fillings, and as garnish for cakes and fruit salads. Pieces of macadamia nuts are often added to granola bars and cereals.

Comments. The highly nutritious seeds contain about 60–80% fat, mainly monounsaturated, and 8% protein. The valuable seed oil is used in cosmetics, especially skin-care products.

Also of commercial importance is *M. tetraphylla*, distinguished from *M. integrifolia* by its rough seed coats. Hybrid forms exist between the two species. The main macadamia-producing regions are Australia, California, Hawaii, South Africa, Central America, Mexico, and Malawi.

Madhuca longifolia (J. Koenig ex L.) J.F. Macbr.

MAHUA TREE, INDIAN BUTTER TREE

Sapotaceae (Sapodilla family)

Description. Deciduous tree with a rounded crown and gray, cracked and fissured bark, 20–25 m (66–82 ft) tall. Alternate elliptic to oblong, leathery leaves 15–25 cm (6–10 in) long by 6–10 cm (2.4–4 in) wide. Flowers cream-colored with fleshy petals. Greenish, ovoid fruits are 3–5 cm (1.2–2 in) long and contain 1–4 shiny brown seeds.

Origin and Distribution. Native to lowlands of southern India and the evergreen forests of the Western Ghats from Konkan southward. The Mahua tree is common in deciduous tropical forests below 1,200 m (4,000 ft). Very rarely cultivated outside India.

Food uses. The seeds contain up to 40% edible fat, semisolid at ambient temperatures and used as vegetable butter. It is employed in the manufacture of sweets and chocolate. The sweet-tasting flowers are eaten as a vegetable. Most often the dried flowers are mixed with granular molasses and fermented to produce an alcoholic drink. The resulting wine is then distilled into a locally popular liquor called *mahua*.

Comments. Two species of *Madhuca* are commonly cultivated in India. The second species, *M. latifolia*, occurs naturally in central and northern India, whereas *M. longifolia* is native to southern India.

The seed oil, commercially known as malina butter, consists mainly of palmitic, stearic, and oleic fatty acids. Besides its use as a vegetable fat, it is made into skin-care products, hair oil, soaps, and detergents. It is also used as lamp oil. The oil plays an important role in traditional Indian medicine, where it is used as a laxative and for treating skin diseases and rheumatism. The seed cake left from the extraction of seed oil is rich in proteins. It is used as fertilizer and for the production of detergents.

Malpighia emarginata DC.

BARBADOS CHERRY, ACEROLA

Malpighiaceae (Acerola family)

Juice made from the Barbados cherry is used in traditional medicine to treat flu and cold symptoms and also to cure respiratory diseases.

Description. Large, densely branched, evergreen shrub or small tree, 4–6 m (13–20 ft) tall. Opposite, simple, dark green leaves, lanceolate-ovate, 3–6 cm (1.2–2.4 in) long with short petioles. Perfect flowers with pink- or lavender-fringed petals in small cymes. Faintly 3-lobed fruits 1–3 cm (0.4–1.2 in) in diameter, round to oblate, red to deep crimson drupes with glossy skin. Orange pulp juicy, acid to subacid, with 3 hard stones.

Origin and Distribution. Native to tropical regions of the Caribbean and Central and South America. The acerola is cultivated in many tropical and warm subtropical countries. The plant is resistant to drought and can withstand light frosts. Also planted as a potted ornamental or as a hedge. The plant is popular as a bonsai because of its colorful fruits and beautiful foliage.

Food uses. Fruits can be eaten fresh, but they are quite sour. Normally they are boiled or stewed, sweetened, strained, and eaten as dessert. The fruit provides a tasty juice enjoyed by itself or mixed with other fruit juices like pineapple or coconut water. The fruits can also be made into a delicious sauce used as a topping on ice cream, cakes, and other fruits; they are also used as pie filling. Acerolas are utilized to make jellies and jams. A wine is made from ripe fruits. The fruit is widely used in the health industry as a natural source of vitamin C.

Comments. The acerola is famous for an exceptionally high content of vitamin C. Unripe fruits can contain as much as 4,500 mg (0.16 oz) vitamin C per 100 g (0.22 lbs) fruit, and 1,000–2,000 mg (0.04–0.07 oz) per 100 g (0.22 lbs) ripe, edible portions of the fruit. That is about 32 times the amount of vitamin C in an orange. The juice also shows very high antioxidant activity and is used in traditional medicine to treat flu and cold symptoms and also to cure respiratory diseases.

Mammea americana L.

MAMEY

Clusiaceae (St. John's wort family)

Description. Medium-sized evergreen tree with dense foliage and compact growth habit, 8–20 m (26–66 ft) tall. Opposite leaves leathery, glossy, broadly ellipitic, up to 20 cm (8 in) long and 10 cm (4 in) wide. Fragrant flowers with 4–6 white petals and orange stamens, borne singly or in small clusters on short stalks. Male, female, and hermaphrodite flowers may occur on the same or separate trees. Fruit is a globular berry with brown skin, 10–20 cm (4–8 in) in diameter. The nonfibrous, fragrant pulp is yellow or orange, crisp, juicy or dry, depending on variety, and contains 1–4 brown seeds.

Origin and Distribution. The tree is native to northern South America and the Antilles. It is not well known in Africa or in tropical Asia. The tree needs a tropical or near-tropical climate and grows in its natural habitat usually below 1,000 m (3,300 ft) altitude.

Food uses. In Jamaica, the fruit is served with wine, sugar, and cream. The pulp is used to make marmalade, jams, and preserves and for pie and tart fillings. The pulp is known to keep its unique flavor over a long period of time. In the Dominican Republic, the flesh is blended with sugar and served as a frozen sherbet. In El Salvador, the pulp is used to flavor a carbonated soft drink marketed under the name Kolashanpan. In the French West Indies, the flowers are used to distill a liqueur called *crème de créole* that is consumed as a digestive or tonic.

Comments. Various parts of the tree, especially the seeds, have insecticidal properties. The pulverized seeds have been used in traditional Central and South American medicine to treat parasitic skin diseases and also to get rid of lice and chiggers on humans and domestic animals.

Mangifera indica L.

MANGO

Anacardiaceae (Cashew family)

Mango peel and sap contain uroshiol, an oily organic allergen also found in poison ivy and poison sumac.

Description. Large evergreen tree 25–40 m (80–130 ft) tall with a broad crown up to 40 m (130 ft) wide. Alternate, lanceolate leaves 12–30 cm (5–12 in) long by 2–6 cm (0.8–2.4 in) wide, often whorled at tips of branches. Young emerging leaves are reddish, yellowish, or pink in color. Multiple small yellow or reddish flowers are produced in erect terminal panicles, branched and up to 40 cm (16 in) long. Fruits range from 5 to 25 cm (2–10 in) in length and up to 2.5 kg (5.5 lbs) in weight. The aromatic flesh is usually juicy, fibrous or nonfibrous, sweet, and yellow to orange in color. Some varieties have a distinct turpentine smell, especially when not fully ripe. Each fruit contains 1 large flattened and ribbed stone with a single seed.

Origin and Distribution. Native to southern Asia, where it has been in cultivation for at least 4,000 years. Buddhist monks possibly carried the mango on voyages to Malaysia and eastern Asia in the fourth and fifth centuries BC. Portuguese and Spanish sailors introduced it to Africa and the Americas in the sixteenth century. The tree was first grown in the Caribbean around 1740.

Requires a tropical climate with a distinct dry season for optimal fruit production. High precipitation when the tree is in bloom inhibits fruit production. Mango trees prefer loamy soils and full sun.

Food uses. Ripe mangos are eaten fresh, used in fruit salads, or made into juice. They are commonly made into desserts, jams, and ice cream or sorbets. They are also used as fillings or toppings in bakery goods. Unripe green mangos are often sprinkled with salt and lime juice and eaten out of hand. They are used in salads as well as to make chutneys, jellies, and pie fillings and are pickled or dried and powdered. In Thailand and other regions like Central America, green mangos are eaten by dipping them in a spicy mixture of salt, sugar, chilies, and sometimes soy sauce.

Mango slices are used in a wide variety of savory dishes, including stir-fries, curries, chicken and seafood salads, and sauces throughout tropical Asia. Tender young mango leaves are eaten boiled in parts of Southeast Asia.

Comments. Ripe mangos are a very good source of vitamins A and C and are high in fiber and minerals. They are also known for their high antioxidant content. The mango is the national fruit of India, Pakistan, and the Philippines and the national tree of Bangladesh. The tree plays an important role in rituals and religious ceremonies in South and Southeast Asia. Mango leaves are used to decorate homes during weddings and celebrations. The most important producers of mangos are India, China, Thailand, and Indonesia. Mango peel and sap contain uroshiol, an oily organic allergen also found in poison ivy and poison sumac that can cause contact dermatitis in people who are susceptible.

Manilkara zapota (L.) P. Royen

SAPODILLA

Sapotaceae (Sapodilla family)

Description. Large evergreen tree with white, gummy latex in all plant parts, 25–35 m (80–115 ft) tall. Alternate, elliptic leaves are spirally clustered at tips of branches, glossy, 7–12 cm (2.8–5 in) long by 2–4 cm (0.8–1.6 in) wide. White flowers are small, inconspicuous, with 3 hairy brown sepals enclosing the inner light green corolla. Fruits spherical, oblate or oval, 5–10 cm (2–4 in) in diameter, with brown and scruffy skin when ripe. Soft pulp yellowish to brown, very sweet and fairly juicy with a malty taste reminiscent of caramel. Fruits contain 3–10 shiny brown or black seeds.

Origin and Distribution. Probably native to the Yucatán Peninsula of Mexico, northern Belize, and northeastern Guatemala. The tree was widely planted throughout tropical regions of Central America and the Caribbean before the arrival of Europeans. During the great colonial interchange of fruit trees, sapodilla seeds were carried to Asia and Africa. Today the tree is widely cultivated in India, Pakistan, and the Philippines.

Food uses. The ripe fruits are usually eaten raw. The soft, sweet pulp can be blended with fruit juices and cream to make a delicious dessert sauce. In Indonesia and Malaysia, the flesh of the sapodilla is cooked with ginger and lime juice. The pulp can also be used as a filling for pies and tarts. The flavor and texture of dried slices are very similar to dates (*Phoenix dactylifera*, p. 254). In Indonesia, after the milky latex is eliminated by rinsing with water, the young shoots are eaten as a vegetable.

In Indonesia and Malaysia, the flesh of the sapodilla is cooked with ginger and lime juice.

Comments. The flavorless and nontoxic latex of *M. zapota* and closely related *M. chicle* contains resins and rubber. It has been produced from wild and planted trees in Central America for millennia by cutting the bark in a zigzag manner and collecting the latex. The latex, called *chictli* by the Mayans, was coagulated in the smoke of a fire; it was used for chewing and also for making rubberlike balls for use in their famous ball games. Around 1866, samples of the dried latex arrived in the United States and were given to the son of Thomas Adams, who quickly realized the great potential of chicle-based chewing gum. In 1943 about 9,000 tons of chicle latex were exported from Mexico to the United States for making chewing gum, which was very popular with American soldiers in World War II. Until about 1960 the latex of *Manilkara* trees was the only source of chewing gum, but it was later largely replaced by synthetic products. The true rubber tree (*Hevea brasiliensis*) is a member of the Euphorbiaceae family.

The dark red wood of sapodilla is very hard and durable, and fully termite resistant. It was commonly used in Mayan temples, where pieces of it can still be seen today.

Matisia soegengii Cuatrec.

ZAPOTE DE MONTE, CHUPA ZAPOTE

Malvaceae (Mallow family)

Description. Medium-sized evergreen tree with a broad growth habit. Alternate, orbicular to cordate leaves soft tomentose, 30–40 cm (12–16 in) in diameter. Yellow hermaphroditic flowers along the lower trunk and on thicker branches. Dark brown, ellipsoid fruits, 12–16 cm (5–6.3 in) long, with velvety skin and bright yellow-orange flesh with long grayish-white seeds, growing in small clusters on trunk and branches.

Origin and Distribution. Native to humid lowland and premontane rainforests of western and eastern Ecuador. This is a rare species that is not commonly cultivated. Fruits are mostly collected from wild trees.

Food uses. The ripe fruits have a sweet, mealy flesh with an agreeable flavor and are usually eaten out of hand.

Comments. With its dense clusters of brown fruits on the trunk and showy yellow flowers, the chupa zapote has some potential for tropical landscaping as a very exotic ornamental. In the wild, the fruits are eaten by ground dwelling animals such as peccaries and agoutis as well as monkeys and birds.

The tree is closely related to the chupa chupa (*Quararibea cordata*), native to tropical South America and often seen in local markets.

This plant is native to Ecuador.

Melicoccus bijugatus Jacq.

MAMONCILLO

Sapindaceae (Soapberry family)

The seeds of this fruit are edible and can be roasted like sunflower seeds or chestnuts.

Description. Large, erect, mostly evergreen tree with gray bark, 25–35 m (80–115 ft) tall. Alternate, compound leaves with 4 opposite, elliptic leaflets with pointed apices, 6–13 cm (2.4–5.2 in) long. Greenish-white, fragrant flowers, 5–9 mm (0.2–0.4 in) wide, are produced in terminal panicles. Male and female flowers are normally found on separate trees. Green fruits spherical with a thin, smooth skin and a yellowish, translucent, juicy pulp enclosing a large, hard seed. The taste ranges from sour to acid-sweet or sweet, depending on variety.

Origin and Distribution. The mamoncillo is native from Mexico, Central America, and the Caribbean to northern South America. The tree is not strictly tropical and can withstand very light frosts.

Food uses. The fruits, which are sold in bunches on street markets, are usually eaten out of hand. After the brittle skin is torn open, the aril is squeezed into the mouth and the juice sucked from the pulp. In Colombia, the peeled fruits are boiled and the resulting juice is chilled and served as a refreshing drink on hot days. In Mexico, the more acidic fruits are eaten with chilies, salt, and lime juice. The seeds are edible and can be roasted like sunflower seeds or chestnuts. Indigenous people of the Orinoco region of Venezuela boil and eat the seeds as a substitute for cassava (*Manihot esculenta*, p. 265).

Comments. The mamoncillo is a minor member of the Sapindaceae family, mainly because very little pulp surrounds a large seed and in most varieties the flesh adheres tightly to the seed. Other species have more pulp that is easily separated from the seed.

The pulp produces a dark brown dye that was used in the West Indies by native Arawak people to dye clothing.

Momordica charantia L.

BITTER MELON

Cucurbitaceae (Cucumber family)

Description. Annual herbaceous vine growing 3–5 m (10–16 ft) in length and climbing with tendrils. Alternate leaves round to broadly oval, deeply lobed with 5–9 lobes. Single, yellow, monoecious flowers with 5 petals measuring 2–5 cm (0.8–2 in) in diameter are borne in leaf axils. Oval to oblong fruits, 10–20 cm (4–8 in) long with warty surface turning from light green to yellow when fully ripe, curling back and exposing the bright red arils surrounding the reddish-brown seeds. Fruits have a bitter taste that increases with ripeness.

Origin and Distribution. Probably native to tropical and subtropical regions of Southeast Asia and southern China. The plant is cultivated throughout the tropics and subtropics for its edible fruits.

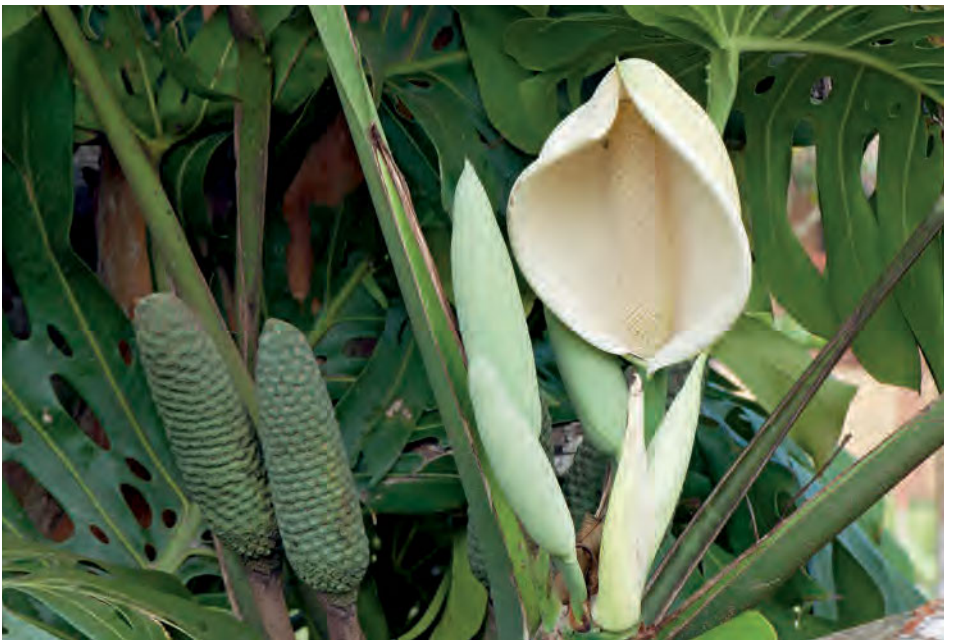
Food uses. Immature fruits are eaten as a cooked vegetable. To reduce bitterness, the fruits must be boiled or immersed in saltwater for several hours. They are very popular in South and Southeast Asia, where bitter melons are commonly used in soups, stir-fries, and curries. Unripe fruits are also pickled or stuffed with meat and vegetables. They are used to make tea and a soft drink. Young shoots, leaves, and flowers are eaten as a vegetable.

Comments. Bitter melon is a good source of vitamin C, iron, calcium, and phosphorous. *M. cochinchinensis* (spiny bitter cucumber) is native from Myanmar to China, Japan, and New Guinea. The immature, round to pear-shaped, spiny fruits are eaten as a vegetable and used in curries and stir-fries.

Monstera deliciosa Liebm.

CERIMAN

Araceae (Arum family)



Description. Creeping herbaceous vine that climbs trees to a height of 8–15 m (26–50 ft). Cylindrical green stems with numerous long aerial roots. Alternate leaves with petioles up to 1 m (3 ft) long. Dark green blades leathery, oval to cordate, 80–100 cm (30–40 in) long, deeply segmented and perforated by round or oval holes. Flowers in erect cylindrical stalks surrounded by a cream-colored, waxy spathe. Compound, elongated green fruits, measuring 20–35 cm (8–14 in) long by 3–4 cm (1.2–1.6 in) in diameter, are covered in a thick, hard rind made of hexagonal plates. Whitish pulp soft, juicy, with a taste and consistency reminiscent of pineapple and jackfruit.

Origin and Distribution. The ceriman is native to the understory of tropical lowland and premontane rainforests of tropical America from southern Mexico south to Panama. The plant is commonly grown as an ornamental and ubiquitous indoor plant. *M. deliciosa* requires a tropical climate and cannot tolerate frost.

Food uses. Before the fruit can be eaten, the hard, scaly rind must be removed and the pulp separated from the inner core. The aromatic pulp of fully ripe fruit is eaten fresh or used in fruit salads or desserts. Also used to make milk shakes and ice cream.

Comments. The aerial roots contain strong fibers used traditionally in Central America for making rope and weaving baskets.

Unripe fruits as well as the sap of the entire plant contain oxalate crystals, which are highly irritable to the skin and throat.

Of the large family Araceae, containing more than 3,700 species, the ceriman is the only species cultivated for its edible fruit. Many members of the family are cultivated as ornamentals and indoor plants.

Morinda citrifolia L.

NONI, GREAT MORINDA

Rubiaceae (Coffee family)

The noni tree has been used as a medicinal plant in traditional herbal medicine for millennia.

Description. Small, 3 to 10 m (10–33 ft) tall, evergreen tree. Opposite, oval, glossy-green leaves 20 to 30 cm (8–12 in) long and 12 to 16 cm (5–6.3 in) wide. White, fragrant flowers are produced in terminal heads. Compound fruit 5 to 10 cm (2–4 in) long, oval or of irregular shape, pale yellow with a soft, juicy pulp containing several small, blackish seeds. Ripe fruits emit a strong odor like old cheese or butyric acid.

Origin and Distribution. Native to Southeast Asia, Australia, and Oceania. Today planted and naturalized along tropical coastlines around the world. Noni trees require a humid, tropical climate.

Food uses. Despite its fetid smell, the fruits are eaten fresh or made into juice. Chilling the juice supposedly eradicates the smell. It is often blended with other fruit juices. Asians and the Aborigines of Australia eat the fruit raw with salt. It is sometimes added to Southeast Asian curries. The edible seeds are roasted and eaten salted. Young leaves are occasionally eaten as a vegetable.

Comments. The noni tree has been used as a medicinal plant in traditional herbal medicine for millennia. Fruits contain about 70% carbohydrates, 36% fiber, about 5% protein, and moderate amounts of vitamins and minerals like potassium and niacin. The juice of the ripe fruits, sometimes fermented, is said to boost the immune system and is used to treat respiratory and digestive problems. Many people drink noni juice to treat a variety of ailments like flu and cold symptoms and serious diseases like arthritis, cancer, and diabetes. Noni has a long and rich history in Indian medicine. The plant was esteemed by ancient Indian physicians to protect the skin from becoming dry and cracked by sun exposure.

There are about 80 species of *Morinda* in the tropics of the Old and New World. *M. citrifolia* is economically the most important species of the genus.

Morus nigra L.

BLACK MULBERRY

Moraceae (Mulberry family)

In ancient Greece, the fruit juice of this species was employed to enhance the color of red wine.

Description. Deciduous, bushy tree, 8–12 m (26–39 ft) tall. All plant parts contain white latex. Alternate, tomentose leaves ovate to broad-elliptic, 6–12 cm (2.4–5 in) long with toothed margins. Monoecious or dioecious, inconspicuous flowers are produced in pendent spikes. Composite black fruits, 1–3 cm (0.4–1.2 in) long, are similar to blackberries and have a pleasant, sweet-sour taste.

Origin and Distribution. Native to southwestern Asia; the exact origin is unknown, however, because the plant spread in prehistoric times to the Mediterranean and to India and China. It thrives in subtropical climates. In the tropics the mulberry is cultivated in cool mountain climates without frost.

Food uses. Fruits are eaten fresh or made into jams and jellies. They are also used for cakes, tarts, and pie fillings. In the Middle Ages, fruits were commonly fermented to make a type of wine. In ancient Greece, the fruit juice was employed to enhance the color of red wine. The leaves are used to prepare herbal teas.

Comments. The bitter-tasting root bark has been used in traditional medicine to treat intestinal worms. Although similar looking, the fruits of *M. nigra* are not closely related to those of the blackberry (*Rubus fruticosus*).

The closely related white mulberry (*M. alba*), native to northern China, is widely cultivated as a host plant for the leaf-eating silkworm (*Bombyx mori*), the cocoon of which is used to make silk.

Muntingia calabura L.

JAMAICA CHERRY

Muntingiaceae (Muntingia family)

Description. Small, fast-growing evergreen tree, 6–12 m (20–40 ft) tall, with spreading, drooping branches. Alternate leaves oblong to lanceolate, 6–12 cm (2.4–4.8 in) long, serrated at margins and pointed at apex. White flowers, 1–2 cm (0.4–0.8 in) wide with 5 petals and numerous yellow stamens, are borne singly or in small clusters. Spherical fruits 1–1.5 cm (0.4–0.6 in) wide with red, orange, or yellow smooth skin and light brown, soft, juicy pulp containing many tiny seeds. The flesh has a very sweet, somewhat musky taste.

Origin and Distribution. The tree grows naturally in Mexico, Central America, parts of the Caribbean, and tropical South America. The Jamaica cherry is widely cultivated or has escaped in most tropical regions of the world. In many parts of tropical Asia, the plant has been naturalized. The very adaptable tree requires a tropical or near-tropical climate. In tropical America, the plant often grows as a pioneer species in secondary forests and in disturbed areas.

Food uses. The ripe fruits are usually eaten out of hand. They are sometimes made into jams. The leaves are boiled to make herbal teas.

Comments. The fruits of the Jamaica cherry are an important food source for frugivorous birds and bats as well as pollinating insects, and the tree can be planted to attract a wide variety of animals. A decoction of the flowers is used in traditional herbal medicine as an antiseptic and to treat abdominal pain.

Musa acuminata Colla × *M. balbisiana* Colla

PLANTAIN

Musaceae (Banana family)

Ripe plantains are fermented to make a mildly alcoholic drink.

Description. Erect herbaceous perennial plant, 5–7 m (16–23 ft) tall, with a fleshy rhizome that produces a succulent pseudostem comprising numerous leaf sheaths. The main pseudostem is surrounded by smaller suckers. Lanceolate leaf blades are 2–2.5 m (6.6–8 ft) long by 40–60 cm (16–24 in) wide. The inflorescence, a transformed growing point, is a terminal spike shooting out from the heart in the tip of the stem and then bending down toward the ground. Tubular, pale yellow, monoecious flowers are grouped in double rows and covered by a fleshy, maroon bract. Female flowers, which develop into plantains, are produced near the base; males emerge toward the tip. Fruits are angled yellow berries with a firm, yellow or orange-yellow flesh, 20–30 cm (8–12 in) long. Modern cultivars are usually seedless.

Origin and Distribution. *M. acuminata* is probably native to Southeast Asia, from where it spread in prehistoric time to South Asia and Oceania. *M. balbisiana* is native to a large region from Sri Lanka and India to southern China. Today the plantain, a hybrid of the two wild ancestor species, is widely cultivated throughout the humid tropics.

Food uses. Unripe, green plantains are commonly eaten as a vegetable. They are boiled, fried, grilled, or baked and used in soups, stews, and stir-fries as well as in meat, fish, and vegetable dishes. In many regions of Latin America, thick, unripe slices of plantain are fried, flattened into patties, fried again, and salted to make *patacones* or *tostones*. They are commonly served with a variety of savory dishes such as grilled fish or meat. In parts of Africa and in the Caribbean, boiled plantains are mashed, seasoned with spices, and served with a tomato sauce as a dish called *fufu*. Thin slices or strips of green plantain, deep-fried and salted, are popular as chips.

Ripe plantains are commonly fried in oil or butter and served as a side dish or dessert. Fully ripe plantains can be eaten raw in fruit salads, although they are not as sweet as a dessert banana. Dried plantains are made into flour that is often used as infant food. Ripe plantains are fermented to make a mildly alcoholic drink. In parts of Asia, the inflorescences are eaten as a vegetable and the male flowers are used in soups and salads.

The leaves of plantains are commonly used as plates or to wrap food.

Comments. Plantains are not as sweet as dessert bananas because they contain more starch and less sugar (15% compared with 19% in a dessert banana). Plantains are a good source of potassium, magnesium, niacin, and vitamins B6 and C.

The major producers of plantains are Uganda, Ghana, and Colombia. The plant is very often cultivated as a dooryard plant.

Musa acuminata Colla
Musa balbisiana Colla

BANANA

Musaceae (Banana family)

The largest producers of bananas are India, the Philippines, and China.

Description. Perennial, herbaceous, 2–10 m (2.6–33 ft) tall, with erect, cylindrical pseudostems of overlapping leaf sheaths and a short, thick underground corm. New, tightly rolled leaves emerge from the center of the pseudostem. Blades light green, oblong, 1.6–3.8 m (5.3–12.5 ft) long, with a prominent midrib and parallel veins. Terminal drooping inflorescence with groups of tubular, yellow or pink monoecious flowers arranged in 2 rows covered by fleshy, purplish-red bracts. Female or hermaphroditic flowers are produced in the upper part of the inflorescence and male flowers in the lower part. Berrylike fruits yellow or reddish, curved, 8–38 cm (3–15 in) long, usually seedless.

Origin and Distribution. The exact origin of the banana is unknown, but it very likely originated in the Indo-Malayan region. Evidence arising from archaeological and paleoenvironmental studies at Kuk Swamp in the Western Highlands Province of Papua New Guinea suggests a very long history of banana cultivation dating back at least 7,000 years and possibly as far back as 10,000 years. Bananas grow best in hot, humid climates on rich, well-drained soils. Today the banana is extensively cultivated throughout the tropics.

Food uses. Bananas are eaten raw, fried, or baked. They are commonly used in fruit salads, desserts, sweets, ice cream, juices, and milk shakes. In Africa they are fermented to make a beerlike alcoholic beverage. Ripe fruits are used to make banana-vinegar. Bananas are also made into jams and preserves. Fruit slices are often dried for later use. Flower buds are eaten as vegetables. The leaves are used for wrapping food.

Comments. Most Bananas are triploid cultivars or hybrids of *M. acuminata* and *M. balbisiana*. Sweet bananas, predominantly consumed raw, are usually referred to as dessert bananas, whereas starchy cultivars, which are used ripe or unripe for cooking, frying, and baking, are usually called plantains or cooking bananas.

The commercially most important banana cultivars for export are the *M. acuminata* cultivars 'Dwarf Cavendish' and 'Gros Michel'. The largest producers of bananas are India, the Philippines, and China.

Bananas play an important part in human nutrition. They are a good source of carbohydrates, fiber, vitamins B and C, and minerals, particularly potassium, magnesium, and manganese.

Similar to the banana plant in appearance and belonging to the same family, the enset (*Ensete ventricosum*) is native to tropical regions of Africa and Asia. The plant does not produce edible fruits, but the starchy corms are used as food.

Musa velutina H. Wendl. & Drude

PINK BANANA

Musaceae (Banana family)

Description. Perennial herbaceous plant with a pseudostem, reaching 1.3–1.6 m (4.3–5.2 ft) in height. Oblong, linear leaves 0.9–1.1 m (3–3.6 ft) long by up to 36 cm (14 in) wide. Flowers with showy, pale pink bracts are produced in erect inflorescences. In the axil of each basal bract, 3–5 hermaphroditic flowers are borne. Orange-yellow male flowers usually fall off along with their bracts. Fruit bunches consist of 5 hands, averaging 4 fruits per hand. Pink, pubescent fruits 6–8 cm (2.4–3 in) long by 3–4 cm (1.2–1.6 in) wide. Mature fruits split open and expose the whitish pulp with numerous hard black seeds.

Origin and Distribution. Native from the province of Assam in northeastern India to northern Myanmar. Widely cultivated in the tropics as an ornamental banana.

Food uses. Fully ripe fruits have a soft, sweet flesh. Fruits are occasionally eaten out of hand, though some effort is required to discard the inedible, hard seeds. The pulp is sometimes used to make banana vinegar.

Comments. The plant, also known by the synonym *M. dasycarpa*, can be invasive and has become a pest in certain regions of the wet tropics. Seeds are easily spread by birds, bats, and mammals, and the plant additionally reproduces asexually through suckers.

Myrciaria cauliflora (Mart.) O. Berg

JABOTICABA

Myrtaceae (Myrtle family)

Description. Small shrubby tree, evergreen, slow growing, 8–12 m (26–39 ft) tall. Leaves opposite, lanceolate to elliptic, 3–9 cm (1.2–3.5 in) long by 1–2 cm (0.4–0.8 in) wide, dark green and glossy. Newly produced leaves are salmon-colored. Flowers are produced in great numbers along the trunk and branches. With its spectacular appearance when flowering, the jaboticaba is an impressive example of a cauliflorous plant. Flowers white with 4 hairy petals and 50–60 stamens. Grapelike fruits single or in clusters, spherical or ellipsoid, 2–4 cm (0.8–1.6 in) in diameter with smooth, glossy red-purple or very dark purple skin. Pulp subacid to sweet, juicy, translucent to white or pinkish with several small seeds.

Origin and Distribution. The jaboticaba is native to seasonally dry regions of tropical and subtropical Brazil, Paraguay, and Bolivia, and to northeastern Argentina and Uruguay. The tree is cultivated in many tropical countries for its fruits and also for its high ornamental value. It grows in tropical and warm subtropical climates and is very common in the region of Rio de Janeiro.

Food uses. The ripe fruits, often seen in Brazilian markets, are usually eaten fresh. The astringent-tasting skin, which is rich in tannins, is often discarded and just the pulp sucked out. Jaboticabas are also used to make jellies, marmalade, and tarts. The pulp is made into juice or fermented into wine.

Comments. In Brazil, the two closely related species *M. tenella* and *M. trunciflora* are grown for their edible fruits, which are also called jaboticabas.

Tannin-rich, sun-dried skins of jaboticaba fruits are used in traditional medicine to treat diarrhea, asthma, and inflammation of the tonsils. The fruits are rich in antioxidants. The very slow-growing tree is used for bonsai in eastern Asia.

Myrciaria dubia (Kunth) McVaugh

CAMU CAMU

Myrtaceae (Myrtle family)

Description. Small bushy tree or shrub, 3–6 m (10–20 ft) tall. Evergreen, opposite, elliptic to ovate leaves 5–11 cm (2–4.4 in) long by 2–5 cm (0.8–2 in) wide. Fragrant white flowers with numerous stamens are borne in the axils of leaves. Globose fruits, 2–3 cm (0.4–1.2 in) wide, reddish-purple to dark purple with soft, thin skin. Transparent, juicy pulp very acidic to fairly sweet, normally with 3 seeds.

Origin and Distribution. The tree grows naturally in the tropical Amazon lowlands of Brazil, Colombia, Peru, and Venezuela. It often forms dominant stands in seasonally flooded vegetation along rivers and lakes or in swampy areas. Camu camu trees can withstand prolonged seasonal floodings. It requires a tropical or warm subtropical climate without frosts and with evenly distributed precipitation and high humidity. Camu camu fruits are still collected mainly from wild trees along rivers and lakes, often by boat. In the Peruvian Amazon provinces of Loreto and Ucayali, the tree is occasionally cultivated in plantations. Very rarely grown outside its natural range.

Food uses. The fruits are too sour to eat out of hand. They are commonly blended with sugar and ice to make fruit drinks. The juice is also used to make jellies and to flavor ice cream, sherbet, sweets, and yogurt.

Comments. The fruit is known for its extraordinarily high content of vitamin C. Fruits can contain up to 3,000 mg (0.11 oz) of this vitamin, about 30 times more than an orange and almost as much as the famed acerola (*Malpighia emarginata*, p. 145). The fruits are also high in flavonoids, calcium, iron, and the amino acids valine, leucine, and serine. It has recently become a focal point for natural food industries because of its high vitamin C content and possible antioxidant activity. Processed into powder and capsules, it is internationally sold as a health food and vitamin supplement.

Myrciaria glazioviana
(Kiaersk.) G.M. Barroso ex Sobral

YELLOW JABOTICABA

Myrtaceae (Myrtle family)

Cultivated in tropical and some subtropical regions of South America, especially in Rio de Janeiro and environs.

Description. Large evergreen shrub, multi-branched and reaching 3–6 m (10–20 ft) in height. Opposite, elliptic leaves leathery, glossy green, 6–11 cm (2.4–4.3 in) long. Young leaves and stems are covered in pubescent hairs. Small white flowers with numerous long stamens are borne singly or in small clusters in leaf axils. Globose fruits measure 2–3 cm (0.8–1.2 in) in diameter with a yellow, softly pubescent skin and a translucent, succulent pulp containing 1 or 2 seeds. Fully ripe fruits have a subacid to sweet taste reminiscent of apricots.

Origin and Distribution. Native to southern Brazil. Cultivated in tropical and some subtropical regions of South America, especially around Rio de Janeiro, but rarely elsewhere. This beautiful shrub with its compact growth, dark green leaves, and white flowers is sometimes planted as an ornamental or used as a potted indoor plant.

Food uses. The fruits are usually eaten fresh. The pulp is used in Brazil to make fruit juices and jellies.

Comments. The fruits are a very good source of vitamin C. The plant is known by various botanical synonyms, among them *Myrciaria glomerata*. It is often confused with the very similar *Eugenia tomentosa*.

Nauclea latifolia Sm.

AFRICAN PEACH, PINCUSHION TREE

Rubiaceae (Coffee family)

The roots of this plant are used in Nigeria to treat high blood pressure.

Description. Small evergreen tree or large shrub, 8–12 m (26–39 ft) tall, with a broad crown and gray trunk. Opposite, simple, oval leaves 12 to 17 cm (5–7 in) long by 10–12 cm (4–5 in) wide with prominent light green veins. White, fragrant flowers form spherical inflorescences measuring 3 to 4 cm (1.2–1.6 in) in diameter. Reddish-brown to pink, syncarp fruits are round, oval, or of irregular shape and measure 4–6 cm (1.6–2.4 in) in diameter. The rugose surface of the fruit is covered with small protuberances. Flesh firm, reddish-pink with soft fibers radiating from the center.

Origin and Distribution. The tree grows wild in rainforests and seasonally dry savanna woodlands of tropical West and Central Africa. It is ultratropical, requiring constant high temperatures and growing only in the inner tropics below 200 m (660 ft) altitude. The tree is sometimes cultivated in tropical Africa as a dooryard plant. More often the fruits are collected from wild trees.

Food uses. Ripe fruits, which have firm flesh and a sweet fruity taste compared by some to strawberries, are eaten fresh or made into juice. Overripe fruits are dried and made into flour for later use.

Comments. The African peach has a long and important history in folk medicine. Decoctions of leaves and bark are used by traditional healers to treat fever, diabetes, diarrhea, malaria, and internal parasites. The roots are used in Nigeria to treat high blood pressure.

The termite-resistant wood is used in construction and for fence posts. It is prized as a firewood and for making charcoal. Two related species, yellow cheesewood (*N. orientalis*) from Southeast Asia, New Guinea, and northern Australia, and *N. diderrichii*, a forest tree from Central Africa, are grown for their edible leaves and fruits and for their medicinal properties, which are similar to those mentioned for *N. latifolia*.

Nauclea orientalis (L.) L.

LEICHARDT TREE

Rubiaceae (Coffee family)

Description. Evergreen or deciduous tree with gray bark, 20–30 m (66–100 ft) tall. Opposite, ovate, glossy green leaves 20–32 cm (8–13 in) long by 8–20 cm (3–8 in) wide with distinctive yellow-green veins. Small, tubular, yellow-orange flowers are densely grouped in spherical flower heads. Flowers are frequently partly fused together forming a long corolla tube tipped with the individual lobes of the petals. Syncarp fruits are round or often irregularly formed, pale yellow, rugose, with several ovoid seeds.

Origin and Distribution. Native to Southeast Asia from Thailand, Myanmar, and the Philippines south to New Guinea and northern Australia. The tree grows naturally in rainforests and in seasonally dry forests, often close to rivers. Occasionally grown as an ornamental tree.

Food uses. The slightly bitter-tasting fruits are eaten out of hand. At one time the fruits were an important bush food for the Aborigines of northern Australia.

Comments. A yellow or orange dye is produced from the bark and wood of the tree. The soft, nondurable, yellowish wood is used in construction. Bark extracts are used in traditional medicine to treat stomach problems and to induce vomiting. Trunks were used by indigenous peoples of Malesia to make canoes.

Nephelium lappaceum L.

RAMBUTAN

Sapindaceae (Soapberry family)

Fruit colors range from dark red (on an orange-yellow background) to yellow.

Description. Medium-sized evergreen tree with a spreading crown. Leaves are alternate, pinnately compound with 2–4 pairs of leaflets (elliptic to obovate, 10–25 cm [4–10 in] long, dull dark green). Small apetalous flowers are produced in loose terminal panicles. Trees produce either male flowers, female flowers, or hermaphroditic flowers that are female with a small percentage of male flowers. Fruits are round or ellipsoid drupes with a leathery skin densely covered in hairlike, soft spines up to 2 cm (0.8 in) long. Fruit colors range from dark red (on an orange-yellow background) to yellow. The translucent or whitish, subacid to sweet pulp contains a single light brown seed.

Origin and Distribution. The rambutan is at home in the rainforests of western Malaysia and Singapore. It is cultivated mostly in Southeast Asia but gaining popularity in other tropical countries, especially in Central America. The tree needs a humid tropical climate with evenly distributed rainfalls or a monsoon climate.

Food uses. Fruits are commonly eaten out of hand. They are sold fresh or canned. Rambutans are used for fruit salads and in the preparation of jams and jellies or preserves but are also used as an ingredient in savory dishes, especially in Southeast Asia. The seeds are sometimes roasted and eaten as a snack in the Philippines.

Comments. The common name is derived from the Malaysian word *rambut*, which means "hairy." The seeds contain up to 40% fat, which is extracted and used in making soap and for industrial purposes. Rambutan flowers are an excellent source of pollen for honey bees. Many cultivars of rambutan exist: red, orange, or yellow fruits, and freestone and clingstone varieties are available. Rambutan fruits are usually sold still attached to the branch. This helps prevent damage and rot.

Nephelium mutabile Blume

PULASAN

Sapindaceae (Soapberry family)

Description. Evergreen tree with short trunk and rounded crown, 10–15 m (33–50 ft) tall. Pinnate or odd-pinnate, alternate leaves with 2–5 pairs of oblong or elliptic leaflets 6–18 cm (2.4–7 in) long by 3–5 cm (1.2–2 in) wide. Tiny greenish flowers are produced in erect panicles. Fruits ovoid, 5–8 cm (2–3 in) long, dark red to red or less often yellow, with a thick, leathery exocarp covered in blunt tubercles or short, fleshy, soft spines less than 1 cm (0.4 in) long. Sweet and juicy pulp white to yellowish-white, translucent, with a single light brown seed.

Origin and Distribution. Native to western Malaysia and Singapore. It is fairly common in Southeast Asia but uncommon to very rare elswhere in the tropics. In the Americas, the pulasan is common only in Costa Rica, where it is planted commercially and the fruits sold in markets. The tree requires a strictly tropical climate with high humidity.

Food uses. The fruits are usually eaten fresh or made into jam. The raw seed is also edible and said to taste similar to almonds. The boiled or roasted seeds are made into a beverage similar to cacao.

Comments. The pulasan is cosely related to the rambutan (*N. lappaceum*), but has sweeter fruits and the flesh is more easily detached from the seed. The common name *pulasan* is derived from the Malay word *pulas*, which means "twist," referring to the way ripe fruits are opened to get to the sweet aril inside. The fruits are a good source of carbohydrates, vitamin C, and calcium.

Neptunia oleracea Lour.

WATER MIMOSA

Mimosaceae (Mimosa family)

Description. Perennial aquatic plant growing to 1.5 m (5 ft) in length, with reddish-purple roots emerging from joints. Also found creeping on riverbanks. Whitish inflated stems with spongy tissue act as a floating device. Alternate, bipinnate, mimosa-like leaves 3–8 cm (1.2–3 in) long with 16–40 elliptic leaflets. Small yellow flowers in axillary, erect, orbicular inflorescences. Flowers with 5 petals and numerous yellow stamens. Fruits are flat pods 3–5 cm (1.2–2 in) long.

Origin and Distribution. Though its exact origin is unknown, water mimosa is thought to be native to Central America and northern South America. Today the plant grows in lakes, rivers, and waterways throughout the tropics. It has become an invasive species in many regions such as northeastern Australia and is therefore considered a pest. Cultivated in Thailand and Cambodia as a vegetable.

Food uses. Young leaves, shoots, and immature fruits all have a cabbagelike flavor and are eaten as a vegetable, especially in Thai and Cambodian cuisine. They are eaten raw, boiled, or fried and commonly used in the preparation of stir-fries.

Comments. The plant is cultivated in flooded fields in Southeast Asia. The plants, which have a very short shelf life, are a common sight in markets in Thailand.

Opuntia ficus-indica (L.) Mill.

PRICKLY PEAR, INDIAN FIG, TUNA

Cactaceae (Cactus family)

Description. Large, branched, shrublike cactus 4–6 m (13–20 ft) tall with flat, green, oval stem segments, 40–60 cm (16–24 in) long by 20–30 cm (8–12 in) wide. These carry long pointed gray thorns and cushions of short, hairlike spines (glochids) at their base. Insect- and bird-pollinated flowers 5–8 cm (2–3 in) long with a cylindrical hypanthium, spirally arranged areoles, and numerous yellow or orange petals and yellow stamens. Fruits yellow, red, or orange, ellipsoid berries, 5–7 cm (2–2.8 in) long. Red or orange flesh juicy, sweet to subacid with numerous black seeds, 3 mm (0.12 in) long.

Origin and Distribution. The exact origin is uncertain. Probably native to Mexico, where close genetic relatives have been found. Widely cultivated and often naturalized in dry tropical and subtropical regions of the world. Like corn (*Zea mays*, p. 241) and squash (*Cucurbita* sp.), this plant has been cultivated in Central America for millennia. The prickly pear was introduced into Europe by Spanish sailors in the sixteenth century.

Food uses. Ripe fruits are eaten fresh. Before the delicious fruit can be eaten, any hairlike spines must be rubbed off with a cloth. The fruit is then halved and eaten with a spoon. Fruits are made into marmalades and jam or dried for later consumption. Young, tender stem segments are eaten as a vegetable.

Comments. This cactus species is also cultivated as the host plant of the cochineal scale insect. The insect, which feeds on the sap of the cactus, produces carminic acid, which is used as a deep red dye for fabrics and cosmetics and as a natural food coloring. The genus *Opuntia* comprises about 200 species, all native to tropical and subtropical America.

Oryza sativa L.

RICE

Poaceae (Grass family)

Description. Perennial grass (annual in cultivation), usually 50–150 cm (1.6–5 ft) tall with jointlike nodes producing straight or arching leaves 40–60 cm (16–24 in) long. Small wind-pollinated flowers are produced in drooping panicles. Fruit is a grain 5–11 mm (0.2–04 in) long by 2–3 mm (0.08–0.11 in) thick.

Origin and Distribution. Recent genome studies indicate that the two main subspecies of rice, *indica* and *japonica*, may have first appeared as far back as approximately 9,000 years ago in the Yangtze Valley in China, with *O. rufipogon* a possible progenitor of all modern rice varieties. New genetic studies indicate the Pearl River delta in southern China as the probable origin of *O. rufipogon*. Rice grows in swampy or inundated, tropical to subtropical habitats. Widely cultivated, especially in Asia, where 95% of the crop is grown and consumed.

Food uses. Rice is a staple food for nearly half the world's population. It is eaten boiled with a wide variety of savory and sweet dishes. Rice flour is used to make noodles, bread, bakery goods, and puddings. It is also used as a thickener for soups and other food products. Rice is fermented to make beer and a winelike beverage (sake).

Comments. *O. sativa* can be divided into the two major subspecies, the short-grained *O. sativa* ssp. *japonica* and the long-grained *O. sativa* ssp. *indica*, which grows in tropical regions and includes important cultivars like basmati and patma rice. *Japonica* cultivars are usually grown in subtropical and temperate regions.

Milled or white rice has a relatively low protein content of only 7%. Rice, a good source of nutritional energy, contains about 75% starch and minerals like manganese, phosphorous, and iron. Milling removes fiber, minerals, and certain B vitamins like niacin and vitamin B6, which are concentrated in the husk. The dark brown grains of so-called wild rice originate from the North American grass *Zizania palustris*.

Pachira aquatica Aubl.

MALABAR CHESTNUT, PROVISION TREE

Malvaceae (Mallow family)

Description. Evergreen tree 15–25 m (50–80 ft) tall with palmate leaves measuring 25–35 cm (10–14 in) in diameter with lanceolate, shiny green leaflets. Very showy, large, bat-pollinated flowers with cream-colored recurved petals 15–30 cm (6–12 in) long and numerous cream and dark red–colored stamens. Large woody fruit pods 20–30 cm (8–12 in) long can weigh up to 3 kg (6.6 lbs) and open with 5 valves when ripe. Exocarp dark brown with several edible, chestnutlike seeds embedded in a cream-colored pulp. Seeds brown with lighter-colored stripes.

Origin and Distribution. Native to a vast region ranging from southern Mexico and Central America to Brazil, Bolivia, and Peru. The tree grows naturally at river margins and in periodically inundated, tropical swamps. The seeds are water dispersed. With its beautiful shiny foliage and showy flowers, which are produced year-round, the tree is occasionally planted as an ornamental.

Food uses. The seeds are eaten raw, roasted, fried in oil, or boiled in saltwater. Raw nuts taste similar to peanuts, while roasted they taste more like chestnuts. They are sometimes ground into flour used to make bread. Young leaves are cooked and eaten as a vegetable, and the flowers are eaten raw in salads.

Comments. In East Asia, where the tree is often called money tree, it is grown as a potted plant, sometimes with braided trunks, or even as a bonsai. The plant is often decorated with red ribbons and is considered a symbol of good financial fortune.

Unripe fruits and the bark of the trunk are used in Guatemalan tribal medicine to treat liver diseases. The bark contains tannins and provides a yellow dye that was used by indigenous people to dye clothing.

Pandanus sp.

SCREWPINE

Pandanaceae (Screwpine family)

Description. Most species palmlike, evergreen, 2–18 m (6.5–60 ft) tall, with numerous horizontal branches and multiple, aerial stilt roots that form a dense tangle. The trunk and branches show persistent leaf scars. The 1.5–2 m (5–6.5 ft) long linear, light-green, tough leaves are clustered in spirals at the tip of each branch. Dioecious flowers, with male flowers produced in spikes. Female flowers usually develop into a compound, somewhat pineapple-like, often orange fruit.

Origin and Distribution. The genus consists of more than 740 species, all of which are native to the tropics of the Old World. The salt-tolerant screwpine often grows naturally in coastal areas, although species of the genus occur from sea level to more than 3,000 m (9,800 ft).

Food uses. The fruits of *P. utilis*, native to Madagascar, are eaten raw or boiled. They are often used as a staple food on small oceanic islands. The young, tender leaves of *P. tectorius*, which is native to Indonesia, Hawaii, many tropical Pacific islands as well as northern and eastern Australia, are used in curries and for the preparation of sweets.

Comments. The screwpine is known as a quintessential tropical landscaping element found in many tropical gardens. The plant leaves of some species also provide fiber, which is used to make rope, mats, and nets. In coastal areas the screwpine is planted for erosion control.

Pangium edule Reinw.

KELUAK

Salicaceae (Willow family)

Raw fruits and seeds contain hydrogen cyanide, which is highly toxic and possibly fatal to humans.

Description. Evergreen tree with smooth bark and spreading branches, 25–35 m (82–115 ft) tall. Alternate, cordate, glabrous leaves with long petioles, blades 25–35 cm (10–14 in) long. Monoecious flowers, with green male flowers borne in small racemes and single female flowers produced in axils of leaves. Ovoid brown fruits with reddish-brown, leathery skin, 16–22 cm (6–9 in) long. Fruits contain 10–12 seeds surrounded by a light brown, hard, wrinkled shell.

Origin and Distribution. Native to mangrove forests of Malaysia, Singapore, Indonesia, and Papua New Guinea. Fruits are collected mainly from wild trees. Rarely cultivated.

Food uses. The seeds are a valued spice in Southeast Asian cuisine. Raw fruits and seeds contain hydrogen cyanide, which is highly toxic and possibly fatal to humans. To eliminate the poison, the seeds are crushed and boiled several times, or they are boiled, mixed with ash, wrapped in banana leaves, and buried in the soil to ferment for about 40 days. After this treatment the blackish-brown seeds are edible and used fresh or dried as a spice with a strong, nutty flavor in curries and soups as well as in chicken, pork, beef, and vegetable dishes. In Indonesia, the seeds are used as an ingredient in the traditional black beef soup called *rawon*. The spice gives the dish its characteristic taste and dark color.

Comments. The potent toxins of the tree were reportedly used by indigenous peoples of Borneo to poison dart tips for hunting and warfare.

Parkia speciosa Hassk.

BITTER BEAN, PETAI

Fabaceae (Bean family)

Description. Large evergreen tree with spreading branches, 25–30 m (80–100 ft) tall. Alternate, bipinnate leaves with 14–18 pinnae with 31–38 linear leaflets. Small yellowish-white, bat-pollinated flowers are produced in pendent inflorescences. Fruits straight or twisted green pods, 40–55 cm (16–22 in) long by 3–5 cm (1.2–2 in) wide, with 10–20 oval green seeds. Seeds of mature fruits are blackish-brown.

Origin and Distribution. The tree grows naturally in lowland rainforests of Malaysia, Singapore, and southern Thailand. In its natural habitat, the pods are often collected from wild trees. Commonly cultivated from Southeast Asia to India as a dooryard tree. Rarely grown elsewhere.

Food uses. Green beans, which emit a strong odor, are commonly used as a vegetable in Thai and Malay cuisine. Often used in strongly flavored, savory meat and shrimp dishes together with garlic, chili pepper, and onion. Ripe, blackish seeds are eaten boiled or roasted or dried for later use. Very young pods without developed seeds are chopped and used in stir-fries and curries. Young, tender leaves are also eaten as a vegetable.

Comments. The genus was named in honor of Mungo Park (1771–1806), a Scottish explorer who made two remarkable journeys to West Africa.

In Thailand, the fermented and cooked seedlings of *P. timoriana*, a closely related species native to tropical Asia, are eaten with *namphrik*, a chili-based hot sauce typical of Thai cuisine. The seeds of *P. javanica* are also eaten raw or roasted.

Parmentiera aculeata (Kunth) Seem.

TREE BANANA, GUACHILOTE

Bignoniaceae (Trumpet creeper family)

Description. Small tree with spreading branches and short, stiff spines, 10–12 m (33–39 ft) tall. Compound leaves 8–12 cm (3–5 in) long with 3 elliptical leaflets, each 3–6 cm (1.2–2.4 in) long with narrowly winged petioles. Greenish-white, bat-pollinated flowers are produced singly or in small clusters on the trunk and lower branches. Yellowish-green, elongated fruits 5–15 cm (2–6 in) long, with longitudinal ridges and smooth, waxy skin.

Origin and Distribution. A minor fruit native from Mexico south to Nicaragua in Central America, where it grows in tropical and subtropical regions with dry or humid climates. This now almost forgotten fruit tree was a common sight in Central America and Mexico in past centuries. Colonial chronicles mention the guachilote as a common dooryard tree in rural areas of Mexico, where the fruit formed an essential part of the diet.

The juice of the fruit is used in traditional medicine as a laxative and diuretic.

Food uses. The fibrous fruits, which have a taste similar to green mangos, are occasionally eaten raw by sucking out the juice. More often the fruits are cooked as a vegetable in stews and soups or roasted over a fire. The fruit can also be made into preserves and marmalades.

Comments. Guachilote fruits are a good source of protein and an excellent source of fiber. Ripe fruits contain 24–26% fiber. Various parts of the tree are used in traditional medicine. Extracts of the bark and roots are used to treat kidney diseases and kidney stones, and the juice of the fruit is used as a laxative and diuretic.

The candle tree (*P. cereifera*, p. 174) is a closely related species with long, pendent, candlelike fruits.

Parmentiera cereifera Seem.

CANDLE TREE

Bignoniaceae (Trumpet creeper family)

Description. Small deciduous tree with a spreading growth habit, 5–10 m (16–33 ft) tall. Opposite leaves whorled on tips of short branches. Trifoliate leaves with obovate leaflets, 4–8 cm (1.6–3.2 in) long. Showy, bell-shaped flowers, pale yellow to yellowish-green with recurved petals, are produced singly on trunk and older branches. During fruiting season, hundreds of fruits cover the trunk and lower branches. Yellow fruits elongated, cylindrical, candlelike berries with thin waxy skin, reaching 40–90 cm (16–35 in) in length. Flesh crisp, pale yellow with numerous small flat seeds.

Origin and Distribution. Native to tropical Central America. Occasionally cultivated as an ornamental, mainly because of its spectacular fruiting habit and the beautiful, cauliflorous flowers. Rare in tropical Africa and Asia, but fairly common in Australia.

Food uses. Ripe fruits, which have a subacid, crispy flesh, are eaten out of hand or used in fruit salads. Slightly underripe fruits are boiled and eaten as a vegetable.

Comments. The genus *Parmentiera* consists of 10 species, of which the tree banana (*P. aculeata*, p. 173) is sometimes cultivated for its edible fruits. The candle tree is considered endangered in its natural environment as a result mainly of habitat destruction.

Passiflora edulis Sims

PURPLE PASSIONFRUIT, MARACUJÁ

Passifloraceae (Passionflower family)

The juicy yellow to orange pulp, which has a sweet, aromatic taste, contains numerous black to brown seeds.

Description. Vigorous, perennial, evergreen woody vine, grows with tendrils. Alternate leaves deeply 3-lobed, 10–22 cm (4–9 in) long, with fine teeth on the leaf margins. Fragrant flowers consist of 3 large green bracts, 5 greenish-white sepals, 5 white petals, and a corona of straight, white-tipped rays that are rich purple at the base. Purple to pink fruits spherical to ovoid with smooth, tough skin. The juicy yellow to orange pulp, which has a sweet, aromatic taste, contains numerous black to brown seeds.

Origin and Distribution. The purple passionfruit is native to southern Brazil, northern Argentina, and Paraguay. The plant grows in a subtropical but frost-free climate. Widely cultivated throughout the subtropics and in higher elevations in the tropics.

Food uses. The fruit is commonly eaten out of hand or made into a delicious juice. The pulp (with the seeds) is made into a fruit puree used as pie filling and topping for desserts and cakes. In Brazil, passionfruit juice is often used instead of lime juice to make caipirinha, a cocktail made from fruit juice, ice, sugar, and cane liquor. This variation is called *caipifruta de maracuyá*. A syrup made from the juice and poured over shaved ice is often sold by street vendors in South America. The bottled juice is also sold commercially, often as part of juice blends. In some regions the juice is fermented to produce a type of wine.

Comments. The closely related and more tropical yellow passionfruit (*P. edulis* var. *flavicarpa*, p. 176) has larger, more acidic-tasting fruits that are used to make juice, ice cream, and desserts.

Passiflora edulis var. *flavicarpa* Sims.

YELLOW PASSIONFRUIT

Passifloraceae (Passionflower family)

In Indonesia and Hawaii the juice of this fruit is boiled with sugar to make a thick syrup that is poured over shaved ice.

Description. Vigorously growing, perennial vine with woody stems and deeply 3-lobed, dark glossy-green leaves. The vines climb by means of long curly tendrils in each leaf axil. Showy flowers are purple-white and very fragrant. Brittle-shelled fruits round to ovoid, 5 to 10 cm (2–4 in) long, shiny yellow. The fruit is filled with a gelatinous pulp that has a highly aromatic but acidic taste. The pulp is orange to yellow in color and contains numerous edible, brown seeds. In tropical climates the plant flowers and fruits continuously.

Origin and Distribution. The yellow passionfruit is native to the Amazon region of tropical South America. It is now cultivated throughout the tropics.

Food uses. The fresh fruit pulp, blended with sugar, ice, and water, makes a delicious drink. The juice works as a natural concentrate and is used to flavor ice cream, cheese cake, yogurts, cocktails, jams, and desserts. It is also often blended with orange or pineapple juice. In Indonesia and Hawaii the juice is boiled with sugar to make a thick syrup that is poured over shaved ice. The frozen juice can last up to a year without loosing any of its flavor. The fruit is also popular in gourmet cooking and is used to add a tropical flavor to many dishes.

Comments. The pulp is a good source of Vitamin C, beta carotene, dietary fiber, and potassium. The leaves of various *Passiflora* species are used for medicinal purposes. They contain glycosides, which have a sedative and tranquilizing effect on humans. Extracts are also used to treat asthma. The juice is known to be beneficial for people with high blood pressure.

The genus consists of an estimated 500 species, of which several are edible and some grown as ornamentals. A closely related variety is the purple passionfruit (*P. edulis*, p. 175), which is more subtropical in its distribution. Native to Southern Brazil, Paraguay, and Northern Argentina, this purple colored fruit is sweeter and richer in flavor and is often eaten fresh.

Passiflora ligularis Juss.

SWEET GRANADILLA

Passifloraceae (Passionflower family)

The brittle shell is cracked open and the pulp, along with the edible, aromatic seeds, sucked out or eaten with a spoon.

Description. Very vigorous evergreen vine with woody stems and tendrils for climbing. Dark green leaves heart-shaped, 10–20 cm (4–8 in) long by 10–15 cm (4–6 in) wide, with distinct veins. Petioles have 3 pairs of nectaries. Fragrant flowers up to 10 cm (4 in) in diameter with green, lanceolate sepals and dark pink petals with 2 rows of filaments, which are striped horizontally with white and purple. Fruits ovate to spherical, 6–8 cm (2.4–3 in) long, orange-yellow with tiny light-colored dots on a smooth, very brittle rind. Yellow to orange transparent pulp mucilaginous, sweet, juicy, with numerous flattened black seeds.

Origin and Distribution. This Neotropical species is native to a vast region from northern Argentina to Central America, where it grows at elevations between 800 and 2,900 m (2,645–9,515 ft). The sweet granadilla requires a cool subtropical climate, can withstand light frosts, and does not grow well in hot tropical lowlands.

Food uses. The ripe fruits are eaten out of hand. The brittle shell is cracked open and the pulp, along with the edible, aromatic seeds, sucked out or eaten with a spoon. The strained pulp is used to make sherbets or blended with water and ice to make juice. The pulp is also used to flavor ice cream, yogurt, and desserts.

Comments. The pulp is a good source of vitamins A, C, and K and also of minerals like calcium, iron, and phosphorous. The main producers of sweet granadillas are Peru, Venezuela, and Colombia.

The genus consists of about 500 species, of which many are Neotropical vines. Besides several species that produce edible fruits such as yellow passionfruit (*P. edulis* var. *flavicarpa*), many are grown as indoor plants for their very beautiful though short-lived flowers. Hybrids of important ornamental species exist, including blue passionflower (*P. caerulea*) and the winged-stem passionflower (*P. alata*).

Passiflora maliformis L.

SWEET CALABASH

Passifloraceae (Passionflower family)

Description. Vigorous evergreen woody vine with alternate, oblong to cordate leaves 6–16 cm (2.4–6.3 in) long. The plant climbs with tendrils. Fragrant flowers with 3 green bracts and green and reddish-brown sepals. Corona with purple, blue, and white streaks. Flowers are visited and probably also pollinated by insects and hummingbirds (pers. observ.). Unripe fruits are surrounded by thin green bracts. Ripe fruits 4–6 cm (1.6–2.4 in) in diameter, yellow to yellowish-brown, spherical to oval with a tough, leathery to hard rind. Pulp subacid to sweet, soft, juicy, orange to yellowish-gray with numerous black seeds.

Origin and Distribution. Originally from Cuba, Puerto Rico, Dominican Republic, Trinidad and Tobago, and also northern South America. Introduced to the southern Pacific islands and parts of Asia. Not commonly cultivated outside its natural range. The plant requires a tropical or subtropical climate without frosts. In the tropics, the sweet calabash is cultivated between 400 and 1,700 m (1,300–5,600 ft) elevation.

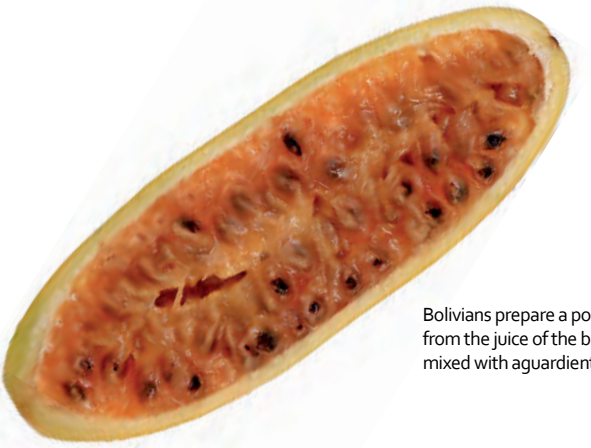
Food uses. The aromatic pulp (with its seeds) is eaten out of hand or served as dessert, usually sweetened with sugar or honey. In the Caribbean, the pulp is often blended with sugar and ice to make a delicious fruit drink. In Jamaica, the pulp is served with wine and sprinkled with sugar.

Comments. The sweet calabash is a minor fruit of the large genus *Passiflora* and of only local importance. It is grown mainly in home gardens and usually not available in markets. It is sometimes cultivated as an ornamental for its beautiful purplish-blue flowers.

Passiflora mollissima (Kunth) L.H. Bailey

BANANA PASSIONFRUIT

Passifloraceae (Passionflower family)



Bolivians prepare a popular cocktail from the juice of the banana passionfruit mixed with aguardiente, sugar, and ice.

Description. Very vigorous evergreen vine, climbing with tendrils. Alternate leaves deeply three-lobed, 8–12 cm (3–5 in) long, with toothed margins and velvety hairs on the leaf blade. Flowers 8–11 cm (3–4.3 in) long with pink petals, purple corona, and white and yellow anthers. Flowers are visited by hummingbirds. Fruits oblong, 6–12 cm (2.4–5 in) long with leathery, orange to yellow skin. Orange pulp very aromatic, subacid to acid with numerous flat, black, edible seeds.

Origin and Distribution. Native to inter-Andean valleys of South America from Colombia and Venezuela south to Bolivia, where the plant grows between 1,600 and 3,300 m (5,250–10,800 ft) above sea level. The fruit, which was already grown in pre-Columbian times, is sometimes depicted on Peruvian Moche ceramics (100–700 AD). The plant grows best in a subtropical or cool tropical climate without strong frosts. In appropriate climates, the banana passionfruit can be very invasive. The plant has escaped cultivation in New Zealand, Hawaii, and New Guinea.

Food uses. Ripe fruits are highly appreciated and regularly available in South American markets. They are eaten fresh by scooping out the pulp after sprinkling with sugar. The pulp with seeds is made into refreshing cold drinks. The juice is often blended with other fruit juices like mango or orange juice. It is also used to flavor ice cream and sherbets. In Bolivia, a popular cocktail is prepared from the juice of the banana passionfruit mixed with aguardiente, sugar, and ice.

Comments. In Hawaii, where *P. mollissima* is called *banana poka*, the vine has become a major pest, invading natural forest habitats. The seeds are dispersed mainly by birds and feral pigs. The banana passionfruit has been directly blamed for driving at least three native Hawaiian plant species to near extinction.

This fast-growing and very prolific vine can produce up to 300 fruits per year on one plant and up to 750,000 fruits per hectare in a plantation.

Passiflora quadrangularis L.

GIANT GRANADILLA

Passifloraceae (Passionflower family)

Description. Very vigorous, large herbaceous vine with a woody base, climbing trees up to a height of 30 m (330 ft) and more. Young shoots are 4-angled. The plant climbs with axillary tendrils. Alternate, smooth leaves broad-ovate, 8–16 cm (3–6 in) long by 10–20 cm (4–8 in) wide, cordate at base and pointed at the apex. Flowers solitary, fragrant, about 12 cm (5 in) wide, sepals white, pink, or purple inside, petals white and pink, and corona filaments purple and white below and blue in the middle. Large, oblong fruits 10–30 cm (4–12 in) long, skin green, greenish-yellow, or deep yellow when fully ripe, with mealy white or pink flesh. Central cavity filled with brown, edible seeds embedded in numerous sweet-sour, juicy arils that can be whitish, yellow, or purple-pink in color.

Origin and Distribution. Native to tropical America from Mexico south to Brazil, Bolivia, and Peru. The exact origin is unknown, because the plant was widely grown and dispersed in pre-Columbian times. It was introduced into tropical Asia in the eighteenth century and is now common in most tropical countries. The giant granadilla requires a tropical climate with high humidity.

Food uses. The pulp with or without seeds is commonly blended with ice, sugar, and water to make a delicious juice. Some people add wine and cinnamon to enhance the flavor. In Australia, the juice is sometimes fermented to make wine. It is also used to flavor ice cream and sweets and to make sherbets and desserts. The flesh of ripe fruits is cooked and eaten as dessert. In Asia, the flesh and the pulp are served with sugar and shaved ice. Unripe fruits are boiled or fried in butter and eaten as a vegetable.

Comments. The pulp of the giant granadilla is a good source of minerals, especially iron, calcium, and phosphorous, and vitamins A and C. The fruit is an excellent source of niacin. In indigenous medicine, the pulp is used to treat insomnia and nervous headaches, among other uses.

Pentagonia grandiflora Standl.

PENTAGONIA, ZAPOTE DE MONTE

Rubiaceae (Coffee family)

Description. Small, evergreen, sparsely branched tree. Large, opposite, glabrous, sessile, dark green leaves with prominent light green veins, 60–90 cm (24–35 in) long. White to cream-white tubular flowers, 3–5 cm (1.2–2 in) long with 5 petals, are produced around the upper part of stem. Green sessile fruits measuring 6–8 cm (2.4–3 in) are clustered at the tip of the plant.

Origin and Distribution. Endemic to the humid Pacific lowlands of western Colombia and Ecuador. The tree grows naturally in the understory of tropical rainforests, where it is most often found in disturbed locations like gaps and along forest edges. The plant requires constant high temperatures and humidity for optimal growth. The fruit is rarely cultivated except in rare fruit collections.

Food uses. Ripe fruits, which have an agreeable, sweet taste, are usually eaten fresh as a snack. Fruits are often collected from wild plants. They are commonly eaten by indigenous people of South American rainforests but rarely available in local markets.

Comments. The genus *Pentagonia* consists of at least 30 species, all confined to the American continent.

Pereskia aculeata Mill.

BARBADOS GOOSEBERRY

Cactaceae (Cactus family)

Description. Deciduous, climbing or shrublike, leaf-bearing cactus, 8–12 m (26–40 ft) tall, with nonsucculent, thorny stems. Alternate, ovate to elliptic leaves 4 to 9 cm (1.6–3.5 in) long with waxy surfaces and fleshy blades. Fragrant pink, yellow, or white flowers, 3–5 cm (1.2–2 in) long, are produced in panicles or corymbs. Round yellow, orange, or orange-red fruits with juicy, subacid to sweet pulp and thin, leathery skin. Fruits contain several small, black seeds.

Origin and Distribution. Native to tropical America from Panama and the Caribbean Islands to eastern South America. *P. aculeata* is adapted to a dry or humid tropical climate and often grows close to the coast. The plant has been introduced into Africa, Asia, and Australia and naturalized in many regions. In parts of Africa and Australia, the plant has become invasive by overgrowing natural vegetation.

Food uses. Ripe fruits are eaten fresh or made into jams and marmalades. In some regions the fruits are stewed with sugar to make desserts and preserves.

Comments. The unique genus *Pereskia* consists of about 25 species of cacti that are characterized by having nonsucculent stems and bearing leaves. The genus is named after the French botanist and astronomer N. C. Fabri de Peiresc (1580–1637).

Persea americana Mill.

AVOCADO, ALLIGATOR PEAR

Lauraceae (Laurel family)

Description. Medium-sized evergreen tree, 20–30 m (66–100 ft) tall. Leaves 15–25 cm (6–10 in) long, alternate, leathery, elliptic with prominent veins. Flowers are inconspicuous, greenish-yellow, 4–8 mm (0.16–0.32 in) wide. There are two flowering types, type A and type B. Type A opens as a female in the morning of one day and reopens as a male flower the next day in the afternoon. Type B flowers open as female the afternoon of the first day and reopen as male the next morning. For successful fruit production, both types must be planted together. Fruits are variable in form and color, but usually egg- or pear-shaped, green or almost black in color with a smooth or rugged surface. The flesh is light green with a buttery soft, almost creamy texture. The fruit contains a single large spherical seed.

Origin and Distribution. The avocado tree is probably native to southern and central Mexico. It was already widely cultivated in Central America, parts of the Caribbean, and South America in pre-Columbian times. The oldest known record is from a cave in Puebla, Mexico, where avocado remains were found dating back to almost 10,000 BC. Avocado trees were introduced into Jamaica in the seventeenth century and spread from there to Asia and Africa in the eighteenth century. Today avocados are grown in many tropical and subtropical countries around the world. The major producers are Mexico, Indonesia, and the United States.

Food uses. Avocados are usually eaten raw, seasoned with lime juice and salt. They are used in salads, soups, as a sandwich spread, or served as a side dish with rice and meat. In Mexico, they are the main ingredient in a popular creamy dip called *guacamole*, made from the flesh of ripe avocado seasoned with lime juice, garlic, onion, tomato, cilantro, and salt. Avocados are also used to prepare fruit shakes and cocktails. The fruit is the source of highly valued avocado oil, which is used in the food and cosmetic industry.

It contains up to 30% mostly monounsaturated fat. It is also a good source of potassium and fiber. The content of oleic acid, a monosaturated fat, is believed to be helpful in lowering high blood cholesterol in humans.

Comments. The name *avocado* originates from the Aztec's Nahuatl word *auacatl*, meaning "testicle." The fruit was an important source of fat and protein in the Aztec diet. Other parts of the plant such as leaves and bark were used for their medicinal properties. The oil of the fruit was used against dandruff and to combat ear infections. Small branches of avocado trees were worn by Aztec women as a fertility symbol. Today, dozens of varieties of avocados exist. One of the most popular is the 'Hass' cultivar, with brownish-black, oval-shaped fruits with a rugged surface. Another type is 'Fuerte', with pear-shaped, smooth green fruits.

Phaleria capitata Jack

LAWE-LAWE

Thymelaeaceae (Mezereum family)

Description. Evergreen shrub or small tree, 6–9 m (20–30 ft) tall. Opposite leaves elliptic-oblong, 10–20 cm (4–8 in) long with glabrous blades. Small white tubular flowers with long stamens are produced in terminal or axillary inflorescences. Since it is cauliflorous, the tree also produces flowers and fruits on the trunk. Fleshy fruits bright red with a smooth skin, measuring 1–1.5 cm (0.4–0.6 in) in diameter and with a sweet, juicy pulp and usually 2 seeds.

Origin and Distribution. Native to Malaysia and Indonesia. Occasionally cultivated in tropical Asia from Sri Lanka and India to the Philippines and New Guinea. Very rare in Africa and tropical America. The plant grows naturally in humid, tropical lowland rainforests and premontane forests to a maximum altitude of about 1,200 m (3,940 ft).

Food uses. The sweet fruits, often collected from wild trees, are eaten out of hand. They are occasionally made into desserts or used as colorful decorations on cakes and desserts.

Comments. The tough fibers of the bark have been used to produce rope and other tying material. The genus *Phaleria* comprises 60 species from tropical to temperate regions around the world. It includes several ornamental species like *P. octandra* and *P. clerodendron* (scented daphne) that are cultivated for their fragrant flowers and colorful fruits, which attract butterflies and birds.

Phyllanthus acidus (L.) Skeels

OTAHEITE GOOSEBERRY, MALAY GOOSEBERRY

Phyllanthaceae (Leafflower family)

Description. Deciduous tree with a spreading growth habit, 5–8 m (16–26 ft) tall. Alternate, compound leaves 16–28 cm (6.3–11 in) long. Leaflets ovate to lanceolate, blue-green and 4–7 cm (1.6–2.8 in) long. Small pink monoecious or hermaphroditic flowers are borne in panicles 8–12 cm (3–5 in) long. Pale yellow fruits are produced in often dense masses directly on the trunk and branches. Oblate fruits with smooth, waxy skin, 1.5–2 cm (0.6–0.8 in) wide with 6–8 distinct ribs. The crisp, juicy, very sour-tasting flesh encloses a stone with 4–6 seeds.

Origin and Distribution. Probably native to Madagascar, from where it spread to India and Southeast Asia in prehistoric times. The tree grows in subtropical or tropical climates with or without a prolonged dry season. Today the plant is of pantropical distribution and has been naturalized in many areas. Commonly cultivated in Southeast Asia as a dooryard tree.

Food uses. The sour-tasting fruits are eaten raw, often sprinkled with sugar. More often they are candied or cooked and made into chutneys, pickles, relishes, or preserves. In Thailand, the fruits are pickled with sugar and chilies and sold as snacks in local markets. In tropical Asia, the fruits are added to savory dishes like curries and seafood. Fruits are boiled with sugar, strained, and cooled to make a refreshing fruit drink. Cooking with sugar turns the yellow fruits dark red. Tender young leaves and shoots are eaten in India and Southeast Asia as a cooked vegetable.

Comments. This beautiful tree with its spectacular fruiting habit is often cultivated as an exotic ornamental.

Physalis peruviana L.

PERUVIAN CHERRY, CAPE GOOSEBERRY

Solanaceae (Nightshade family)

Golden, marble-sized berries are surrounded by elongated, papery calyx leaves that form a balloonlike husk around the fruit.

Description. Small herbaceous or soft-wooded plant, 0.5–1.5 m (2–4 ft) tall, with spreading branches. Alternate, heart-shaped leaves, 5–12 cm (2–5 in) wide, with pointed apices. Yellowish flowers with purplish-brown spots at the base of petals are borne in leaf axils. Golden, marble-sized berries are surrounded by elongated, papery calyx leaves that form a balloonlike husk around the fruit. The juicy flesh of the fruit, which contains numerous tiny seeds, has a pleasant sweet, grapelike taste.

Origin and Distribution. Native to mountainous regions of Colombia, Ecuador, Peru, and Chile. The plant, which grows at elevations between 1,000 and 3,000 m (3,300–10,000 ft) in the Andean mountains, is adapted to a cool high-altitude climate. It was extensively grown by pre-Columbian cultures of South and Central America. Starting around 1800, the plant was cultivated by early settlers in the Cape region of South Africa. From there it spread to Asia and Australia, where it has become naturalized in several areas. Today the Cape gooseberry is grown in many tropical and subtropical countries.

Food uses. The fruits are eaten fresh or used in fruit salads and desserts. They are made into sauces, pie fillings, chutneys, jams, and ice cream. In Colombia the fruits are served stewed with honey. Because of their exotic appearance, the fruits in their papery husks are sometimes used to garnish various restaurant dishes. In tropical America, the fruit halves are used in avocado salads. Cape gooseberries are commonly canned in syrup.

Comments. The plant has acquired several colloquial names. Besides the two mentioned above, the fruit is also called golden berry, Inca berry, and Peruvian ground cherry.

Physalis philadelphica Lam.

MEXICAN HUSK TOMATO, TOMATILLO

Solanaceae (Nightshade family)

Description. Semiwoody annual shrub 1–1.5 m (3–4 ft) tall. Alternate, ovate leaves with pointed apex 4–7 cm (1.6–2.8 in) long by 2–4 cm (0.8–1.6 in) wide. Hermaphroditic yellow flowers with reddish-brown spots are borne in leaf axils. Green, reddish-green, or greenish-yellow oblate to globose fruits 4–6 cm (1.6–2.4 in) long, covered in dry, papery calyx leaves. Flesh yellowish-green, juicy with a mild, subacid flavor.

Origin and Distribution. Native to mountainous regions from central Mexico south to Guatemala. The tomatillo was widely cultivated by Aztecs and Mayans in pre-Columbian times. It grows best in cooler mountain climates. Grown commercially in subtropical areas of India as well as in Australia and South Africa.

Food uses. Ripe fruits are eaten out of hand. The fruit is an essential ingredient in the traditional, ubiquitous Mexican *salsa verde* (green sauce), which contains green tomatillos, jalapeño chili peppers, garlic, onion, and spices. Often used as a vegetable in stews, meat dishes, soups, and Asian curries. Fruits are used to make jams, marmalades, and chutneys.

Comments. The Aztecs called the fruit *tomatl*, meaning round and plump. In Mexico the local nomenclature often causes confusion, since the common red tomato is called *jitomate* and the green tomatillo, *tomate*. Tomatillos are a good source of vitamins C and K, potassium, and fiber.

Plukenetia volubilis L.

SACHA INCHI

Euphorbiaceae (Spurge family)

Description. Perennial, semiwoody, evergreen vine, 2–4 m (7–20 ft) tall. Alternate, heart-shaped, hairy leaves 8–14 cm (3–5.5 in) long by 6–12 cm (2.4–5 in) wide with serrated margins. Flowers monoecious with small white male flowers and pairs of female flowers at the base of the inflorescence. Fruits, which ripen from green to brown, are star-shaped capsules 3–6 cm (1.2–2.4 in) wide with usually 4 but sometimes up to 7 distinct lobes. Ripe fruits contain several round, flattened, dark brown seeds, 1–2 cm (0.4–0.8 in) long.

Origin and Distribution. Native to the western Amazon lowlands and the eastern slopes of the Andes of Peru, where the plant grows in wet tropical rainforests from sea level to 2,000 m (6,600 ft). South American indigenous tribes have used the seeds and leaves as a food staple for at least 3,000 years.

Food uses. The seeds, which are inedible when raw, develop a mild, nutty flavor after being roasted. They are commonly eaten with salt or sugar and are sometimes coated with chocolate and sold as snacks. The seeds also provide a light brown edible oil of high quality, used in the preparation of a wide variety of meals.

Comments. The seeds of the sacha inchi plant are very nutritious, containing 35–60% oil rich in unsaturated fats and vitamins A and E, and about 27% protein. Further, the seeds contain all essential amino acids and are a very good source of omega-3 and omega-6 fatty acids as well as minerals and fiber.

The plant is also called Inca peanut or Inca nut. Both names are misleading since the plant was cultivated millennia before the Incas' reign and the fruit is botanically not a nut.

Pometia pinnata J.R. Forst. & G. Forst.

FIJI LONGAN, MATOA

Sapindaceae (Soapberry family)

Description. Large evergreen tree, 25–30 m (80–115 ft) or in some cases up to 50 m (165 ft) tall, with an irregular, dense crown, gray bark, and often large buttresses. Alternate, paripinnate leaves up to 1 m (3 ft) long with 4–8 pairs of oblong to lanceolate leaflets 15–30 cm (6–12 in) long. Small, monoecious, white to yellowish-green flowers are borne in terminal panicles. Fruits variable in shape and color. Usually round to oval with smooth, greenish, yellow-green, purple, reddish, or brown skin. Gelatinous, translucent to white, sweet, juicy pulp with a single large seed.

Origin and Distribution. The tree grows naturally in a vast region ranging from Sri Lanka and the Andaman Islands throughout Southeast Asia, with extension to southern China, Vietnam, Malesia, and the South Pacific as far as Samoa, Tonga, and Niue. The Fiji longan is often cultivated within its natural range, especially on the southern Pacific islands. Rarely grown elsewhere.

Food uses. The ripe fruit is consumed fresh as a seasonal fruit. It is similar in taste to the lychee (*Litchi chinensis*), but less aromatic. The edible seed is eaten boiled or roasted.

Comments. During the fruiting season, matoa fruits are in high demand and widely sold in markets, but they are usually not exported. The fruit is mainly of local importance, lacking the appeal and superior taste of the lychee and rambutan (*Nephelium lappaceum*).

The matoa is also a valuable timber tree. The durable wood is used in construction and furniture making.

Posoqueria latifolia Roem. & Schult.

NEEDLE FLOWER TREE

Rubiaceae (Coffee family)

Description. Small evergreen tree 6–10 m (20–33 ft) tall. Opposite, glabrous, elliptic to ovate-elliptic leaves 10–25 cm (4–10 in) long by 5–15 cm (2–6 in) wide. Very showy, sweetly fragrant white flowers are produced in drooping clusters at tips of branches with tubelike corollas 8–16 cm (3–6.3 in) long. Orange-yellow, globose fruits with smooth, thick skin and several translucent-orange seeds covered in a thin layer of mealy orange pulp.

Origin and Distribution. Native to the American tropics from Mexico to northern South America. The tree grows naturally in the understory of wet tropical forests; it also grows in seasonally dry tropical forests, where it is often confined to river margins and moist pockets. It is occasionally cultivated as an ornamental.

Food uses. Ripe fruits are opened and the soft, sweet aril around the seeds is eaten. Although fruits have very little pulp, they do have a delicious flavor reminiscent of a blend of mango (*Mangifera indica*, p. 147) and banana (*Musa* sp., p. 157).

Comments. Although of not much value as a fruit tree, the needle flower tree is a little-known and underestimated ornamental for tropical gardens and parks. It combines fairly compact growth with glossy dark green foliage and masses of large, very fragrant white flowers and conspicuous yellow-orange fruits. The flowers, which are particularly fragrant at night, are pollinated by nocturnal hawk moths, which have exceptionally long tongues, enabling them to reach the nectar in the corolla tubes, which can measure up to 16 cm (6.3 in) in length.

Pourouma cecropiifolia Mart.

AMAZON TREE GRAPE, UVILLA

Urticaceae (Nettle family)

The ashes of the leaves of *P. cecropiifolia* are chewed together with coca leaves by indigenous Colombian tribes to enhance the effect of the drug.

Description. Medium-sized, evergreen, sparsely branched tree, 10–20 m (33–66 ft) tall, with a cylindrical trunk. Leaves palmately compound with 9–11 oblong to lanceolate leaflets with prominent veins, each leaflet 20–35 cm (8–14 in) long with a petiole 15–35 cm (6–14 in) long. Small white dioecious flowers are produced in erect inflorescences in the axils of leaves. Fruits in pendent racemes of 20 or more fruits. Each fruit globose, dark purple, 2–4 cm (0.4–0.8 in) in diameter with a leathery, inedible skin. Translucent to whitish pulp juicy, very sweet with a taste reminiscent of grapes with a hint of vanilla. Each fruit contains one light brown seed.

Origin and Distribution. Native to the Amazon basin of South America. Very rarely grown outside its natural range. The tree is ultratropical, requiring year-round high temperature and humidity. It is cultivated by indigenous tribes of the Amazon region and can often be seen close to human settlements.

Food uses. The sweet fruits must be peeled and are then eaten fresh or made into jams and jellies. In South America, a refreshing drink is prepared from the fruits, which are blended with water, ice, and sugar. Uvillas can be fermented to produce a wine. The toasted seeds are ground and made into a coffee-like beverage.

Comments. The genus *Pourouma* consists of more than 50 species, of which several produce edible fruits. Fruits are very fragile and do not keep well after being harvested, limiting their commercial viability. The ashes of the leaves of *P. cecropiifolia* are chewed together with coca leaves by indigenous Colombian tribes to enhance the effect of the drug.

Pouteria caimito (Ruiz & Pav.) Radlk.

ABIU

Sapotaceae (Sapodilla family)

Description. Medium to tall evergreen tree, 10–35 m (33–115 ft) tall, with white or reddish sticky latex in all plant parts. Alternate leaves elliptic or ovate-oblong, 10–25 cm (4–10 in) long, tapering at base. Small white or greenish-white flowers, 5–9 mm (0.2–0.35 in) wide, are borne singly or in small clusters in the axils of leaves. Bright yellow, ovoid or nearly spherical fruits measure 5–12 cm (2–5 in) in diameter, sometimes with a short nipple at the apex and a thick, smooth skin. Pulp soft, sweet, mucilaginous, with 1–4 brown oblong seeds.

Origin and Distribution. Native to the western Amazon region of South America. The tree requires a tropical climate with high humidity throughout the year. It is frequently grown as a dooryard tree in tropical regions of Central and South America, but rarely elsewhere. Abiu fruits can be found regularly in the markets of Peru, Ecuador, Colombia, and Brazil.

Food uses. The fruits have a quite subtle flavor and are usually eaten fresh. They should be fully ripe for consumption to avoid the sticky latex present in even slightly underripe fruits. In the Pará region of Brazil, the fruit is made into sherbets and ice cream. The pulp can be mixed with yogurt as a breakfast dish. The chilled flesh sprinkled with lime juice is sometimes eaten as dessert.

Comments. Because of its specific name *caimito*, the plant is sometimes confused with *Chrysophyllum cainito*, the star apple (p. 61) native to the West Indies, which is also called *caimito* in Spanish. In Brazil the pulp of the abiu is eaten to ease coughs and bronchitis.

Pouteria campechiana (Kunth) Baehni

CANISTEL

Sapotaceae (Sapodilla family)

Description. Medium sized evergreen tree, 20–30 m (66–100 ft) tall. Leaves alternate, lanceolate-oblong, 10–30 cm (4–12 in) long by 4–8 cm (1.6–3 in) wide. Flowers whitish, fragrant, solitary or in small clusters in axils of leaves. Fruits vary greatly in shape but are usually round, ovoid, or spindle-shaped with a short, pointed apex and measure 4–7 cm (1.6–2.8 in) in diameter. Skin smooth, yellow to orange-yellow with mealy, soft, and rather dry flesh with the consistency of hard-boiled egg yolk and a sweet, musky taste. Fruits contain 1–4 glossy brown seeds.

Origin and Distribution. Native to southern Mexico, Belize, Guatemala, and El Salvador. The canistel is a common dooryard tree in Yucatán, Mexico. The plant is cultivated on a small scale in most countries of tropical America and also in parts of Southeast Asia. The tree thrives in moist, tropical climates with a short dry season but can also be grown in humid tropical climates and warm subtropical regions like southern Florida.

Food uses. Canistel fruits can be eaten fresh but are more often used for making pies, puddings, and bakery goods like cupcakes, pastries, and also pancakes. The fruits are sometimes eaten with salt, pepper, and mayonnaise. The seeded pulp is often blended with sugar and milk to make delicious milk shakes or ice cream.

Comments. The species name of the fruit is derived from the Mexican town and state of Campeche on the peninsula of Yucatán. Ripe fruits are a good source of vitamins A and B, niacin, and minerals like calcium. The fruit is sometimes called Mayan egg fruit because of the resemblance of the flesh to boiled egg yolk and its origin in southern Mexico.

Pouteria hypoglauca (Standl.) Baehni

CINNAMON APPLE

Sapotaceae (Sapodilla family)

Description. Small to medium-sized evergreen tree, 10–20 m (33–66 ft) tall. All plant parts contain white, sticky latex. Alternate leaves often clustered at tips of branches. Blades lanceolate to elliptic, 10–24 cm (4–9.5 in) long by 5 to 8 cm (2–3 in) wide. Yellowish flowers are borne in clusters in axils of leaves along branches. Yellowish-green, smooth-skinned, globose to ovoid fruits 15–20 cm (6–8 in) in diameter, with pale yellow, somewhat mealy, sweet-tasting pulp containing 1–4 light brown seeds.

Origin and Distribution. Native to tropical lowland regions of Central America. The tree is occasionally cultivated as a dooryard tree within its natural range, but very rare elsewhere.

Food uses. Sweet, fully ripe sweet fruits taste similar to the sapote (*P. sapota*, p. 196) and are commonly eaten out of hand. The fruit is occasionally used to make desserts or fruit juice by blending the pulp with ice, sugar, and water.

Comments. About 21 species of the genus *Pouteria*, which is widespread in the tropical regions of the world, produce edible fruits. The canistel (*P. campechiana*) and sapote in particular, both native to tropical America, are of commercial importance.

Pouteria lucuma (Ruiz & Pav.) Kuntze

LUCMO, LÚCUMA

Sapotaceae (Sapodilla family)

Remains of seeds have been found in Chilca, a site south of Lima dating to around 7500 BC.

Description. Medium-sized, erect evergreen tree with milky latex in all plant parts, 10–16 m (33–52 ft) tall. Alternate leaves clustered at tips of branches. Leaf blades oval to elliptic, 13–26 cm (5.2–10.4 in) long; upper side dark green, underneath pale to brown. Flowers yellowish-green, tubular with pubescent petals. Fruits round, egg-shaped, or oblate, 7–11 cm (2.8–4.3 in) in diameter with green skin and yellow, mealy, and rather dry pulp with 1–5 shiny dark brown seeds.

Origin and Distribution. The lucmo is native to the highlands of Ecuador, Peru, Bolivia, and Chile, where it grows in a subtropical mountain climate at elevations between 1,000 and 2,500 m (3,300–8,200 ft). This fruit tree has been cultivated in the central Andes for millennia. Remains of seeds have been found in Chilca, a site south of Lima dating to around 7500 BC. Fruits were often depicted on ceramics and at burial sites, especially those of the Moche people, showing the importance of the fruit as a food plant in ancient, pre-Columbian cultures. Today the lucmo is rarely grown outside its natural habitat.

Food uses. The pulp is sometimes eaten out of hand but is usually made into preserves or stewed with sugar and eaten as dessert. In Peru, the pulp is very popular for flavoring ice cream. It is also used to make milk shakes and as a filling for tarts and pies.

Comments. Lucmos are very nutritious fruits and a good source of carbohydrates and protein. They are also rich in carotene, vitamin B3 and other B vitamins, and minerals like calcium and phosphorus. The fruits and other parts of the plant were used in traditional medicine as a treatment for skin diseases, diabetes, and depression.

Pouteria sapota (Jacq.) H.E. Moore & Stearn

SAPOTE

Sapotaceae (Sapodilla family)

The name *sapote* is derived from the Aztec's Nahuatl language meaning "soft, sweet fruit."

Description. Erect evergreen tree with white latex in all plant parts, 20–45 m (66–147 ft) tall. Alternate, obovate leaves, which are clustered at the tips of branches, are 12–32 cm (5–13 in) long by 5–12 cm (2–5 in) wide. Small white flowers emerge in the axils of leaves. Fruit round to elliptic, 10–24 cm (4–9.5 in) long with a rough, grayish-brown skin. Creamy pulp deep-orange to red, soft, very sweet, with 1–4 spindle-shaped, shiny brown seeds. The taste of the fruit is often described as a mix of pumpkin and sweet potato.

Origin and Distribution. The tree grows naturally from southern Mexico to Nicaragua. Sapote fruits have been used by indigenous people of Mexico and Central America as a staple food for millennia. Today it is widely grown in tropical America and on a much smaller scale in several countries of Southeast Asia. The tree needs a humid, tropical climate and grows normally below 600 m (2,000 ft) elevation.

Food uses. The sweet pulp is often eaten fresh or made into milk shakes, smoothies, and ice cream. Pieces of fruit are sometimes added to green salads. The fruit makes excellent jellies and jams. In Cuba, a thick preserve called *crema de mamey colorado* is a popular food. In Mexico, a dessert called *dulce de sapote* is made from ripe fruits, lime or orange juice, sugar, and rum. In Oaxaca, Mexico, the ground kernels are mixed with corn, sugar, and spices into a nutritious beverage called *pozol*.

Comments. The name *sapote* is derived from the Aztec's Nahuatl language meaning "soft, sweet fruit." This general term has been applied to a variety of different and not closely related plants, including white sapote (*Casimiroa edulis*, p. 57) and black sapote (*Diospyros digyna*, p. 93), among several others.

The fruit is reputed to have kept Cortez and his army alive during his famous march from Mexico City to Honduras.

Pouteria viridis (Pittier) Cronquist

GREEN SAPOTE

Sapotaceae (Sapodilla family)

Description. Evergreen tree, 15–25 m (50–80 ft) tall. Alternate, simple leaves oblong to lanceolate, 20–30 cm (8–12 in) long by 5–10 cm (2–4 in) wide. Blades dark green, glabrous with pubescent veins. Pink or white flowers are produced in small clusters of 2–5. Fruits yellowish-green to greenish-brown, ovoid to spherical, frequently with pointed, elongated apex, 8–12 cm (3–5 in) in diameter. The skin is often covered in brown lenticels, especially around the apex. Orange to reddish, soft juicy pulp contains 1–2 shiny, dark brown seeds 4–5 cm (1.6–2 in) long.

Origin and Distribution. Native to Central America from Costa Rica north to southern Mexico. The tree grows in cool but frost-free mountain climates between 1,000 and 2,200 m (3,300–7,300 ft) above sea level. Usually cultivated as a dooryard tree. The plant is little known outside its natural range.

Food uses. The sweet, delicious flesh of fully ripe fruits is usually eaten fresh. The pulp is also used in fruit salads or served as dessert. In Central America, the edible seeds are eaten roasted and salted.

Comments. Although much less well known, the fruit is considered by many to be superior in taste to its close relative, the sapote (*P. sapota*).

Psidium acutangulum DC.

PARÁ GUAVA

Myrtaceae (Myrtle family)

The sour-tasting fruits are commonly blended with sugar or honey, ice, and water to make fruit drinks.

Description. Small shrubby tree 6–10 m (20–33 ft) tall. Opposite, elliptical leaves 9–13 cm (3.5–5.2 in) long, with pointed apex and rounded base. White flowers with 5 petals and hundreds of long white stamens are produced singly or in small clusters in the axils of leaves. Round to oval, pale yellow fruits with smooth skin, 5–9 cm (2–3.5 in) long, with juicy acid pulp and several hard seeds.

Origin and Distribution. Native from Venezuela, Colombia, the Guyanas, and Brazil to Ecuador, Peru, and Bolivia, where the tree grows naturally in humid forests of tropical lowlands and middle elevations. Grown as a dooryard tree in South America. Sporadically cultivated outside its natural range.

Food uses. The ripe fruits are used similar to those of the guava (*P. guajava*, p. 201). The sour-tasting fruits are commonly blended with sugar or honey, ice, and water to make fruit drinks. The juice is also used to flavor desserts, ice dream, and yogurt. In South America, the fruit is used to make a flavorful jelly.

Comments. This little-known guava species is sometimes mentioned under the synonym *Britoa acida* or *Psidium araca*.

Psidium cattleyanum Sabine

CATTLEY GUAVA, STRAWBERRY GUAVA

Myrtaceae (Myrtle family)

Ripe fruits contain vitamin C and are a good source of minerals such as potassium.

Description. Evergreen shrub or small tree 3–4 m (10–13 ft) tall. Opposite, glossy, obovate leaves 5–12 cm (2–5 in) long by 2–6 cm (0.8–2.4 in) wide. Fragrant, white flowers with long stamens are produced singly or in small groups in axils of leaves. Fruits round, 3–4 cm (1.2–1.6 in) in diameter, with persistent calyx leaves at the apex. There are two distinct varieties of the Cattley guava. The variety *longipes* bears red or purple-red fruits, and variety *littorale* produces yellow fruits, occasionally called lemon guava. Flesh aromatic with a subacid to sweet taste similar to a blend of strawberry and passionfruit. The central core contains numerous small, hard seeds.

Origin and Distribution. Native to eastern Brazil and Uruguay. The tree grows in tropical and warm subtropical climates. The Cattley guava is grown to some extent throughout tropical and subtropical America, but is uncommon in Africa and Asia. It is often grown as a beautiful ornamental or formed into a hedge. The tree tends to form dense stands and in some places is considered invasive. In Hawaii the plant has become a pest.

Food uses. Fruits are eaten fresh or made into fillings for pies and tarts. Ripe fruits are also used to make jellies and jams. Slices of the flesh are sometimes added to fruit punches. The roasted seeds have been used as a substitute for coffee and the leaves sometimes used to make tea.

Comments. This plant, which is closely related to the common guava (*P. guajava*, p. 201), is named in honor of the English horticulturist Sir William Cattley (1788–1835), an avid collector of tropical plants. Ripe fruits contain 20–50 mg (0.0007–0.002 oz) vitamin C per 100 g (0.22 lbs) and are a good source of minerals such as potassium.

Psidium friedrichsthalianum (O. Berg) Nied.

COSTA RICAN GUAVA, CAS

Myrtaceae (Myrtle family)

The fruits, which are rich in pectin, are sometimes used to make jellies and jams.

Description. Small evergreen tree, 7–10 m (23–33 ft) tall, with 4-angled, reddish, finely pubescent branchlets. Leaves are 5–12 cm (2–5 in) long, elliptic to oval with a pointed apex and a glossy upper side. Fragrant white flowers with up to 300 stamens are produced singly in leaf axils. Nearly spherical fruits, 5–8 cm (2–3 in) wide, with a yellowish-green skin when ripe and dry calyx leaves often still attached to the fruit. Flesh pale yellow with numerous small, very hard seeds. Ripe fruits have an acidic but very aromatic taste.

Origin and Distribution. The Costa Rican guava is native from northern Colombia throughout Central America up to southern Mexico. The tree is usually grown in home gardens from sea level to middle elevations. The fruit has gained minor importance in some Asian countries such as the Philippines. In Central America, it is commonly called *cas* or *cas agria*.

Food uses. Entire ripe fruits are blended with sugar, ice, and water to make a delicious, refreshing drink. The fruits, which are rich in pectin, are sometimes used to make jellies and jams. The processed pulp is sold as a concentrate to restaurants for the preparation of fruit drinks that are very popular in Central America.

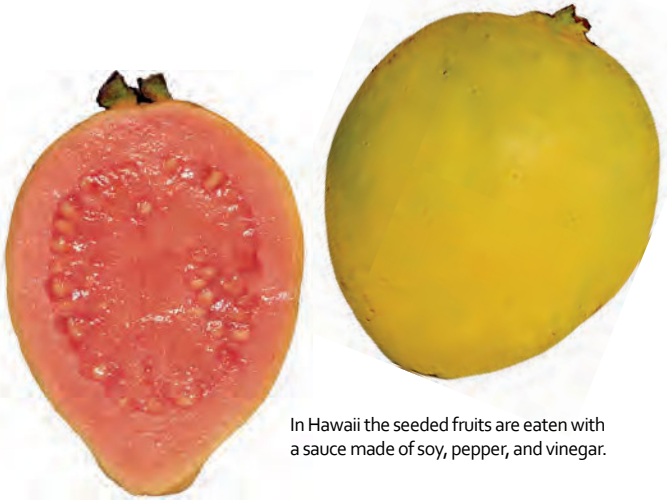
Comments. The Costa Rican guava is closely related to the guava (*P. guajava*). The genus consists of at least 100 species of tropical trees and shrubs, distributed mainly in tropical America.

The tree is named in honor of Emmanuel von Friedrichsthal, an Austrian botanist, naturalist, and archaeologist who traveled extensively through Central America in the eighteenth century.

Psidium guajava L.

APPLE GUAVA, GUAVA

Myrtaceae (Myrtle family)



In Hawaii the seeded fruits are eaten with a sauce made of soy, pepper, and vinegar.

Description. Small, evergreen tree, 6 to 10 m (20–33 ft) tall, with a flaking, greenish to copper-brown bark and twisted trunks. Opposite leaves elliptic to oval, 6 to 14 cm (2.4–5.5 in) long and 3 to 5 cm (1.2–2 in) wide with minute pubescent hairs on the underside of the blade. Perfect flowers, which are borne singly or in small clusters in axils of leaves, are white with 4 to 5 petals and up to 250 stamens tipped with yellow anthers. Fragrant fruits globose or ovoid, 5 to 10 cm (2–4 in) in diameter with greenish to light-yellow skin and adherent sepal leaves at the apex. Pulp pink, yellowish or almost white, very aromatic, subacid to sweet with numerous small, very hard seeds in the center.

Origin and Distribution. Probably native to Central America and southern Mexico. The guava has been dispersed throughout tropical and subtropical regions of the American continent by animals and humans for millenia. Spanish and Portuguese traders took seeds to Africa and Asia. Needs a tropical or warm subtropical climate with moist or seasonally dry conditions. In many parts of the tropics the guava has become naturalized; in some areas like southern Florida it has become invasive and is considered a pest.

Food uses. Guavas, which are very rich in pectin, are used to make jellies, jams, and marmalades. To obtain the juice, the fruits are boiled and the seeds strained. The resulting juice is used to flavor fruit drinks, ice cream, yogurt, and sodas. The pulp is used in many recipes for cake fillings, chutneys, pies and relishes. It is also boiled into a thick, sweet, reddish-brown paste, which is commonly used to make sweets. Unripe, green fruits are eaten as snacks with salt and lime juice. Ripe guava halves are sweetened and made into fruit salads or desserts. In Hawaii the seeded fruits are eaten with a sauce made of soy, pepper, and vinegar.

Guava pulp is processed industrially and the frozen concentrate is used in the production of juices and for bakery goods.

Comments. Guavas are a very good source of vitamin C, containing up to 350 mg (0.012 oz) per 100 gr (0.22 lbs) of pulp. They are rich in fiber and minerals like potassium and manganese, vitamin A, and folic acid. They also contain high amounts of carotenoids and polyphenols, which may act like antioxidants in humans. The leaves have been used extensively in traditional medicine to treat digestive disorders and inflammation.

Psidium guineensis Sw.

BRAZILIAN GUAVA

Myrtaceae (Myrtle family)

Since the tree is not often cultivated, fruits are collected mainly from wild trees.

Description. Small, evergreen tree, 4–8 m (13–26 ft) tall. Opposite leaves ovate to elliptic, 5–14 cm (2–5.5 in) long, leathery with finely toothed margins and the lower surface pubescent. White flowers, with numerous brushlike stamens, are borne in the axils of leaves. Round to oval yellow fruits, 2–3 cm (0.8–1.2 in) in diameter, with thick yellowish-white, firm flesh and many small hard seeds in the core. Ripe fruits have a subacid, somewhat strawberry-like taste that is less musky than the guava (*P. guajava*).

Origin and Distribution. Although the scientific species name might suggest a West African origin, the plant is native to tropical and subtropical parts of America ranging from southern Mexico and the Caribbean to Argentina and Brazil. Since the tree is not often cultivated, fruits are collected mainly from wild trees. Rarely grown outside its natural range.

Propagated through seeds. The tree requires a tropical or warm subtropical climate but can withstand short, light frosts. Brazilian guavas grow best on loamy soils and in full sun.

Food uses. Ripe fruits are sometimes eaten fresh but are used primarily to make jellies and preserves. The boiled and thickened juice is used for preparing desserts and in baking.

Comments. The Brazilian guava is a minor member of the genus *Psidium*, although it is reportedly superior to the guava (*P. guajava*, p. 201) for jelly.

Psophocarpus tetragonolobus (L.) DC.

WINGED BEAN

Fabaceae (Bean family)

Description. Short-lived perennial, herbaceous climbing plant growing to 5 m (16 ft) in length. Alternate, trifoliate leaves ovate to lanceolate, 9–14 cm (3.5–5.5 in) long by 5–12 cm (2–5 in) wide. White, blue, or reddish flowers, 2–2.5 cm (0.8–1 in) wide, are produced in loose pendent clusters. Fruit pods 16–24 cm (6.3–9.5 in) long with 4 distinctive longitudinal wings with frilly edges. Unripe, pale green fruits have a waxy skin and translucent flesh that tastes somewhat like asparagus. Ripe fruits turn light brown and split open, releasing the beanlike seeds.

Origin and Distribution. Probably native to tropical Africa. Some authors suggest New Guinea as a possible origin. Cultivated throughout the tropics and frost-free regions of the subtropics. The plant grows well in warm, humid climates with evenly distributed rainfall.

Food uses. Nearly all plant parts are used as food. The tender unripe fruits are eaten raw in salads or boiled and fried as a vegetable. The seeds of ripe fruits are eaten like beans and also used to make tofu and vegetarian milk. The seeds produce an edible oil used to cook with and make salads. Dried seeds are made into flour.

Young shoots, leaves, and flowers are eaten raw or boiled as a vegetable. The nutritious tuberous roots, which have a nutty flavor, contain starch and are high in protein; they are eaten boiled, roasted, or fried.

Comments. The winged bean is a highly nutritious plant, with seeds containing 30–35% protein and about 30% carbohydrate. Green plant parts also contain protein and are a good source of minerals and vitamins A and C.

Punica granatum L.

POMEGRANATE

Lythraceae (Loosestrife family)

Dried seeds are used as a spice in the cuisines of Pakistan and India, where they are called *anardana*.

Description. Evergreen or deciduous shrub or small tree, 5–9 m (16–30 ft) tall. Opposite or whorled, lanceolate, leathery leaves of variable size, but usually 3–8 cm (1.2–3 in) long. Bright red tubular flowers with fleshy, pointed sepals, 3–7 petals, and numerous stamens. Fruit a globose to slightly oblate berry with tough, leathery skin and persistent calyx leaves at the apex, 7–13 cm (2.8–5.2 in) wide. Fruits contain numerous hard seeds surrounded by dark red or pink, juicy arils separated by white, spongy tissue.

Origin and Distribution. Native from Iran to Pakistan and the western Himalaya regions of India. The plant has been cultivated since ancient times. It was mentioned in Egyptian mythology and art and praised in the Old Testament of the Bible and in the Babylonian Talmud. It reached India from Iran about the first century AD and was reported growing in Indonesia in 1416.

Today the pomegranate is widely cultivated in mountainous regions of the tropics and in subtropical regions of the world. The plant grows best in semiarid, subtropical climates with hot summers and cool winters.

Food uses. Ripe fruits are opened and the arils eaten out of hand with the seeds. In many regions, the arils are strained to make a delicious juice. Pomegranate arils are ingredients in a wide variety of Mediterranean, Middle Eastern, and Indian dishes. A thick, sweet syrup obtained from the fruit is used in the preparation of cocktails and in Middle Eastern and Indian cuisine. It is also used to make sauces for traditional meat and poultry dishes. More recently, the arils have been introduced into granola bars, cereals, and salad dressings as well as dessert and ice cream toppings. Dried seeds are used as a spice in the cuisines of Pakistan and India, where they are called *anardana*. Arils are fermented to make alcoholic, winelike beverages.

Comments. Pomegranate juice is a good source of vitamins C and B5, potassium, and polyphenols. Numerous studies have recently examined the potential antioxidant activity of pomegranate arils and seeds.

Quararibaea cordata (Bonpl.) Vischer

CHUPA CHUPA

Malvaceae (Mallow family)

The common English name for the plant is derived from the Spanish word *chupar*, to suck, describing the way the pulp is sucked to separate it from the large seeds.

Description. Tall, erect tree reaching 35–45 m (115–150 ft) in height. Alternate, long-petioled leaves clustered at tips of branches, broadly heart-shaped, 16–32 cm (6.3–12 in) long by 14–28 cm (5.5–11 in) wide. Pink or yellow perfect flowers with 5 petals are produced in great quantities along trunk and lower branches. Fruits spherical, ovoid, or elliptic, 10–15 cm (4–6 in) long by 6–10 cm (2.4–4 in) wide with thick greenish-brown, downy rind and persistent calyx at base. Sweet, soft but fibrous flesh orange-yellow with 2–5 seeds.

Origin and Distribution. Native to Brazil, Peru, Ecuador, Venezuela, and Colombia in the western regions of the Amazon basin. The tree is rarely cultivated outside its natural range except in botanical gardens or as a curiosity. The chupa chupa requires a humid, tropical or warm-subtropical climate without frost.

Food uses. The fruits, which have an agreeable taste, are usually eaten out of hand. They are occasionally made into marmalade, sweets, or juice.

Comments. Interestingly, the ripe fruit does not fall off the tree but remains on the tree until it rots. It must be cut off with a knife when ripe. Ripe fruits turn yellow around the calyx. A few natural varieties exist, and these usually differ in being sweeter and having less fibrous pulp.

The tree is also known by the synonym *Matisia cordata*. The common English name for the plant is derived from the Spanish word *chupar*, to suck, describing the way the pulp is sucked to separate it from the large seeds.

Randia formosa (Jacq.) K. Schum.

BLACKBERRY JAM FRUIT

Rubiaceae (Coffee family)

Description. Evergreen shrub, 2–3 m (6–10 ft) tall, with opposite, lanceolate, softly pubescent leaves 4–6 cm (1.6–2.4 in) long. White, sweetly fragrant, tubular flowers 4–5 cm (1.6–2 in) long with a star-shaped corona. The flowers are pollinated by nocturnal moths. Fruits are yellow ovoid berries, 1–2 cm (0.4–0.8 in) long, with a fairly thick, almost woody skin that contains a soft, nearly black pulp with several small flat seeds.

Origin and Distribution. Native to tropical regions of Central and South America. Though it is sometimes cultivated for its fruits, it is generally rare as a fruit tree. The plant grows under tropical and warm subtropical conditions.

Food uses. The pulp of ripe fruits has a sweet taste very similar to blackberry jam and is eaten fresh as a snack. In South America, the fruits are used to make a refreshing beverage.

Comments. The genus *Randia* comprises more than 100 species distributed worldwide in the tropics and subtropics. Only a few produce edible fruits, but some are cultivated as ornamentals because of their compact growth habit and often beautiful and fragrant flowers.

Rhodomyrtus tomentosa (Aiton) Hassk.

CEYLON HILL GOOSEBERRY, DOWNY MYRTLE

Myrtaceae (Myrtle family)

Description. Small evergreen tree or large shrub 6–10 m (20–33 ft) tall. Opposite, elliptic, leathery leaves 4–7 cm (1.6–2.8 in) long by 2–3 cm (0.8–1.2 in) wide. The underside of the leaves is densely covered in grayish-white tomentose hairs. Showy pink or purplish-pink flowers 2–3 cm (0.8–1.2 in) wide are produced singly or in small clusters in leaf axils. Fruits purple, ellipsoid, 1–1.5 cm (0.4–0.6 in) long with persistent calyx leaves and a juicy, sweet pulp with few small seeds.

Origin and Distribution. Native to South and Southeast Asia, where the tree often grows in riparian or seasonally wet habitats.

Food uses. The ripe fruits are often made into an excellent jam. They are also cooked with sugar to make fillings for pies and tarts. In Cambodia and Vietnam, the fruits are fermented to produce a winelike, alcoholic drink locally called *ruou sim* (myrtle wine).

Comments: In the wild, the fruits are eaten by a wide variety of frugivorous birds and mammals. The plant is also known by various synonyms, including *Myrtus tomentosa* and *M. canescens*. In Hawaii and other tropical regions, the plant has become invasive and is considered a pest.

Rollinia mucosa (Jacq.) Baill.

BIRIBÁ

Annonaceae (Custard apple family)

The fruits contain several hard, dark brown seeds.

Description. Fast-growing, evergreen tree, 5–14 m (16–45 ft) tall. Leaves alternate, oblong-elliptic with pointed apex, 10–25 cm (4–10 in) long with a pubescent underside. Hermaphroditic flowers—with 3 hairy sepals, 3 triangular, fleshy outer petals, and 3 inner rudimentary petals—are borne in the axils of the leaves. Heart-shaped to oblate fruits measure 10–18 cm (4–7 in) in diameter. The leathery yellow rind is composed of hexagonal segments, each tipped by a short, soft protuberance. Translucent, white pulp very soft, juicy with a subacid to sweet taste. The fruits contain several hard, dark brown seeds.

Origin and Distribution. The biribá is native to tropical America from southern Mexico and the Caribbean south to northern Argentina, Paraguay, and Brazil. It is very rarely cultivated outside its natural range except in rare fruit collections and botanical gardens. The tree requires a moist, tropical climate.

Food uses. The sweet pulp is eaten fresh or chilled as a dessert. After the inedible seeds are removed, the pulp is most commonly blended with milk or water, ice, and sugar to make a delicious fruit drink.

Comments. When ripe, the biribá is very sensitive to bruising through handling, causing the yellow to turn black, making the fruit unattractive. This sensitivity prevents the fruits from being shipped or exported. Locally, the fruits are quite popular and often seen in markets.

Rubus eriocarpus Liebm.
Rubus glaucus Benth.

MORA, ANDEAN BLACKBERRY

Rosaceae (Rose family)

Description. Spiny evergreen or deciduous shrub with scandent branches, 2–3 m (7–10 ft) tall. Alternate, dark green, trifoliate leaves 6–12 cm (2.4–5 in) long by 2–7 cm (0.8–2.8 in) wide, elliptic to ovate leaflets with serrated margins and silvery, tomentose underside. Hermaphroditic pale pink to white flowers with 5 petals and numerous stamens. Aggregate fruits consist of tiny drupes, grow 1–1.5 cm (0.4–0.6 in) long, turn from green to red to shiny black when fully ripe.

Origin and Distribution. *R. eriocarpus* is native to mountainous regions between Mexico and Panama. *R. glaucus* occurs naturally in Central and South America. Both grow in high altitudes between 1,500 and 3,300 m (5,000–11,000 ft), with *R. eriocarpus* usually occurring at higher elevations.

Food uses. In Central and South America, mora fruits are used mainly for making delicious milk shakes (*mora con leche*) and fruit juices. The fruits are also used in desserts, jams, and jellies as well as in pie fillings and cakes. In some regions they are made into wine.

Comments. The genus consists of more than 375 species, with many very closely related, forming apomictic microspecies. The two described species are very similar. In regions of Central America where both species coexist, *R. eriocarpus* usually occurs at higher altitudes than *R. glaucus*.

Sandoricum koetjape (Burm. f.) Merr.

SANTOL

Meliaceae (Mahogany family)

Santol fruits are especially popular in India, Laos, and the Philippines.

Description. Tall evergreen tree, often with a thick, buttressed trunk, reaching 30–50 m (100–165 ft) in height. Alternate, compound leaves with 3 elliptic to oblong leaflets, each measuring 20–27 cm (8–11 in) in length. Greenish or yellowish, slightly fragrant flowers are borne in small drooping panicles. Spherical to oblate fruits, measuring 5–8 cm (2–3 in) in diameter with orange or yellow rind. The rind contains a milky sap. The edible parts of the fruit are the 3–5 fleshy segments with translucent, juicy arils surrounding the inedible brown seeds. The pulp has a sweet to sweet-sour, fruity aroma.

Origin and Distribution. The tree is native to Cambodia, southern Laos, Thailand, southern Myanmar, and the Malay Peninsula. Widely cultivated as a fruit tree from India to Southeast Asia. Very rarely cultivated in Africa or tropical America. The tree is best suited to a humid tropical climate but can withstand prolonged dry seasons.

Food uses. Santol fruits are most often eaten out of hand. Peeled and seeded fruits are made into jellies and marmalades. In Southeast Asia, ripe fruits are boiled and served in syrup as a dessert. Santol fruits play a role in a variety of savory meat and fish dishes that are especially popular in India, Laos, and the Philippines. In the region of Bicol in the Philippines, grated santol fruits are cooked in coconut milk in a dish called *ginataang santol* and served with spicy pork. Young fruits are sometimes candied. Very ripe fruits are fermented with rice to make an alcoholic drink.

Comments. Fruits are a good source of vitamin C, containing about 90 mg (0.003 oz) ascorbic acid per 100 g (0.22 lbs) pulp. There are two main varieties of the santol, based on the color of their senescent leaves. The older leaves of one variety are red whereas the leaves of the second turn yellow before falling off. These were formerly placed in two separate species.

The santol is very prolific, with mature trees producing between 18,000 and 24,000 fruits per year.

Sauropus androgynus (L.) Merr.

KATUK, SWEET LEAF

Euphorbiaceae (Spurge family)

Description. Vigorous evergreen shrub, 2–3 m (7–10 ft) tall, with dark green oval leaves 5–6 cm (2–2.4 in) long. Perfect flowers with dark red petals are borne in leaf axils. Angular fruits whitish-pink or pink with 4–6 black seeds.

Origin and Distribution. The exact origin of the katuk is unknown. It grows wild and in cultivation from India and Sri Lanka to Southeast Asia. The plant needs a humid tropical climate with evenly distributed rainfall. It is commonly grown as a living fence in home gardens.

Food uses. The leaves and the young shoots, which have a pleasant sweet and slightly nutty flavor, are eaten raw or cooked as a nutritious vegetable. Katuk leaves are considered the most popular leaf vegetable in Southeast Asia, retaining their dark green color and firm texture when cooked. In Malaysia, the leaves are stir-fried with eggs and dried anchovies. In many Asian countries katuk is used as a leaf vegetable in soups and curries. The tender and succulent shoot tips are sold as a delicacy. In Sabah, Malaysia, a special technique is used to produce extra long shoots that resemble Asparagus (*Asparagus officinalis*). They are prepared in gourmet restaurants as "tropical asparagus" or "Sabah vegetable."

Comments. Katuk leaves are very nutritious. They contain 6–10% of their fresh weight in protein, which is about 10 times as much as in spinach and greater than any other leaf vegetable. Leaves are also a very good source of vitamins B, C, and K, provitamin A, and minerals like calcium and iron. The plant is easy to grow in the tropics and produces high yields. It has a good potential for human nutrition in areas with protein and vitamin A deficiencies. The plant is well suited for cultivation in agroforestry projects, since this rainforest plant can grow in the shaded understory of plantations.

The consumption of large amounts of raw katuk leaves can be hazardous because of their high content of the alkaloid papaverin, which can cause dizziness and constipation and lead to lung damage.

Sechium edule (Jacq.) Sw.

CHAYOTE

Cucurbitaceae (Cucumber family)

Description. Perennial vine, climbs with tendrils. Leaves 20–25 cm (8–10 in) long, alternate, heart-shaped with 3–5 lobes. Flowers monoecious with pale yellow male flowers in small racemes and greenish female flowers. Fruits pear-shaped, pale green, dark green, or yellowish-white, 8–20 cm (3–8 in) long and weighing up to 1 kg (2.2 lbs). Skin smooth or with soft spines, often with deep ridges. Firm, crisp flesh light green with a single whitish, somewhat flattened seed.

Origin and Distribution. The plant is native from central Mexico to Nicaragua, with the greatest number of varieties found in Guatemala. Today it is cultivated in many tropical and subtropical countries, especially in Central America, where chayote has been cultivated since pre-Columbian times and is important for human nutrition.

Food uses. The fruits have a mild flavor and are eaten raw or cooked as a vegetable. Young, underripe fruits are eaten in salads. In Central American countries, cooked slices of chayote are commonly served as a side dish and often used in soups and stews. The versatile fruits can be mashed, fried, baked, preserved in vinegar, or marinated with lime juice.

The seeds, which have a nutty flavor, are also edible and sometimes consumed as a vegetable. Young shoots can be eaten like asparagus, and the leaves are often prepared like spinach. In Thailand, the young shoots and leaves are used in the preparation of soups and stir-fries. The large, starchy roots, which can weigh up to 10 kg (22 lbs), are used like cassava or potatoes and eaten boiled, fried, or roasted.

Comments. The common name of the plant is the Spanish form of the original Nahutal name used by the Aztecs, who called the fruit *chayotli*, meaning spiny calabash. Chayote is often cultivated in backyards, since it requires little maintenance and produces a large number of fruits over several years. The fruits are a good source of vitamin C and fiber and are very low in calories.

Sechium tacaco (Pittier) C. Jeffrey

TACACO

Cucurbitaceae (Cucumber family)

Description. Vigorous perennial vine 8–12 m (26–39 ft) long, climbing with branched tendrils. Alternate, ovate-cordate, glabrous leaves 10–28 cm (4–11 in) wide with grooved petioles 8–15 cm (3–6 in) long and 3–5 pointed lobes. Small yellow-green to cream-colored, monoecious flowers, about 4 mm (0.16 in) wide, are insect-pollinated and borne in axillary racemes. Fruits are dark green, ovoid, 5–7 cm (2–2.8 in) long with 5 longitudinal grooves. The leathery skin is covered with several small spines. The fruit contains a single reddish-brown seed and firm green flesh turning fibrous when ripe.

Origin and Distribution. Native and endemic to Costa Rica and adjacent regions in Nicaragua and Panama. The plant grows mainly in subtropical mountain climates at elevations from 600 to 1,500 m (2,000–5,000 ft) without frost.

Food uses. The unripe, tender, seeded fruits, which have a mild, somewhat cucumber-like taste, are used as a vegetable in soups or cooked with meat and vegetables like corn and squash in stews. Ripe fruits become very fibrous and tough and the seeds bitter. Diced cooked fruits are sometimes served as a side dish.

Comments. The fruits are commonly sold in markets of Central America. The plant is also known by the synonym *Polakowskia tacaco*.

Sicana odorifera (Vell.) Naud.

CASSABANANA

Cucurbitaceae (Cucumber family)

The aromatic fruits are often hung in closets for their long-lasting fragrance.

Description. Vigorous perennial herbaceous vine that climbs with tendrils and grows 10–15 m (33–50 ft) in height. Alternate leaves cordate to kidney-shaped, 10–14 cm (4–5.5 in) long, deeply 3-lobed, hairy. Monoecious, cup-shaped flowers yellow or white, with 5 petals. Male flowers about 2–3 cm (0.8–1.2 in) wide; female flowers 5–6 cm (2–2.4 in) wide. Strongly aromatic, ellipsoid to cylindrical fruits, 40–60 cm long by 8–12 cm (3–5 in) wide, with smooth, hard, dark red to reddish-brown or almost black skin. Melonlike, sweet and juicy flesh orange-yellow with numerous oval seeds in the central cavity.

Origin and Distribution. Probably native to Brazil, from where it spread in prehistoric times throughout tropical South and Central America. The plant requires a tropical climate. Grown in tropical America as a fruit plant and as an ornamental. Rarely cultivated elsewhere.

Food uses. Unripe, green fruits are eaten boiled in soups, stews, and as a cooked side dish called *picadillo* in Spanish. Fully ripe fruits, which have a delicate flavor reminiscent of peach or banana, are consumed fresh or made into juice. In Latin America, the fruits are boiled to make a delicious dessert. Also used in preserves or to make jellies and jam.

Comments. The aromatic fruits are often hung in closets or around the house for their long-lasting fragrance. *S. odorifera* is the only species in the genus *Sicana*.

Solanum melongena L.

EGGPLANT, AUBERGINE

Solanaceae (Nightshade family)

Probably native to a region from India and Sri Lanka to Bangladesh and Myanmar.

Description. Perennial, bushy, evergreen shrub, 1–2 m (3–6 ft) tall. Alternate, simple, ovate leaves with petioles 6–9 cm (2.4–3.5 in) long and blades with lobed margins 8–22 cm (3–9 in) long by 4–14 cm (1.6–5.5 in) wide. Purple to white flowers with campanulate corollas and yellow stamens are produced singly or in cymes. Fruits are elongated, ellipsoid or ovoid berries, 10–40 cm (4–16 in) long, with a smooth, shiny skin and a firm whitish flesh with numerous pale brown seeds. Unripe fruits are often attractively colored, ranging from white to green and purple. Ripe fruits are usually yellow or brown.

Origin and Distribution. Probably native to tropical regions, from India and Sri Lanka to Bangladesh and Myanmar. Wild forms of *S. melongena* have been found in Myanmar. The plant spread in prehistoric times through South Asia and from there into western Asia and Southeast Asia. Today the plant is grown worldwide in the tropics and in the subtropics as an annual. The eggplant, which is sensitive to cold, requires a long, warm growing season.

Food uses. Immature fruits, with a texture similar to mushrooms and a fine, delicate flavor, are eaten boiled, grilled, fried, steamed, baked, or roasted in a wide variety of savory dishes. They are used as a popular vegetable in stews or as a side dish with meat and seafood recipes. Boiled pieces of eggplant are an essential ingredient in the traditional French stew called *ratatouille*. In Southeast Asia, the fruits are often eaten raw in salads. Eggplants are preserved by pickling or drying. Mature fruits have hard seeds and become fibrous and often bitter.

Comments. China and India are the largest producers of eggplants, providing close to 80% of world production. Eggplants comes in many varieties, reflected in different shapes, sizes, and colors of fruit. They are low in calories, with only 15 kcal per 100 g (0.22 lbs) fruit. Different parts of the eggplant play an important role in traditional Asian medicine.

Solanum muricatum Aiton

MELON PEAR

Solanaceae (Nightshade family)

Description. Small perennial shrub with highly variable leave shapes, usually simple but sometimes pinnate. Perfect flowers with 5 petals. The flower color changes with temperature: plants cultivated in cool temperatures below 20 °C (68 °F) produce blue flowers; above 25 °C (77 °F), they turn white. Fruits of variable shape, but normally pear-shaped or spherical, 10–20 cm (4–8 in) in diameter. Smooth waxy skin with variable coloration, most often yellow or orange with purple or reddish streaks. Pulp melon-like, the central cavity with or without seeds.

Origin and Distribution. Probably native to the western Andean regions and inter-Andean valleys of Colombia, Ecuador, Peru, and northern Chile, where it has been cultivated for at least 6,000 years. The plant is unknown in the wild. Melon pears played an important role in pre-Columbian times and were commonly depicted on ceramics and textiles of the Chimú, Paracas, and Moche cultures. Today the plant is grown in many countries with a subtropical or tropical climate and is slowly gaining international acceptance.

Food uses. Melon pears, which have a sweet, juicy taste, are normally sliced and served like melons. They are used in fruit salads, juices, and desserts. Slightly underripe fruits are sometimes boiled like a vegetable and served as a side dish.

Comments. Melon pears are fairly rich in vitamins A and C and low in carbohydrates and calories. They are commercially cultivated in Peru, New Zealand, and Western Australia and, to a lesser extent, in Turkey and California. They are currently being introduced into upscale markets in Asia, Europe, and North America.

Solanum quitoense Lam.

NARANJILLA, LULO

Solanaceae (Nightshade family)

The taste of ripe fruits is sometimes described as a mix of rhubarb and lime.

Description. Small perennial, herbaceous shrub, usually spineless or less often very spiny, becoming woody with age, 1.5–2.5 m (5–8 ft) tall. Young growth is densely covered in short purple or whitish hairs. Alternate, oblong-ovate, soft woolly leaves 50–60 cm (20–24 in) long by 35–45 cm (14–18 in) wide. White and purple fragrant flowers are borne in small clusters in the axils of the leaves. Round to ovate, 5–7 cm (2–2.8 in) in diameter, bright orange fruits are covered in short brown hairs. Tomatolike flesh greenish or yellowish, translucent, juicy, subacid with numerous small seeds. The taste of ripe fruits is sometimes described as a mix of rhubarb and lime.

Origin and Distribution. Native to an extensive mountainous region from Costa Rica and Panama in Central America south to Colombia, Ecuador, and Peru. The plant, which does not tolerate frost, grows best in partly shaded, humid areas at elevations between 1,000 and 2,500 m (3,300–8,200 ft).

Food uses. Fully ripe fruits are sometimes eaten fresh by squeezing the pulp out of the fruit. Fruit pieces are often eaten with salt and lime juice. Most often, naranjillas are blended with sugar, water, and ice to make a tasty, refreshing fruit drink. In Colombia, a wine is made from ripe fruits and sold commercially. In northwestern South America, the strained pulp is blended with condensed milk and served half-frozen as *sorbete de lulu*. Fruits are sometimes used to make jellies and jams or sauces served with ice cream and desserts or other local dishes. Lulo growers who are trying to promote the fruit in South America have created a cocktail based on the fruit and vodka.

Comments. There are two major varieties of the naranjilla. The spineless and most cultivated variety is apparently native to Peru and Ecuador, whereas the spiny variety, called *S. quitoense* var. *septentrionale*, is native to Central America. The Spanish name *naranjillo* means "little orange."

Solanum sessiliflorum Dunal

COCONA

Solanaceae (Nightshade family)

The sweet-sour taste of the fruit has been described as a flavorful mix of tomato and lemon.

Description. Perennial herbaceous shrub, 1.5–2.5 m (5–8 ft) tall. Branches are covered in soft white hairs. Alternate, ovate leaves, 40–50 cm (16–20 in) long by up to 40 cm (16 in) wide with fine, short hairs on the underside. Yellowish-green flowers with 5 petals are borne in leaf axils. Fruits oblong, round, or pear-shaped with a thin, shiny skin. Fruit colors range from red and reddish-brown to bright orange and yellow. The firm, cream-colored flesh encloses a gelatinous pulp with numerous tiny seeds. The sweet-sour taste of the fruit has been described as a flavorful mix of tomato and lemon.

Origin and Distribution. The cocona is native to the upper Amazon region of northwestern and western South America. The plant requires a tropical to subtropical climate and grows between sea level and 1,500 m (5,000 ft). It is very rarely cultivated outside its natural range.

Food uses. In South America, where coconas are regularly sold in the markets, the fruits are most often eaten fresh or made into juice. For fruit drinks, the pulp is blended with ice and sugar. Boiled with sugar, the fruits are used to make sauces, pie fillings, jams, and marmalade. The fruit is also used as a vegetable in savory dishes like meat stews, fish dishes, salads, and soups. In Peruvian cuisine, the fruit has become an ingredient in more elaborate dishes at upscale restaurants. In Brazil, the leaves are cooked and eaten.

Comments. Coconas are a good source of vitamin B5, carotene, and minerals like iron, phosphorous, and calcium. Indigenous people of Peru use the juice of the fresh fruit to treat diabetes and high blood pressure (pers. comm.). The plant is closely related to the naranjilla (*S. quitoense*, p. 217), native to the Andes of northwestern South America.

Solanum torvum Sw.

TURKEY BERRY, PEA AUBERGINE

Solanaceae (Nightshade family)

Description. Perennial, evergreen, spiny shrub, 2–4 m (6.6–13 ft) tall. Alternate to near opposite, lobed leaves broad oval to ovate, 10–15 cm (4–6 in) long by 8–10 cm (3–4 in) wide. White flowers with 5-lobed corollas are produced in branched inflorescences. Fruits, orange to orange-yellow berries measuring 1–1.5 cm (0.4–0.6 in) in diameter, contain numerous tiny flat brown seeds.

Origin and Distribution. Native to tropical and subtropical regions from southern North America south to Brazil and Argentina. The plant has been introduced into Africa and Asia, where in many parts it has become naturalized. *S. torvum* grows in disturbed, sunny locations such as clearings, gaps, and roadsides.

Food uses. The green, pealike fruits are eaten as a vegetable and used in soups and stir-fries, especially in the cuisine of Thailand and Laos, where they are a common sight in markets. The pea aubergine is an essential ingredient in yellow Thai curry. In Tamil Nadu, India, the green fruits are eaten fried in a variety of dishes. In Jamaica, the fruit is used in traditional dishes that contain salted fish and akee fruits.

Comments. *S. torvum* is commonly used as a disease-resistant rootstock for grafting varieties of eggplant (*S. melongena*, p. 215). The plant is considered a weed in many tropical and subtropical regions.

Spondias dulcis Parkinson

AMBARELLA

Anacardiaceae (Cashew family)

Boiled and strained fruits produce a thick sauce similar to applesauce.

Description. Fast-growing deciduous tree, 10–20 m (33–66 ft) tall. Alternate, pinnate leaves 20–60 cm (8–24 in) long with 9–25 elliptic leaflets, 6–10 cm (2.4–4 in) long. Tiny whitish flowers are produced in terminal panicles. Fruits oval, 5–9 cm (2–3.5 in) long, with green skin turning golden yellow when fully ripe. Crisp, subacid, juicy flesh with 1 large fibrous woody stone with 1–5 seeds.

Origin and Distribution. Native from eastern Indonesia and Papua New Guinea to Melanesia and Polynesia. The tree was introduced into Jamaica in 1782. Cultivated on a small scale in most tropical countries, but usually uncommon. The ambarella thrives in humid tropical and warm subtropical climates; it cannot withstand frost.

Food uses. Unripe, green fruits are often eaten with lime juice, salt, and sometimes chili sauce, just like green mangoes. Green fruits with crunchy flesh are also made into preserves, pickles, jams, and relishes. Ripe fruits are eaten fresh or made into a delicious juice. Boiled and strained fruits produce a thick sauce similar to applesauce. Ambarellas are sometimes used as an ingredient in a typical Asian dish called *rojak*, a traditional fruit and vegetable salad dish. In Southeast Asia, fruits are eaten after being dipped in shrimp sauce. Young leaves have an acidic taste and are eaten raw or boiled and served with rice and fish or meat dishes in Indonesia.

Comments. The tree is also known by the synonym *S. cytherea*. And it is known by a great variety of vernacular names, including golden apple, June plum, Otaheite apple, great hog plum, and, in South America, yuplón and mango oro, among many other names.

Spondias mombin L.

YELLOW MOMBIN

Anacardiaceae (Cashew family)

Fruits are eaten by cattle and pigs as well as by numerous wild mammal and bird species.

Description. Erect deciduous tree with a corky, fissured bark, 20–30 m (66–100 ft) tall. Leaves, which are very aromatic when crushed, are 20–45 cm (8–18 in) long, odd pinnate with 7–19 opposite or sub-opposite leaflets. These are lanceolate to ovate, pointed, 6–16 cm (2.4–6.3 in) long. Tiny yellowish-white, insect-pollinated flowers, 0.5–0.7 mm (0.02–0.03 in) across, are borne in terminal panicles. Abundant fruits in pendent clusters, ovoid, 3–4 cm (1.2–1.6 in) long, with leathery yellow skin. Pulp juicy, aromatic, subacid to sweet with a large fibrous stone. Flavor reminiscent of mango.

Origin and Distribution. The yellow mombin is native throughout tropical America, where it grows from sea level to about 1,200 m (3,900 ft) in seasonally dry and wet forests. It is occasionally planted in tropical Asia and fairly common in Africa but rarely cultivated for its fruits.

Food uses. The ripe fruits are sometimes eaten fresh or more often made into juice, jellies, jams, ice cream, or sherbets. Green fruits are eaten with lime juice and salt. In Mexico, the green fruits are pickled in vinegar and used like olives. In parts of Brazil, the fruits are fermented to make a wine called *vinho de taperiba*.

Comments. The yellow mombin is widely planted as a living fence post. The fruits are eaten by cattle and pigs as well as by numerous wild mammal and bird species. The wood can be used to make paper.

Several parts of the plant are used in traditional medicine. A bark decoction is used to relieve cough and the juice of the ripe fruits is employed as a febrifuge.

Spondias purpurea L.

PURPLE MOMBIN, RED MOMBIN

Anacardiaceae (Cashew family)

In Mexico, the pulp of green fruits is made into a spicy green sauce with salt and chili peppers.

Description. Small to medium-sized deciduous tree with thick, spreading branches, 7–12 m (23–39 ft) tall. Alternate leaves pinnate with 5–21 elliptic leaflets, 3–5 cm (1.2–2 in) long. Tiny purplish-red flowers are produced in short panicles before new leaves appear. Fruits, oval drupes 3–5 cm (1.2–2 in) long, with a thin, waxy skin and a single large stone, turn from green to dark red, orange, or, less often, yellow when ripe. Pulp crisp, fairly juicy, with a subacid, aromatic taste.

Origin and Distribution. The purple mombin is native to semiarid tropical regions, from Mexico south to Peru and Brazil, where it grows naturally up to an altitude of about 2,000 m (6,500 ft). It is now grown in many tropical countries around the world and has been naturalized in parts of India, the Philippines, and Nigeria.

Food uses. The ripe fruits, which contain a large stone and little pulp, are enjoyed fresh as a snack. Unripe, green fruits are sold in markets in Latin America. They are usually eaten with lime juice and salt. Fruits can be stewed and served with sugar as a dessert. The juice of boiled fruits is fermented to make vinegar and wine. In Mexico, the pulp of green fruits is made into a spicy green sauce with salt and chili peppers. In Asia, green fruits are pickled or made into a jam. The young leaves, which have a sour taste, can be eaten cooked.

Comments. In Central America, this fruit is commonly called *jocote*, a name derived from the Nahuatl word *xocotl*, meaning "sour fruit." The tree is easily propagated from large hardwood cuttings and used in many parts of tropical America as a living fence post.

Spondias tuberosa Arruda

BRAZIL PLUM, UMBU

Anacardiaceae (Cashew family)

Description. Small deciduous tree with a very broad growth habit, 4–6 m (13–20 ft) tall. Alternate pinnate leaves with 5–9 ovate leaflets. Small white flowers are produced in terminal panicles. Fruits 3–5 cm (1.2–2 in) long, oval, yellowish-green with leathery skin. The juicy flesh has a sweet to subacid, aromatic taste.

Origin and Distribution. Native and endemic to tropical northeastern Brazil, where the tree grows wild in the seasonally dry forest called *caatinga*. The tree is very rarely cultivated outside its natural range. Fruits are usually collected from wild trees.

Food uses. Fruits are eaten fresh or made into sweet preserves and jam. In Brazil, the pulp is boiled with sugar to prepare a gelatin commonly eaten as dessert. Ripe fruits are used to make juice and fermented for the production of vinegar. A traditional dessert of northeastern Brazil made from cooked, green umbu fruits, milk, and sugar is called *umbuzada*.

Comments. The tuberous roots contain large amounts of potable water. This delicious fruit is an underappreciated member of the Anacardiaceae family, better known for fruit trees like the mango (*Mangifera indica*, p. 147) and the cashew tree (*Anacardium occidentale*, p. 14).

Stelechocarpus burahol (Blume) Hook. f. & Thomson

KEPEL

Annonaceae (Custard apple family)

Description. Pyramidal evergreen tree with horizontal branches and a dark gray to brown trunk covered in thick tubercles, 22–28 m (72–92 ft) tall. Leaves alternate, glabrous, oblong-elliptic to ovate-lanceolate, 12–30 cm (5–12 in) long by 5–10 cm (2–4 in) wide. Unisexual, cream-colored female flowers emerge directly from tubercles on lower trunk and thicker branches. Fruits, which sometimes cover the lower part of the trunk, are globose to ovate, brown, and measure 5–8 cm (2–3 in) in diameter. Pulp light orange to yellow, soft, juicy with aromatic flavor reminiscent of coconut. Each fruit contains 4–6 oval brown seeds, each about 3 cm (1.2 in) long.

Origin and Distribution. The kepel is native to Indonesia and Malaysia. It grows wild in secondary rainforests on the island of Java. The tree is also cultivated in the Philippines and to a lesser extent in northeastern Australia. It is very rare outside its natural range. The kepel prefers a humid tropical climate and grows well below elevations of 600 m (2,000 ft). It is grown for its fruit and as an ornamental.

Food uses. The fruits, which are highly esteemed in Indonesia, are eaten fresh. It is said that consuming the fruit gives the fragrance of violets to body excretions like breath, urine, and perspiration.

Comments. Eating the fruit can cause temporary sterility in women. In fact, it was commonly used by Indonesian women for family planning and as a body perfume. In Java, the use of the fruit was restricted to the consorts of the Sultan of Jogja. The pulp is used in traditional medicine as a diuretic and to combat kidney inflammation.

The kepel is also a beautiful ornamental tree with its erect, pyramidal growth habit, cauliflorous fruits, and pink to burgundy-red flushes of new leaves.

Swinglea glutinosa (Blanco) Merr.

TABOG

Rutaceae (Citrus family)

Description. Small evergreen tree, 8–10 m (26–33 ft) tall. Alternate, trifoliate, oblanceolate leathery leaves with terminal leaflet 8–12 cm (3–5 in) long by 4–6 cm (1.6–2.4 in) wide and lateral leaflets 2–4 cm (0.8–1.6 in) long. White flowers with 5 petals are borne singly or in small clusters in axils of leaves. Green to yellowish-green, ovoid fruits 5–10 cm (2–4 in) long with juicy, sour pulp and thick, leathery skin. Fruits contain numerous flattened seeds.

Origin and Distribution. Native to Colombia. The tree was introduced in Central and South America as well as in Southeast Asia, but never gained the interest of growers. It grows naturally in lowland and premontane forest up to 1,500 m (5,000 ft). Occasionally cultivated as a dooryard fruit tree, as an ornamental, or as a living fence.

Food uses. The sour-tasting fruits are used similar to lemon (*Citrus limon*, p. 69) and Mexican lime (*Citrus aurantiifolia*, p. 64). The juice is used to make lemonade or in salad dressings, desserts, and mixed drinks.

Comments. The tabog is sometimes used as a rootstock for other citrus varieties. The genus *Swinglea* has this single species.

Synsepalum dulcificum (Schumach. & Thonn.) Daniell

MIRACLE FRUIT

Sapotaceae (Sapodilla family)

Description. Slow-growing, evergreen shrub or small tree with compact growth habit, 3–5 m (10–16 ft) tall. Alternate, cuneate, or elliptic leaves 5–9 cm (2–3.5 in) long. White flowers are produced several times per year. Smooth-skinned, dark red fruits are ovoid berries 1.5–2 cm (0.6–0.8 in) long. A thin layer of sweet-tasting pulp encloses a single large seed.

Origin and Distribution. Native to tropical West Africa, where it grows in the understory of humid lowland rainforests. Occasionally cultivated for its fruits or as an ornamental. Sometimes grown as bonsai.

Food uses. Eating the fruit causes sour foods to taste sweet. This effect can last up to one hour. It has been traditionally used in West Africa to make sour-tasting palm wine taste sweet. It was also consumed before eating sour bread and bland-tasting foods. Today the fruit is probably consumed most often out of curiosity. In the past it was used as a food additive to replace sugar in sweets and candies.

Comments. The effect of experiencing sour foods as sweet is due mainly to the glycoprotein miraculin. Although the mechanism is not fully understood, it is believed that molecules of miraculin bind to the sweet receptors of the tongue, which then become sensitive to sour foods. The effect does not work with bitter-tasting foods. The fruits are currently being researched to create a natural sweetener.

The genus *Synsepalum* contains about 36 species, all native to tropical Africa.

Syzygium aqueum (Burm. f.) Alston

WATER APPLE

Myrtaceae (Myrtle family)

Description. Medium-sized evergreen tree, 6–12 m (20–40 ft) tall, with a wide, open crown. Opposite, leathery leaves almost sessile, oblong to elliptic, 10–24 cm (4–9.5 in) long by 8–15 cm (3–6 in) wide. Yellow or yellowish-white flowers with numerous stamens are borne in small clusters of 3 or 4. White, pink, or reddish pyriform fruits 2–3 cm (0.8–1.2 in) long by 3–4 cm (1.2–1.6 in) wide with a thin waxy skin. White flesh mildly fragrant, sweet, crisp or spongy with 1 or 2 seeds or lacking seeds.

Origin and Distribution. The tree grows wild from India to Malaysia and Indonesia. Widely cultivated throughout tropical Asia. Occasionally grown in Africa and tropical America. Requires a tropical climate with evenly distributed rainfall throughout the year. In Southeast Asia, the water apple is cultivated from sea level to 1,300 m (4,300 ft).

Food uses. The ripe fruits, especially those of sweeter varieties, are mainly eaten fresh. They can also be used in fruit salads or for garnishing desserts. The young leaves are used in tropical Asia to wrap food items.

Comments. This beautiful tree is often grown as an ornamental. The wood is very hard and used in construction and toolmaking. In Southeast Asia, various varieties of this species exist. These fruits differ in taste, texture, and skin color (white, pink, or red). This plant is also known by the synonym *Eugenia aquea*. The English common name of this plant may cause confusion because it is also applied to several other *Syzygium* species, including *S. malaccense* (p. 230).

Syzygium cumini (L.) Skeels

JAMBOLAN, JAMBUL

Myrtaceae (Myrtle family)

Description. Tall, fast-growing tree, often with multiple trunks and flaking bark, 25–35 m (80–115 ft) in height. Opposite leaves oval to elliptic, 10–25 cm (4–10 in) long, leathery, glossy dark green with yellowish midvein. Fragrant flowers in small clusters. The first white (then pink) petals fall off early, leaving only numerous light pink stamens. Fruits oblong to spherical, dark purple or almost black with a thin, shiny skin. Purple or translucent gelatinous flesh with distinct sweet-sour to sweet, sometimes astringent taste. Fruits contain a single brown or greenish seed.

Origin and Distribution. The jambolan is native to India, Sri Lanka, Bangladesh, parts of Myanmar, and the Andaman Islands. Very common in Southeast Asia and naturalized in many regions. The fruits of the tree are readily dispersed by native bird species; as a consequence the tree has become invasive in several places, including Hawaii, Brazil, and many islands in the South Pacific. The jambolan grows best in a tropical climate with high annual precipitation.

Food uses. Superior varieties with low astringency and sweet taste are eaten fresh. Fully ripe fruits are often made into juice, sauces, sherbets, jellies, and jams. The juice resembles grape juice. To reduce astringency, fruits are soaked in saltwater. In India, a bottled drink made from the fruits is sold. In the Philippines, a wine is made from jambolan fruits. In parts of India, jambolan vinegar is commonly sold.

Comments. Fruits are a good source of vitamin C. The jambolan plays an important role in the practices of many Asian cultures and religions. The tree is venerated by Buddhists and also commonly planted near Hindu temples that venerate Krishna. The leaves and fruits are employed in worshipping the elephant-headed god Ganesha.

Syzygium jambos (L.) Alston

ROSE APPLE, MALABAR PLUM

Myrtaceae (Myrtle family)

In Southeast Asia, the fruit halves are sometimes filled with rice and meat and served as appetizers.

Description. Spreading evergreen tree with drooping branches, 6–12 m (20–40 ft) tall. Opposite, leathery, dark green leaves lanceolate, 12–22 cm (5–9 in) long by 3–6 cm (1.2–2.4 in) wide. Pale yellow flowers, 5–10 cm (2–4 in) wide with 250–300 stamens, are produced in terminal clusters. Smooth pale yellow, white, or pinkish fruits spherical or pear-shaped, 4–6 cm (1.6–2.4 in) in diameter with persistent calyx leaves. Flesh yellowish, crisp to mealy, mildly rose scented, enclosing 1–4 seeds in central, hollow cavity.

Origin and Distribution. Native to Southeast Asia. Planted in most tropical countries and naturalized in many parts of tropical Asia. The tree was introduced around 1762 into Jamaica, from where it spread throughout the Caribbean and Central America. It is considered invasive in some regions, including Hawaii and parts of Central America and the Galápagos Islands.

Food uses. The ripe fruits are usually eaten fresh and sometimes stewed to make desserts and jellies. The flesh of ripe fruits is used to flavor cold drinks. In Jamaica, the fruits are candied with cinnamon. In Southeast Asia, the fruit halves are sometimes filled with rice and meat and served as appetizers. In Honduras, the yellow flowers are used as an ingredient in omelets.

Comments. The name *rose apple* often causes confusion as it is sometimes also applied to other *Syzygium* species, including *S. malaccense* (Malay apple, p. 230), *S. samarangense* (Java apple, p. 232), and *S. aqueum* (water apple, p. 227).

The soft wood of the tree is used as firewood. The bark contains tannins and provides a brown dye. In Guatemala, the trees are planted as living fence posts.

Syzygium malaccense (L.) Merr. & L.M. Perry

MALACCA APPLE, MALAY APPLE

Myrtaceae (Myrtle family)

In Indonesia, the colorful flowers are eaten in salads or used to decorate rice dishes, and the tender leaves are sometimes eaten as a vegetable.

Description. Erect evergreen tree with a pyramidal crown, 15–20 m (50–66 ft) tall. Leaves opposite, glossy, elliptic-lanceolate, 15–40 cm (6–16 in) long. Showy, purplish-pink flowers with numerous stamens are produced in small clusters on branches. The flowers are mainly hidden by foliage. As they fall they form a beautiful purple-pink carpet below the tree. Fruits round to pear-shaped, pink to dark red with a smooth, waxy skin. Pulp white, spongy, fairly juicy, with one single large seed. The fruit has a sweetish, but not very distinctive taste.

Origin and Distribution. Native to Malaysia and Indonesia. It is a common dooryard tree in tropical Southeast Asia. Captain Bligh, of mutiny on the HMS *Bounty* fame, brought seedlings of the Malay apple from Timor to Jamaica on a later voyage in 1793. It is now widespread in the tropics and quite common in tropical America.

The Malay apple needs a strictly tropical climate and thrives only in low or middle elevations with a humid climate.

Food uses. The fruit, usually eaten out of hand, has a refreshing, thirst-quenching taste. In Asia, it is stewed and served as dessert. Underripe fruits can be pickled or made into preserves and jellies.

In Indonesia, the colorful flowers are eaten in salads or used to decorate rice dishes, and the tender leaves are sometimes eaten as a vegetable.

Comments. The Malay apple is much admired for the beauty of its foliage, its showy flowers, and its fruits. In many countries it is grown as an ornamental. The astringent bark has been used in traditional Asian medicine as a remedy for dysentry and diarrhea.

Syzygium paniculatum Gaertn.

MAGENTA LILLY PILLY

Myrtaceae (Myrtle family)

Description. Bushy evergreen tree with flaky bark, 8–12 m (26–39 ft) tall. Opposite, simple leaves obovate, 4–10 cm (1.6–4 in) long, glossy. White flowers with small petals and long stamens are produced in small clusters at tips of branches. Smooth, spherical to egg-shaped, single-seeded fruits of intense magenta color, or less often white or purple, 1–2 cm (0.4–0.8 in) long. Fully ripe fruits have an applelike, subacid taste.

Origin and Distribution. Native to eastern Australia, where it is confined to a narrow coastal strip in New South Wales. Widely cultivated in Australia as a fruit tree and as an ornamental. Grown to a much lesser extent as a fruit tree in subtropical or mountainous regions of Southeast Asia. Occasionally grown as an ornamental in the tropics and subtropics. The plant grows naturally in subtropical coastal rainforests and gallery forests.

Food uses. Ripe fruits, often collected from wild trees, are eaten out of hand or cooked to make desserts, preserves, and jams.

Comments. *S. paniculatum* is an endangered species in its natural habitat. The main threats are habitat loss from residential development, overgrazing, and competition with invasive plant species. An additional threat is its lack of resistance to bush fires.

S. australe, the brush or scrub cherry, a closely related species also native to Eastern Australia, is often confused with this species.

Syzygium samarangense (Blume) Merr. & L.M. Perry

WAX JAMBU, JAVA APPLE

Myrtaceae (Myrtle family)

Description. Evergreen tree with a spreading crown and short trunk, growing to a height of 8–15 m (26–50 ft). Opposite, elliptic leaves 12–26 cm (5–10.4 in) long with very short petioles. Fragrant cream-colored or white flowers, with numerous long stamens, are produced in drooping panicles. Pear-shaped fruits have pink, reddish, cream-colored, or greenish waxy skin. The white flesh is soft and juicy with a sweet, somewhat insipid flavor. Fruits contain no seeds at all or 1 or 2; the seeds are round.

Origin and Distribution. Native to Malaysia and adjacent regions of tropical Southeast Asia, where it is commonly grown as an ornamental and a fruit tree. Rarely cultivated in the Americas or Africa. The wax jambu is ultratropical, requiring year-round high temperatures and a climate with a short but distinct dry season.

Food uses. Fruits are eaten fresh or used in fruit salads. Unripe fruits are eaten with salt and lime juice or made into sauces. In parts of Asia, the halved fruits are served with salt, sugar, and chili paste.

Comments. The common names given to *Syzygium* species can be confusing, because they are applied to different species. *S. samarangense* is sometimes also called water apple, which is actually the common name for *S. aqueum* (p. 227). The genus comprises approximately 1,100 species native to Africa, Asia, Australia, and the southern Pacific. Several species like the rose apple (*S. jambos*, p. 229) and the Malay apple (*S. malaccense*, p. 230) are cultivated as fruit trees or ornamentals. In Southeast Asia, various varieties differing in growth habit and fruit characteristics are cultivated commercially. The most popular varieties such as 'Kong Wan Pink' and 'Delima' have pink fruits with sweet white flesh.

Tamarindus indica L.

TAMARIND

Fabaceae (Bean family)

The tamarind fruit has been used in traditional medicine of Asia and Africa for millennia. The pulp is a natural laxative and digestive aid.

Description. Medium-sized evergreen tree reaching 20–30 m (66–100 ft) in height. The bark of this long-lived tree is gray and fissured. Leaves pinnate, feathery, 7–15 cm (2.8–6 in) in length, with 10–20 pairs of leaflets, each 1–2.5 cm (0.4–1 in) long. Flowers in small terminal racemes, yellow with orange or red streaks. Fruits beanlike, flattened pods, irregularly shaped and with brittle shell. Pods 8–18 cm (3–7 in) long, brown or grayish-brown with a soft, dark brown, very acidic pulp containing 1–12 glossy, hard brown seeds.

Origin and Distribution. Indigenous to tropical Africa, especially Sudan and adjacent regions. This ancient fruit tree had been cultivated for so long in India that Arab traders, who compared the pulp of the tamarind to the date, called it *tamar hindi* (Indian date), which gave rise to its modern common and scientific names. The tamarind was well known to ancient Egyptians and Greeks. Spanish and Portuguese sailors took the plant to the Americas, where it is now commonly grown as a fruit and shade tree. It favors a tropical or near-tropical climate with a short dry season.

Food uses. Unripe, tender, and very sour fruits are cooked and eaten with rice and meat or fish in Asia, especially in India. Fully grown but still unripe fruits are eaten in Thailand with chili, salt, and sugar. They are sometimes pickled or made into preserves. The less acidic pulp of ripe fruits is blended with water and sugar to make a popular fruit drink.

In several Central American countries, a carbonated tamarind soda is available. The pulp is made into numerous products, including chutneys, curries, and sauces. Tamarind is an ingredient in the famous Worcestershire sauce. In Asian cuisine, the pulp is an important ingredient in many savory dishes. The dehydrated pulp is sweetend with sugar and sold as candy. Tamarind syrup is used to sweeten cones of ice cream or shaved ice in Mexico.

The young, sour-tasting leaves are used in fish salads and soups in Thailand. The equally sour-tasting flowers are eaten raw in salads or cooked in chili sauce or soups.

Comments. The tamarind has been used in traditional medicine of Asia and Africa for millennia. The pulp is a natural laxative and digestive aid. In Africa, a decoction of leaves has been used to treat malaria, and the fruit was employed to prevent scurvy and as an antiseptic.

Terminalia catappa L.

TROPICAL ALMOND, INDIAN ALMOND

Combretaceae (Indian almond family)

The ripe, corky fruits float in water, stay viable in seawater, and are dispersed over great distances by ocean currents.

Description. Medium-sized, fast-growing, deciduous tree with whorls of horizontal branches, 15–25 m (50–80 ft) tall. This pagoda-like growth is very characteristic of young trees. Alternate, obovate leaves clustered at tips of branches. Blades 15–35 cm (6–14 in) long by 8–25 cm (3–10 in) wide, leathery, glossy. Senescent leaves turn dark red, scarlet, or yellow. Greenish-white flowers in slender spikes appearing in leaf axils. Fruits egg-shaped, flattened, 5–7 cm (2–2.8 in) long, with 2 longitudinal ridges. Ripe fruits turn yellow or reddish. Fruits contain 1 cylindrical seed encased in a fibrous husk within a fleshy mesocarp.

Origin and Distribution. Native to coastal areas of Southeast Asia. Widely grown as an ornamental and shade tree throughout the humid tropics. Naturalized and very common in many tropical regions, especially along coasts.

Food uses. The edible seed kernels have an almond-like taste and are eaten raw or roasted. Seeds contain 35–55% of a bland, yellow oil that is used for cooking.

Comments. The tree has a far-reaching root system and is often planted for erosion control. The bark provides yellow and black dyes used in the leather industry. Leaves are rich in flavonoids and tannins. They are commonly used in folk medicine to treat diarrhea and dysentery. The hard red wood is of good quality and used for construction, boat building, and floors.

Ripe, corky fruits float in water, stay viable in seawater, and are dispersed over great distances by ocean currents.

Terminalia kaernbachii Warb.

OKARI NUT

Combretaceae (Indian almond family)

Description. Evergreen tree with horizontally spreading branches, 20–35 m (66–115 ft) tall, with leaves whorled at the tips of branches. Obovate leaves 16–30 cm (6.3–12 in) long by 8–15 cm (3–6 in) wide, tapering at base. Underside of leaves pubescent with short reddish-brown hairs. Small yellowish flowers are produced in erect spikes. Fruits are ellipsoid, laterally compressed drupes, 8–12 cm (3–5 in) long, turning from green to dark red when fully ripe. Each fruit contains a hard stone with an edible seed within.

Origin and Distribution. Wild populations are known from West Papua, the Aru Islands, Papua New Guinea, and the Solomon Islands, where it also is widely cultivated. The Okari nut grows in humid tropical rainforests from sea level to about 1,100 m (3,600 ft). The tree was introduced into Queensland but is very little known in Southeast Asia and in tropical regions of Africa and the Americas.

Food uses. The kernel of the ripe fruit, a high-quality nutlike seed that tastes similar to almonds, is eaten raw or roasted and salted. In the plant's native region, the seeds are used to make sweets and as an ingredient in bakery goods.

Comments. The seeds are the largest known in the Combretaceae family. They are common in markets during harvest season. The tree produces a hard wood used occasionally in construction and in the manufacture of tools and furniture.

The genus *Terminalia* comprises more than 100 species of trees native to tropical regions around the world. The name is derived from the Latin word *terminus*, referring to the whorled leaves at the tips of the branches, which are typical for the genus.

Treculia africana Decne.

AFRICAN BREADFRUIT

Moraceae (Mulberry family)

Description. Large, evergreen tree, 20–40 m (66–144 ft) tall, with a dense crown and buttressed trunk. All plant parts contain white, sticky latex. Alternate, simple leaves 30–45 cm (12–18 in) long by 15–20 cm (6–8 in) wide. Flower head brown-yellow, rounded, 2.5–10 cm (1–4 in) across, male and female flowers usually separate, growing beside leaves or on older wood down the trunk. Spherical, woody, rough-skinned, compound fruits reach 30–40 cm (12–16 in) in diameter and can weigh up 15 kg (33 lbs). The spongy, fibrous pulp contains numerous orange seeds, 1 cm (0.4 in) long.

Origin and Distribution. Native to tropical Africa, where the tree grows naturally in riverine habitats and seasonally inundated forests. The tree is rarely cultivated outside its natural range.

Food uses. The starchy, nutritious seeds are ground and the protein-rich flour is used for making bread, bakery goods, and pasta. Whole seeds are roasted, salted, and eaten as snacks. In Nigeria, a nonalcoholic drink called almond milk is made from the powdered seeds. Oil extracted from the seeds is used as cooking oil and for producing margarine.

Comments. The seeds contain about 23% protein and 11% oil and are a good source of phosphorous and potassium. The yellow, dense heartwood is used for making furniture and in general construction.

Trichosanthes cucumerina L.

SNAKE GOURD

Cucurbitaceae (Cucumber family)

In Southeast Asia, cooked snake gourds are used to make curries and stir-fries.

Description. Annual, herbaceous, trailing or climbing plant with rough, 5-angled stems. Alternate, cordate leaves with 5–9 pointed lobes covered in short, soft hairs. Leaf blades 10–20 cm (4–8 in) long and wide with toothed margins. Male flowers are produced in axillary racemes whereas female flowers are borne singly. Both produce 5 white petals with conspicuous, lacelike appendices. Light green cylindrical, pointed fruits up to 1.5 m (5 ft) long by 10 cm (4 in) wide, with longitudinal dark green stripes and a firm, somewhat mucilaginous flesh. Fully ripe fruits, which have a bitter taste, turn orange and contain numerous flat, light brown seeds.

Origin and Distribution. Probably native to India and Sri Lanka. Widely cultivated in South and Southeast Asia. Uncommon elsewhere. The plant grows in humid tropical and warm subtropical climates and is often cultivated as a dooryard plant.

Food uses. Immature fruits are boiled or fried and eaten as a vegetable. Very young and tender fruits are used raw in salads. Young leaves and shoots are also used as a vegetable. In Southeast Asia, cooked snake gourds are often found in curries and stir-fries.

Comments. Several other species of the genus *Trichosanthes* are cultivated as vegetables, potherbs, or medicinal plants. *T. dioica* (pointed gourd) is widely cultivated as a perennial plant in India and the green fruits are used in soups, stews, and curries. *T. kirilowii* is an herb used in traditional Chinese medicine.

Vangueria madagascariensis J.F. Gmel.

SPANISH TAMARIND

Rubiaceae (Coffee family)

Description. Small evergreen tree with several trunks and spreading branches, 4–6 m (13–20 ft) tall. Opposite, light green, elliptic leaves 20–25 cm (8–10 in) long by 10–14 cm (4–5.5 in) wide. Small greenish-white flowers are borne in the axils of leaves. Spherical to oblate, large green fruits with greenish pulp, 3–4 cm (1.2–1.6 in) across. When fully ripe, the skin and the flesh, which has an aromatic, subacid taste, turn dark brown. Fruits contain 4–6 brown seeds.

Origin and Distribution. Native to tropical Africa from Cameroon and Angola to Ethiopia and Madagascar. The tree grows in evergreen lowland and montane rainforests and in seasonally dry forests.

Food uses. Slightly underripe fruits, which have the consistency and taste of green apples, are eaten out of hand. When fully ripe the fruits develop a sweet-sour flavor with an aroma similar to tamarind (*Tamarindus indica*, p. 230). The pulp is blended with ice, sugar, and water to make refreshing drinks.

Comments. The genus *Vangueria* comprises more than 50 species, all native to tropical Africa. The species is known by many synonyms, including *V. edulis*, *V. floribunda*, and *V. edulis*.

The durable wood of *V. madagascariensis* is used in construction and as firewood.

Vigna unguiculata subsp. *sesquipedalis* (L.) Verdc.

YARDLONG BEAN, SNAKE BEAN

Fabaceae (Bean family)

Description. Annual creeping or climbing herbaceous plant. Alternate, trifoliate leaves rhombic to ovate, asymmetrical, 8–16 cm (3–6.4 in) long, softly pubescent. Yellowish-white or purple flowers are borne in axillary racemes. Pendent fruits cylindrical, slender green pods 40–90 cm (16–35 in) long with numerous purple, white, or black kidney-shaped seeds, 4–7 mm (0.16–0.28 in) long.

Origin and Distribution. Native to tropical southeastern Africa, where wild ancestors grow in savannas and dry forests. The plant was most likely domesticated in tropical West African savannas. Cultivated throughout the tropics and warm subtropics.

Food uses. Young, tender pods are used as a vegetable in stir-fries, soups, and curries or simply boiled and served as a side dish. Immature and less often mature seeds are eaten cooked. Tender shoots and leaves are used as potherbs. In South Asia, a thick, spicy stew called *dal* is prepared from the dry seeds and served with rice and vegetables.

Comments. The yardlong bean is a subspecies of the common cowpea (*Vigna unguiculata*), native to tropical regions of Africa. The catjang cowpea (*V. unguiculata* subsp. *cylindrica*) is also widely cultivated in the tropics and subtropics for its immature seedpods and beans.

The moth bean (*V. aconitifolia*) and the azuki bean (*V. angularis*), both native to tropical Asia, are also cultivated for their immature pods and mature seeds. Mature seeds contain about 50% carbohydrate and 20% protein.

Yucca gigantea Lem.

SPINELESS YUCCA

Asparagaceae (Asparagus family)

Description. Evergreen, usually multitrunked, woody plant with an often very thick stem base, 6–10 m (20–33 ft) in height. Linear, dark green, stiff, spineless leaves with rough edges and a pointed apex, 0.8–1.2 m (2.6–3.9 ft) long. White to cream-colored, bell-shaped flowers with fleshy petals are produced in large, erect, showy panicles. Fruits fleshy, brown, ovoid, 2–3 cm (0.8–1.2 in) long.

Origin and Distribution. Native to Central America, the Antilles, and Mexico. Widely cultivated in the tropics and frost-free regions of the subtropics as an ornamental. Often grown as a potted indoor plant.

Food uses. The flower petals have a slightly bitter taste and are used as a cooked vegetable or raw in salads. In Central America, they are a popular ingredient in dishes like scrambled eggs and omelets. In Mexico, they are used in soups and savory meat dishes.

Comments. In Central and South America, the yucca is often grown as a windbreak and for erosion control in coffee plantations. The flower of *Y. gigantea* is the national flower of El Salvador and the state flower of New Mexico. In Spanish-speaking countries the yucca is often confused with yuca (*Manihot esculenta*, p. 265), also called cassava, of the Euphorbiaceae family, which produces starchy, underground tubers. The plant is also known by the synonyms *Y. elephantipes* and *Y. guatemalensis*.

Zea mays L.

MAIZE, CORN

Poaceae (Grass family)

There are more than 3,000 varieties of corn. It is the world's most important cereal, with global production exceeding 800 million tons.

Description. Erect annual grass 2–3 m (6.6–10 ft) tall, forming a stalk of overlapping sheaths that grows to 5 cm (2 in) in diameter. Leaves alternate, broad-linear blades, 50–100 cm (20–40 in) long. Flowers are monoecious, with male flowers produced in terminal panicles. Female flowers are produced in the leaf axils; spikelets occur in 8–16 rows on a thickened, woody axis (cob). The whole structure (ear) is enclosed in numerous foliar bracts and a mass of long styles protruding from the tip (silk). Seeds are usually yellow or white, but many varieties with purple, black, or variegated colors exist.

Origin and Distribution. Native to Mesoamerica; in southeastern Mexico, maize was domesticated some 12,000 years ago from wild grass ancestors called teosintes (*Z. diploperennis*, *Z. perennis*, and *Z. luxurians*). In the sixteenth century, it spread to Europe and from there to Africa and Asia. Human selection has produced a wide array of cultivars adapted to different climates and altitudes.

Food uses. Unripe seeds are eaten raw, boiled, roasted, steamed, or dried. Entire cobs are boiled, grilled, or roasted and often served as a side dish or sold from roadside stalls as a snack. Corn flour is used to make the classical Mexican *tortilla* as well as tacos, and enchiladas. It is an essential ingredient in *tamales*. The seeds of purple maize varieties are used in Latin American countries to make *chicha morada*, a nonalcoholic refreshing drink (real *chicha* is a milky alcoholic drink made from fermented corn). Another drink originating in pre-Columbian Mesoamerica and still popular, especially in southern Mexico, is *pozol*, made from fermented corn dough.

Comments. There are more than 3,000 varieties of corn. It is the world's most important cereal, with global production exceeding 800 million tons. The United States is the largest producer of corn, followed by China and Brazil. Ripe seeds contain about 70% carbohydrate and 9% protein that is relatively low in essential amino acids.

Ziziphus mauritiana Lam.

INDIAN JUJUBE, INDIAN PLUM

Rhamnaceae (Buckthorn family)

Description. Bushy, mostly evergreen tree, 8–12 m (26–39 ft) tall, with short spines on characteristic zigzag branches. Alternate, simple leaves ovate to elliptic, 3–6 cm (1.2–2.4 in) long by 2–4 cm (0.8–1.6 in) wide with soft brown or whitish hairs on the underside of the blade. Tiny greenish-yellow to yellow flowers with 5 petals are produced in axillary cymes. Round or oval fruits 2–5 cm (0.8–2 in) long have a smooth, thin skin and vary in color from orange or brown to reddish-brown and red. The flesh is light brown, soft, slightly mealy and has an agreeable subacid to sweet flavor reminiscent of apples. Fruits contain a single stone with 2 seeds.

Origin and Distribution. Probably native to India; the plant spread in prehistoric times by way of human migration to the Middle East, northern Africa, Southeast Asia, and southern China. *Z. mauritiana* grows best under hot, dry, sunny conditions with a short rainy season and annual rainfall of 300–1,500 mm (12–60 in).

Food uses. The fruits of sweet varieties are blended with water, sugar, and ice to make a popular fruit drink. Dried fruits are made into a butterlike paste used as a condiment. More acidic varieties are used mostly for pickling and the preparation of chutneys. Slightly underripe fruits are often eaten with salt. In Indonesia and in Africa, young leaves are cooked and eaten, and the fermented and dried pulp is pressed into cakes resembling gingerbread.

Comments. The tree is often planted in poor rural communities in dry regions of Africa and India to provide food, erosion prevention, firewood, and living fences. The fruit is a good source of vitamin A and a very good source of vitamin C. *Z. jujuba* (Chinese jujube) is native to semiarid, temperate, and subtropical regions from South Asia to China. The fruits of this frost-resistant species are often eaten dried as a snack. *Z. nummularia* is native to Pakistan and western India, where it grows naturally in arid regions. The fruits are usually eaten fresh.

2
Palms

For those from cold climates, palms are the quintessential tropical tree, virtual emblems of the exotic, whether dotting a seashore or providing shade in some tropical garden. For people who live in tropical or subtropical places, especially in rural areas, many palm species are critically important plants, used on a daily basis for food and drink (including palm wine), construction, furniture, firewood, thatching material, and the production of countless other goods, from waxes to oils and ropes to baskets.

Except for the grass family (Poaceae), no other plant family contains as many useful plants as the palm family. They have been used intensively by people throughout history, playing a vital role in tribal customs, mythology, and religion.

All palms belong to the family Arecaceae, which comprises more than 2,600 species. Although a very diverse group botanically, most palms have single (or multiple) unbranched trunks, with palmately or pinnately compound leaves arranged at the top of the trunk. Palms reach their greatest diversity in the tropics, where they occur from sea level to 4,000 m (13,000 ft), in rainforests, swamps, savannas, deserts, and a range of other habitats.

Areca catechu L.

BETEL NUT, ARECA PALM

Arecaceae (Palm family)

Description. Slender, single-trunked palm, 10–20 m (33–66 ft) tall, with 8–12 pinnate fronds. Leaves 1–1.5 m (3.3–5 ft) long with 30–50 leaflets. Small, greenish-white flowers in dense, pendent inflorescences borne below the crown shaft. Yellow, orange, or bright red ovoid fruits (drupes) 6 to 9 cm (2.4–3.5 in) long with fibrous pericarp and a single, large seed.

Origin and Distribution. The exact origin of the plant is unknown, since the palm is closely associated with human settlements and early migrations. Possibly native to the Philippines and Southeast Asia. Today the betel nut is widely cultivated from East Africa through tropical Asia to Oceania. The palm is typically planted in home gardens. Often cultivated as an ornamental.

Food uses. The seeds of ripe or unripe betel nuts are consumed as a mild narcotic. Slices of the seed are boiled or roasted with limestone and often other spices like cinnamon or catechu (*Acacia catechu*). The seeds are chewed together with leaves of the betel pepper (*Piper betle*, p. 299) and lime juice. The chewing of betel nuts is said to cause euphoria and a sense of well-being, a hot sensation in the body, and heightened alertness. Continuous use may cause addiction and cancer of the mouth and tongue. The palm heart, although bitter, is eaten as a vegetable in the Philippines. The tender shoots are also eaten after being cooked in syrup.

Comments. The oil-rich endosperm of the seeds contains tannins and several alkaloids like arecaine and arecoline, which are mainly responsible for the intoxicating effects of the fruit. Betel nuts are also used in traditional medicine in a variety of applications. Extracts of the seeds are employed internally to eliminate internal parasites.

Acrocomia aculeata (Jacq.) Lodd. ex Mart.

MACAW PALM

Arecaceae (Palm family)

Description. Solitary palm with black spines on gray trunk, 15–18 m (50–60 ft) tall. Pinnate leaves 3–4 m (10–13 ft) long with irregularly arranged, linear leaflets, each 0.8–1 m (2.6–3.3 ft) long. Small pale yellow flowers in branched inflorescences 1–1.5 m (3.3–5 ft) long. Fruits are yellowish-green, globose drupes measuring 3–5 cm (1.2–2 in) in diameter and containing a single seed.

Origin and Distribution. Native to tropical America from southern Mexico and the Caribbean south to northern Argentina and Paraguay. The tree grows in a variety of habitats but is found mostly in seasonally dry lowland forests. Occasionally cultivated as an ornamental, but usually rare outside its natural range.

Food uses. The sweet-tasting seed kernels of ripe fruits are sometimes eaten as a snack. The heart of the palm is used as a vegetable and eaten raw in salads or cooked. Young, tender leaves are eaten as a green vegetable. The flesh of ripe fruits has a somewhat bitter taste, though it is eaten as a snack by some people. The palm is known mostly for being the source of sugary sap that is fermented into an alcoholic winelike drink called *coyol* in Central America. The sap is harvested by cutting the terminal bud lengthwise.

Comments. This palm is known by numerous synonyms, including *A. vinifera*, *A. lasiospatha*, and *A. sclerocarpa*.

Astrocaryum jauari Mart.

JAUARI PALM

Arecaceae (Palm family)

Description. Multistemmed palm 6–12 m (20–40 ft) tall with erect trunks densely covered in sharp spines up to 10 cm (4 in) long. Pinnate leaves 3–6 m (10–20 ft) long with irregularly arranged leaflets and black spines on the rachises. Monoecious flowers are borne in branched inflorescences. Fruits are greenish-orange ovoid drupes, 2–4 cm (0.8–1.6 in) long and with a single seed.

Origin and Distribution. Native to the Amazon basin of South America, especially along the Rio Negro and the upper Orinoco. The plant, which thrives in hot, humid climates, is rarely cultivated.

Food uses. The fleshy mesocarp of the fruit is edible. The palm heart, which is of very good quality, is used raw in salads or used cooked as an ingredient in savory dishes. The seeds provide an edible oil that is used by indigenous tribes for cooking.

Comments. The fruits are eaten by at least 16 species of fish, which either gnaw the pulp, fragment the seed, or swallow the entire fruit, thus acting as dispersal agents. The fruiting season of the jauari palm is synchronized with annual flooding, ensuring optimal dispersal.

Bactris gasipaes Kunth

PEACH PALM

Arecaceae (Palm family)

Description. Multi- or single-stemmed palm with trunk covered in long, black spines, 5–18 m (16–60 ft) tall. Pinnate leaves about 3 m (10 ft) long with a 1-m-long (3.3 ft) petiole. The rachis is covered in black or brown spines. Leaflets linear, 92–123 per side, irregularly arranged in different planes. Flowers are produced in inflorescences, with 45–57 flowering branches and yellowish male and female flowers. Fruits, which grow in pendent clusters of up to 250 fruits, are ovoid or conical in shape, 3–5 cm (1.2–2 in) in diameter, and have leathery red, orange, or yellow skin and an orange-colored, mealy flesh with 1 or sometimes no seed. The fruits have a unique, agreeable taste, somewhat reminiscent of a winter squash with drier texture.

Origin and Distribution. The peach palm is extensively cultivated throughout humid tropical regions of Central and South America. The closest wild relative from which it seems to be selected is *B. macana*, which grows in the western Amazon basin.

Food uses. This delicious fruit is almost never eaten raw, but commonly boiled in saltwater for at least an hour, often with pork fat. When cool, the fruits are peeled, seeded, halved, and served with mayonnaise. In Colombia, halved fruits are eaten with honey. Dried fruits can be ground into flour. Indigenous tribes use fermented fruits to produce *chicha*, an alcoholic, beerlike beverage.

Comments. The peach palm is a major source of palm hearts, an exquisite vegetable extracted from the inner core and growing bud of the palm tree. The fruits contain about 3–8% fat and 3% protein and are high in calcium, phosphorous, iron, and vitamins A and C.

Borassus flabellifer L.

ASIAN PALMYRA PALM, TODDY PALM, NUNGU PALM

Arecaceae (Palm family)

Unripe fruits are cut open to obtain the sweet, jellylike seed kernels, which are eaten out of hand or canned for preservation.

Description. Majestic palm, up to 30 m (100 ft) tall with gray-green, palmate leaves that can measure more than 3 m (10 ft) across. Dioecious flowers are borne in large racemes, 70–150 cm (28–59 in) long. Fruits, borne in clusters, are globose or oval, dark brown to black drupes with a smooth skin, measuring 12–18 cm (5–7 in) in diameter. The yellowish or orange fibrous pulp contains 3 hard white seeds. The seeds of immature fruits are soft, jellylike, and transparent.

Origin and Distribution. Native from Southeast Asia throughout India and Pakistan to Iran. This drought-resistant palm thrives in tropical and subtropical climates with or without a distinct dry season. Throughout tropical Asia, the toddy palm is cultivated for its numerous uses and as an attractive ornamental.

Food uses. Very underripe tender fruits are pickled in vinegar or punctured to drink the liquid endosperm of the developing seed, which is similar to coconut water. Unripe fruits are cut open to obtain the sweet, jellylike seed kernels, which are eaten out of hand or canned for preservation. The pulp of ripe fruits is eaten raw or boiled, fried, or roasted.

Male and female flowers are cut to obtain a sugary liquid called toddy. Each inflorescence produces 3 to 6 liters (0.8–1.6 gal) of sap per day for up to 200 days. This sap ferments spontaneously and is a popular alcoholic drink in many Asian regions. The fermented sap is often distilled to produce liquor commonly known as *arrack*. The unfermented sap, a refreshing drink, is made into a crude sugar called jaggery, also known as Javanese sugar and widely used in Indonesian cuisine. The sweet sap is also used to produce vinegar.

The shoots of germinated seeds have succulent underground stems that are eaten roasted or boiled as vegetables, especially in India and Sri Lanka.

Comments. This plam is the national tree of Cambodia. It is somewhat similar in appearance to the Bismarck palm (*Bismarckia nobilis*), which is native to Madagascar and equally popular as an ornamental palm. The trunk of the palm consists of very hard wood used in construction and furniture making. The large tough leaves are used for thatching roofs and to make mats, hats, baskets, and many other things. The African palmyra palm (*B. flabellifer* var. *aethiopum*), a variety native to Africa, is used like the Asian palmyra palm.

Cocos nucifera L.

COCONUT PALM

Arecaceae (Palm family)

Description. Single-stemmed palm, 20–30 m (66–100 ft) tall, with pinnate leaves 4–6 m (13–20 ft) long. These consist of 150–180 tough, leathery leaflets, each 70–90 cm (28–35 in) long. Monoecious, pale yellow flowers are produced in branched inflorescences. Fruits are drupes with a thin hard exocarp, a thick, fibrous mesocarp, and a woody, very hard endocarp (shell). Ripe, dark brown coconuts contain a layer of white, fatty endosperm (kernel) surrounding the central cavity, which is partly filled with a transparent liquid. In unripe coconuts the gelatinous endosperm is not yet fully developed and the cavity is totally filled with a sweet-tasting liquid endosperm (coconut water).

Origin and Distribution. Most scientists believe that this palm is native to Southeast Asia and Melanesia. Coconuts can be dispersed over great distances by ocean currents and establish themselves in coastal areas. The salt-tolerant plant, now of pantropical distribution, requires a tropical climate with high humidity and high intensity of sunlight.

Food uses. Coconut water is sterile and rich in sodium, potassium, and sugar, making it an energizing drink. The gelatinous endosperm is often scooped out with a spoon. The endosperm of ripe coconuts is used to make coconut milk, which contains about 17% fat. Dried and shredded kernels, called copra, are used to make ice cream, bakery goods, granola bars, and desserts. Coconut oil, which is extracted from copra and contains 65–86% saturated fat, is used mainly for cooking. In germinated coconuts the endosperm converts into a sweet, spongy mass that is sometimes eaten as a snack.

Comments. The fibers of the husks are used to make mats, ropes, and mattresses. Shells are burned to make charcoal. Leaves are used to make brooms and woven to make mats, bowls, hats, and many other items. Coconut husks are often carved to make souvenirs, ash trays, and bowls. Because falling coconuts can cause serious injury, fruits must be harvested before they are fully ripe.

Elaeis guineensis Jacq.

AFRICAN OIL PALM

Arecaceae (Palm family)

Description. Large single-stemmed palm, 20–30 m (66–100 ft) tall, with pinnate leaves 3–6 m (10–20 ft) long. Monoecious flowers are produced in dense axillary clusters with small, 3-petaled individual flowers. Orange-red fruits in bunches weighing 30 to 40 kg (66–88 lbs). Asymmetrical fruits 3–4 cm (1.2–1.6 in) long with oil-rich mesocarp and a single seed kernel surrounded by a hard endocarp.

Origin and Distribution. Native to tropical West Africa. Oil palms were introduced to Java, Indonesia, by the Dutch in 1848 and to Malaysia in 1910 by Scotsman W. Sime and Englishman H. Darby. The oil palm requires an ultratropical climate with consistent high temperatures and precipitation and is cultivated in equatorial regions of Africa, Asia, and America.

Food uses. Oil extracted from the mesocarp and seed kernel is widely used as an edible oil for cooking and frying and for the production of margarine. The palm oil is an important ingredient in a vast variety of processed foods.

Comments. The orange-brown oil of the African oil palm, which is semisolid at room temperature, contains about 50% saturated fats like palmitate and stearate. This high content makes the fat highly resistant to oxidization when heated.

In recent years, oil of *E. guineensis* has become a source of biofuel. The largest producers of palm oil are Malaysia and Indonesia. The extensive plantations in monoculture, found worldwide in the tropics but especially in Southeast Asian countries, cause irreversible loss of habitat and biodiversity. A second species, *E. oleifera*, is native to tropical regions of Central and South America.

The African oil palm produces high yields. One hectare (2.5 acres) of oil palm can produce up to 7 tons of oil per year. The protein-rich residues of the oil extraction and the palm kernel meal are used as animal feed.

Elaeis oleifera (Kunth) Cortés

AMERICAN OIL PALM

Arecaceae (Palm family)

Description. Large single-stemmed palm with pinnate fronds, 20–35 m (66–115 ft) tall. Leaves with spiny rachises 3–5 m (10–16 ft) long with 60–80 lanceolate leaflets. Small white flowers in monoecious, sessile inflorescences. Fruits orange oval drupes, 2–3 cm (0.8–1.2 in) long. The oil-rich flesh is of dry, mealy to fibrous consistency.

Origin and Distribution. Native to tropical America from southern Mexico to southern Brazil. The palm grows naturally in humid tropical lowlands on riverbanks and swampy soils. Most fruits are collected from wild plants and processed locally. Although occasionally grown in plantations, this palm is far less commercially important than its close African relative African oil palm (*E. guineensis*), which is cultivated in enormous numbers throughout the tropics.

Food uses. The fruit and seed oil has a slightly nutty taste and is used as a cooking oil. The heart of palm is edible and good tasting. It is eaten raw in salads or boiled as a side dish.

Comments. The oil is used locally to manufacture soap, cosmetics, and hair care products.

Euterpe oleracea Mart.

AÇAI PALM

Arecaceae (Palm family)

Description: Slender palm, 20–30 m (66–100 ft) tall, with multiple slender stems and pinnate leaves, 2–3 m (6.6–10 ft) long. Numerous small brownish or purple flowers in pale yellow racemes up to 1 m (3.3 ft) long. Fruits are globose drupes, 1–2 cm (0.4–0.8 in) in diameter, with glossy dark red to dark purple skin. The very thin, purple pulp surrounds a large, single seed that makes up about 80% of the fruit.

Origin and Distribution. The açai palm forms dense stands in swampy floodplains and along riverbanks throughout the Amazon lowlands of northern South America. In Brazil, it is often cultivated for its fruits. The tree requires a humid tropical climate.

Food uses. The pulp of the fruit has been used to make a dark purple beverage with a unique flavor, served ice cold and sweetened. In Brazil the juice is often mixed with cassava (*Manihot esculenta*, p. 265) flour to produce a nutritious meal. The juice is also used to make wine and liqueurs. The palm heart is considered a delicacy and used in salads and meat dishes.

Recently the fruit has become a focal point of the health and wellness industry. The pulp is high in minerals as well as antioxidants and flavonoid-like compounds and is said to be beneficial for losing weight, curing diabetes, and treating sexual disorders. Indeed, the açai is often described as a new miracle fruit. Ongoing studies have yet to reveal the certainty of any real health benefits of the açai fruit.

Comments. One hundred grams (0.22 lbs) of the powdered and freeze-dried pulp contain 533 kcal, 52.2 g (1.8 oz) carbohydrates, 8.1 g (0.29 oz) protein, and 32.5 g (1.15 oz) total fat. The hard, insect-resistant wood is used for general construction purposes, and the leaves are used to thatch houses and to make hats, baskets, and mats. If well managed, the production of açai fruits in small groves in the Amazonian lowland can be a good example of sustainable usage of tropical forests without damage to existing ecosystems like that caused by large sugarcane and soybean plantations. The palm heart of the closely related, single-stemmed *E. edulis* is of equally high quality.

Hyphaene thebaica (L.) Mart.

DOUM PALM, GINGERBREAD PALM

Arecaceae (Palm family)

Description. Palm with fan-shaped leaves, gray bark, and characteristic V-shaped branching of the trunk. Leaf blades 1.5–1.8 m (5–6 ft) in diameter with petioles 0.8–1 m (2.6–3.3 ft) long. The leaf sheaths are covered in recurved spines. Dioecious flowers in spikes on branched inflorescences 1–1.2 m (3.3–3.9 ft) long. Orange fruits round or pyriform, 8–10 cm (3–4 in) in diameter with smooth, hard skin, turning brown when fully ripe. Fruits contain a single yellowish-white seed.

Origin and Distribution. Native to the Sahel zone of sub-Saharan and central Africa, where the palm often grows in wadis, oases, and along streams. Widely cultivated since ancient times in dry, tropical regions of Africa. Occasionally also grown in India.

Food uses. The fibrous, sweet flesh of fully ripe fruits is eaten out of hand or made into sweets, cakes, and molasses. The dried flesh is ground into flour and used in baked goods and sweets. In Turkana, Kenya, a powder made from the outer covering of the fruit is added to water and milk and left to stand to make a mild alcoholic drink.

The kernels of unripe fruits are edible. The heart of palm of young shoots is of good quality and eaten as a vegetable. The shoots of germinated seeds are also eaten as a vegetable.

Comments. The tough fibers of the leaves are used to make a variety of products, including ropes, mats, baskets, and brooms. Entire leaves are used for thatching. In ancient Egypt, the fruit was considered sacred and has been found as offerings in tombs of Egyptian pharaohs.

The scientific species name refers to Thebes, an ancient Egyptian city on the banks of the Nile in the vicinity of Luxor.

Phoenix dactylifera L.

DATE PALM

Arecaceae (Palm family)

Description. Erect, single-trunked palm, 30–35 m tall, with persistent leaf bases on the trunk. Pinnate leaves in terminal rosettes, each leaf 4–6 m (13–20 ft) long with silvery green pinnae 25–45 cm (10–18 in) long. Dioecious, fragrant, white to cream-colored flowers in inflorescences up to 75 cm (30 in) long. Oblong, reddish-brown to yellowish-brown fruits 3–8 cm (1.2–3 in) long, with soft, sweet flesh surrounding a single seed.

Origin and Distribution. The date palm has been in cultivation since ancient times in the river valleys of the Nile, Euphrates, Tigris, and Indus. It is probably of Middle Eastern origin. Archaeological evidence associates date palms with human settlements from as early as 5000 BC. The date palm grows naturally in arid and semiarid habitats with seasonal rainfall and in river valleys.

Food uses. Ripe, sweet dates are eaten out of hand, either fresh or dried. The fruits have been an important food for nomads, desert travelers, and caravans for millennia. Today they are a common ingredient in bakery goods, puddings, cereals, desserts, granola bars, and sweets. Seeded fruits are often stuffed with cream cheese, diced nuts, or candied fruits. Dates are an ingredient in a wide variety of sweet and savory dishes. In Saudi Arabia a special kind of cookie, called *ka'ak*, is made with dates. A type of wine has been made from fermented dates since ancient times. In some regions the flowers are cut to obtain the sap, which is then converted to palm sugar or molasses, which can be fermented and distilled to make the liquor called *arak*. In the Middle East, fruits are fermented to make vinegar.

Comments. More than 600 cultivars of the date palm, one of mankind's oldest cultivated fruit trees, have been described. Dates contain about 80% carbohydrate and are a good source of potassium and magnesium.

The date palm was revered by many ancient civilizations of northern Africa and the Middle East. It is mentioned no less than 26 times in the Koran.

Salacca affinis Griff.

RED SALAK

Arecaceae (Palm family)

The tree is endangered in the wild as a result of habitat destruction in coastal areas.

Description. Very short-stemmed, clump-building palm with pinnate leaves 3–5 m (10–16 ft) long. Rachis densely covered in sharp yellowish-brown spines, 6–10 cm (2.4–4 in) long, and clustered, fan-shaped leaflets. Dioecious reddish flowers are produced in short catkinlike, axillary, branched inflorescences, 50–100 cm (20–40 in) long. Bright red ovoid fruits 4–6 cm (1.6–2.4 in) long covered in characteristic smooth, reflexed scales that resemble a snakeskin. Fruits usually contain 2 or 3 large light brown seeds and a white, sweet-tasting flesh with applelike consistency.

Origin and Distribution. Native to tropical regions of Malaysia, Borneo, and Sumatra, where the palm grows in lowland freshwater swamp forests. The tree is rare and endangered in the wild as a result of habitat destruction in coastal areas. It was considered extinct in Singapore and only recently rediscovered. Rarely cultivated except in rare tree collections and botanical gardens.

Food uses. The ripe fruits have a sweet, tart flavor and are usually eaten fresh. The flesh can be used in desserts or fruit salads.

Comments. The genus *Salacca*, distributed throughout Southeast Asia, includes 20 species; several, including the snake fruit (*Salacca zalacca*, p. 257), are commonly cultivated as fruit trees. The word *salak* means "rough bark" in Malay and refers to the typical scaly rind of many *Salacca* fruits.

Salacca wallichiana Mart.

RAKUM PALM

Arecaceae (Palm family)

Description. Creeping, short-stemmed palm with multiple trunks reaching 2–4 m (2.6–13 ft) in height. Pinnate leaves, covered in long, flat spines, are 3–6 m (10–20 ft) long with linear leaflets 60–80 cm (24–31 in) long. Dioecious flowers are borne in branched inflorescences 1–2 m (3.3–6.6 ft) long. Male and female flowers with 3 sepals and 3 petals and reddish spadices. Fruits, which are produced in dense clusters, are orange-brown to reddish-brown drupes with a thin brittle skin made up of small scales. Inside, 1–3 seeds are embedded in a fleshy, juicy sarcotesta that can be yellow, pink, or yellowish-brown in color.

Origin and Distribution: Native to Myanmar, Thailand, and parts of the Malaysian peninsula. The palm grows naturally in humid tropical lowland rainforests with a short dry season. Cultivated on a small scale in Southeast Asia, especially in Thailand, where the fruits are sometimes found in local markets. Rarely grown in tropical Africa or America, except occasionally in rarefruit collections.

Food uses: Ripe fruits, which have an agreeable, tart to sweet flavor, are mainly consumed fresh or used in fruit salads. Unripe, acidic fruits are used as a substitute for limes.

Comments: The leaves of the rakum palm are used in rural areas of Southeast Asia for thatching, and the plant is a source of cork. The palm is also known by the synonym *S. rumphii*.

Salacca zalacca (Gaertn.) Voss

SNAKE FRUIT, SALAK PALM

Arecaceae (Palm family)

Description. Short-stemmed palm with clustered stems and pinnate leaves that grow up to 6 m (20 ft) long. Petiole 2 m (6.6 ft) long and densely covered in long, blackish-brown, very sharp spines. Dioecious flowers originate at the base of the palm, hidden among the petioles. Fruits round or oval; skin reddish-brown with scales like snake skin that give the plant its common name. Pulp with 3 lobes with 1 seed in each. The yellowish-white flesh has an apple-like texture and an aromatic, subacid to sweet taste.

Origin and Distribution. The salak palm is native to the Malay Archipelago. This popular palm is grown as a fully or partly domesticated palm throughout its native habitat. The fruits are commonly sold in local markets.

Food uses. The leathery skin of the fruit is peeled and the pulp usually eaten out of hand. This fruit is valued for its refreshing sweet-sour flavor. Slices can be used in fruit salads, desserts, and as food decoration. The flesh of the seeded fruits is often candied or pickled. On the island of Bali, fruits are fermented to produce a sweet wine.

Comments. The genus contains more than 15 species, with *S. zalacca* the most important. At least 20 cultivars of the salak palm exist, with differences in fruit texture, moisture, and acidity. The most popular varieties are 'Salak Bali' from Bali, with a crunchy consistency, and 'Salak Pondoh' from the Indonesian province of Yogyakarta, with an intensely sweet aroma.

3
Tubers

Potatoes, taro, cassava, yams and other tubers are actually the underground storage organs of their respective plants. The many tuber species, although often not even closely related, all mainly contain carbohydrates in the form of starch. A variety of species are used for human consumption, forming daily food staples for people around the world.

Each continent seems to have its preferred tuber. In Europe and North America, people mainly eat potatoes and/or sweet potato; in South America, cassava and potatoes are popular; in Africa, it is yam and cassava; and in Asia, taro is widely eaten. Nevertheless, tubers generally play a larger role in the diets of people who live in the tropics.

Besides being food, some tubers are fermented into alcohol, and maca is even consumed as an aphrodisiac. This chapter describes many important tuber species from tropical regions throughout the world, both popular species and lesser known tubers like oca, maca, and malanga.

Alocasia macrorrhizos (L.) G. Don

GIANT TARO, GIANT ELEPHANT EAR

Araceae (Arum family)

The stems and young leaves are used as a vegetable in Southeast Asia, though they are poisonous when raw and must be boiled (and the water discarded) before consumption.

Description. Large, evergreen, perennial plant, 1–2.8 m (3.3–9 ft) tall with stem up to 30 cm (12 in) thick. Plants contain a whitish latex that can be very irritating to the skin because of its calcium oxalate content. Big, upright leaves with petioles 1–1.5 m (3.3–5 ft) long and glossy spear-shaped blades with wavy margins, 1–1.25 m (3.3–4 ft) long. Typical arum flowers, with erect greenish spathe 25 cm (10 in) long and white spadix. Fruits are small orange berries.

Origin and Distribution. Native to Southeast Asia and tropical regions of northeastern Australia. Widely planted in the tropics as a showy ornamental. The plant requires a humid tropical climate and semi-shady conditions.

Food uses. The somewhat woody, starchy corms are edible and occasionally eaten boiled or baked or prepared like other edible aroids. The stems and young leaves are used as a vegetable in Southeast Asia, though they are poisonous when raw and must be boiled (and the water discarded) before consumption. After boiling, leaves are used in stir-fries or cooked in coconut milk with other vegetables.

Comments. Raw leaves are toxic to humans because they contain calcium oxalate crystals and cyanide. *A. cucullata* (Chinese taro), also native to Southeast Asia, produces edible corms.

Arracacia xanthorrhiza Bancr.

ARRACACHA

Apiaceae (Carrot family)

This plant was commonly grown in pre-Columbian times and is considered one of the oldest cultivated plants of South America.

Description. Small perennial herb (annual in cultivation), 0.5–1 m (1.6–5 ft) tall, with parsleylike leaves that have 3–4 leaflets with toothed margins and dark or purple-tinged petioles. Small yellow or purple flowers are produced in loose umbels. The plants produce 6–10 carrot-sized storage roots that can be pale yellow or purplish and measure between 8 and 24 cm (3–9 in) in length. The starchy flesh is white, yellow, or light purple in color.

Origin and Distribution. Although the exact origin is unknown, it is probably native to Colombia, Ecuador, and Peru, where it grows in inter-Andean valleys at elevations between 1,000 and 3,200 m (3,300–10,500 ft). The plant was commonly grown in pre-Columbian times and is considered one of the oldest cultivated plants of South America, domesticated even before the potato and maize. Today arracacha is cultivated mainly in its original Andean habitat and in Brazil, where it is a popular vegetable. Mostly unknown elsewhere.

Food uses. The roots, which are not eaten raw, are boiled, fried, or roasted. The taste has been described as a blend of roasted chestnuts, parsley, and cabbage. The starchy roots are often used as a side dish similar to boiled or mashed potatoes and as an ingredient in soups and stews. The flour is used to make biscuits and pastries. Tender leaves and petioles are used raw or cooked as a green vegetable.

Comments. Arracacha roots contain 10–25% starch and are rich in calcium, with about four times more calcium than a potato. The vegetable is a good source of iron, niacin, phosphorous, and vitamin A but contains only fair amounts of protein. The flour is very digestible because of its small grain size; it is often preferred over other starchy vegetables for baby food.

Colocasia esculenta (L.) Schott

TARO

Araceae (Arum family)

The starchy corms shave a mild, nutty flavor and are eaten boiled, roasted, or fried.

Description. Perennial herbaceous plant, in cultivation often annual. Alternate, peltate leaves with long fleshy petioles and cordate blades 0.6–0.8 m (2–2.6 ft) long. Typical arum flower with tiny monoecious flowers on an erect stalk with a pale yellow spathe. Fruits are small berries.

Origin and Distribution. This ancient food plant is probably native to swampy lowland areas of Malaysia and adjacent regions of Southeast Asia. Taro has been in cultivation for at least 7,000 years and spread very early to South Asia and throughout Southeast Asia and Oceania. Today it is cultivated worldwide in the tropics and warm subtropics in regions with year-round high precipitation. The plant is grown for its edible corms and leaves and as an ornamental.

Food uses. The starchy corms have a mild, nutty flavor and are eaten boiled, roasted, or fried. They are consumed very much like potatoes. *Poi*, a pastelike food product made from fermented taro tubers, is a staple food in Hawaii, Tahiti, and other Pacific islands. Young, tender taro leaves, which are rich in minerals and vitamins, are eaten boiled as a vegetable like spinach. Young shoots are sometimes blanched to produce a vegetable with a flavor something like mushrooms. In tropical Asia, puddings are made from boiled and mashed taro and coconut. Flour is produced from the starchy corms.

Comments. Taro leaves and corms contain highly irritating calcium oxalate crystals, which are destroyed through cooking. More than 200 cultivars of taro exist, including those with edible corms and ornamental varieties with often variegated or purple leaves. The varieties with starchy, edible corms are divided into upland taro, grown in moist soil, and wetland taro, cultivated in flooded fields.

Dioscorea alata L.

WINGED YAM, PURPLE YAM

Dioscoreaceae (Yam family)

Description. Vigorous herbaceous, perennial vine with winged stems, growing more than 15 m (50 ft) in length. Spirally arranged, cordate, entire leaves 15–20 cm (6–8 in) long by 10–15 cm (4–6 in) wide with 5–7 conspicuous veins. Small greenish flowers are produced in racemes 20–30 cm (8–12 in) long. Fruits oval capsules 2–4 cm (0.8–1.6 in) long with papery wings. Mature plants produce starchy tubers that can weigh up to 10 kg (22 lbs) and have a brown or purple rind and firm white, cream-colored, or purplish-white flesh.

Origin and Distribution. This ancient food plant has been in cultivation for millennia and is not known from the wild. Probably native to Southeast Asia. It is cultivated throughout the tropics and has been naturalized in many regions. The plant requires a humid tropical climate or a monsoon climate with a short dry season.

Food uses. Tubers are prepared and eaten very much like potatoes. They are boiled, fried, toasted, baked, or mashed. Purple yam is also used to make ice cream, cakes, desserts, and pastries. In Africa, the tubers are boiled and mashed to make a paste served with many traditional dishes. They are an important source of flour and starch.

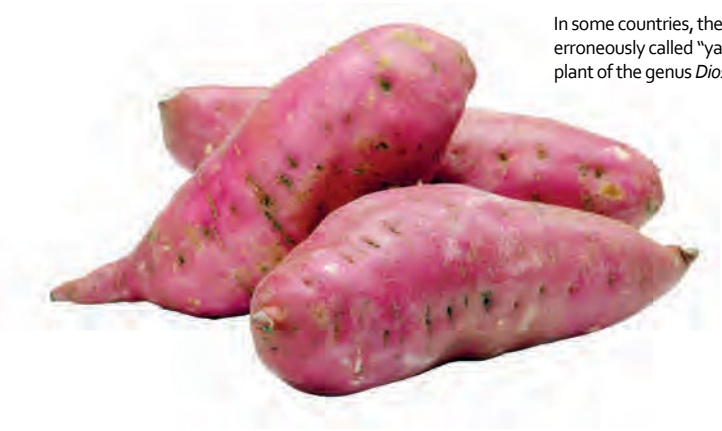
Comments. The plant has become a pest in some tropical and subtropical regions. It is a good source of vitamins C and B6, manganese, potassium, and fiber. Yam tubers can be stored for weeks without spoilage and were important food on sailing ships in the nineteenth century.

Other *Dioscorea* species of importance are white yam (*D. rotundata*), from Africa, Chinese yam (*D. opposita*), and the lesser yam (*D. esculenta*), from Southeast Asia.

Ipomoea batatas (L.) Lam.

SWEET POTATO

Convolvulaceae (Morning glory family)



In some countries, the sweet potato is erroneously called "yam," an unrelated plant of the genus *Dioscorea*.

Description. Herbaceous, perennial, creeping vine. Alternate leaves cordate to palmately lobed, with erect petioles. Flowers 3–5 cm (1.2–2 in) in diameter, pale pink with a purplish center. Fruit capsules contain many hard, black seeds. The edible part of the plant is the enlarged, elongated (or round) storage root, of smooth or irregular shape. Plants develop 4–10 yellow, orange, purple, or red storage roots with firm cream-white, orange, or yellow flesh.

Origin and Distribution. Probably native to tropical Central America, northern South America, and the West Indies. A very close relative, *I. trifida*, grows wild in Mexico. Remains of sweet potatoes, perhaps wild species, found in Peruvian caves were estimated to be more than 8,000 years old. Spanish and Portuguese traders brought the tuber to Europe around 1600 AD, and from there it spread to their African and Asian colonies. Interestingly, the sweet potato was cultivated in Polynesia before the arrival of Europeans. Possible explanations include transoceanic voyages of seeds and travels of Polynesians to South America, where they might have encountered this important vegetable.

Food uses. The tubers are eaten boiled, baked, roasted, or fried. Because they are sweet, they are also candied or used in the preparation of desserts. In Malaysia, the diced tuber is prepared together with yam and coconut milk in a sweet dish called *bubur caca*. In North America, mashed sweet potatoes are often served at Thanksgiving. In parts of Africa, crushed and sun-dried tubers called *inginyo* are eaten with peanut sauce and smoked fish. In the Andes of Peru, an ancient dish called *pacha manca*, consisting of goat meat, potatoes, and sweet potatoes, is cooked with hot rocks in an earthen oven covered with leaves and soil. Flour made from the storage roots is used to make bread. Sweet potatoes are processed into noodles, alcohol, chips, and candy. Young leaves and shoots are commonly eaten as a vegetable.

Comments. The sweet potato is a staple food in many tropical countries and an important source of calories. Storage roots are rich in carbohydrates, fiber, beta carotene, and the vitamins C and B6. They are fairly low in protein compared with other vegetables. However, leaves and shoots are rich in protein, vitamins A, C, and B2, and lutein.

Although the name might suggest a close relationship to the potato, the two species are not closely related and belong to two distinct families.

In some countries, the sweet potato is erroneously called "yam," an unrelated plant of the genus *Dioscorea*. Many cultivars of the sweet potato exist. They differ mainly in the texture, taste, starch content, color, and size of the storage root.

Although sweet potato is of American origin, today about 92% of world production occurs in Asia.

Lepidium meyenii Walp.

MACA

Brassicaceae (Mustard family)

Description. Low-growing, rosette-forming herbaceous plant with biennial growth habit; 14–20 thin, frilly leaves, each 6–10 cm (2.4–4 in) long, form a low-growing rosette on the surface of the soil. New leaves are continuously produced from the center of the plant. Small greenish-white flowers are produced in a central raceme. Small siliculate fruits 4–5 mm (0.16–0.2 in) long with tiny, reddish-gray seeds. Plants are cultivated for their fleshy hypocotyl, which is fused with the taproot. The edible tuber is reddish, purple, greenish, or gray to almost black in color and is shaped like a small turnip.

Origin and Distribution. Maca is native to the high Andes of Peru, where it grows naturally in the dry, cold Puna region between 3,900 and 4,500 m (12,800–14,800 ft). The plant has been cultivated in a small area around lake Junin for at least 4,000 years.

Food uses. Maca is grown as a root vegetable and as a medicinal plant. The tubers are normally eaten cooked. Newly harvested tubers are roasted in an earthen pit called *huatia* and considered a delicacy. Maca is also dried and made into flour for baking, or boiled and mashed to produce a porridgelike meal. The tubers are occasionally fermented to make a beerlike alcoholic beverage called *chicha de maca*. Another traditional way of preserving maca tubers is by a process similar to freeze-drying: exposing to subfreezing temperatures during Andean nights and drying in the sun during the day.

Comments. Maca tubers were supposedly eaten by Inca warriors before battles, as they were believed to enhance strength and endurance. They were also believed to increase male sexual powers. The tubers contain about 60% carbohydrate and 10% protein, as well as many essential minerals, including selenium, magnesium, and calcium, important fatty acids, and 19 different amino acids.

Because of its high nutritional value and its possible libido-enhancing properties, maca is slowly becoming more and more popular around the world.

Manihot esculenta Crantz

CASSAVA, MANIOC

Euphorbiaceae (Spurge family)

Before eating, cassava roots should always be soaked in water and boiled to eliminate any trace of toxic glucosides.

Description. Perennial woody shrub, 2–3 m (6.6–10 ft) tall, with deeply palmately lobed, gray-green leaves. The long-petioled leaves are short-lived and fall off after a few months. Small, yellowish-purple, bell-shaped flowers are produced in small terminal panicles. Fruits are small, angled seed capsules. Plants produce long, tapered, dark brown storage roots, which can grow up to 100 cm (40 in) long by 20 cm (8 in) wide and weigh up to 15 kg (33 lbs). The white or yellowish flesh consists mainly of starch and water.

Origin and Distribution. The Amazon region of northern Brazil and southern Mexico, including parts of northern Guatemala, are two possible locations where wild cassava originally grew and where domestication took place about 10,000 years ago. Recent studies show that genetic variation, which is greater in Mexican forms than in those from Brazil, indicates a Central American origin. Cassava roots were often depicted on pre-Columbian ceramics and textiles.

Food uses. Cassava root, a staple food in many tropical countries, is boiled, fried, or roasted and used in a great variety of dishes, including stews, soups, meat dishes, and purées. In Brazil, a flour called *farinha* is made from cassava root and plays an essential part in most Brazilian meals. The juice of the root is boiled down to a thick syrup called *cassareep* that is used as a culinary flavoring and to make sauces. In Africa, a paste made of cassava flour is fermented, boiled, and served with meat or fish in banana leaves. Starchy roots have been employed to produce fermented drinks and distilled liquor.

Comments: Cassava root occurs in two basic varieties, called bitter and sweet, depending on content of bitter-tasting cyanogenic glucosides. Sweet varieties contain only small amounts of the poisonous substance. Cassava roots should always be soaked in water and boiled before consumption to eliminate any trace of these toxic glucosides. Bitter varieties are grown mainly for industrial purposes like biofuel and flour production. Because its high yields are second only to those of sugarcane, cassava is cultivated to produce ethanol for fuel.

Cassava roots contain 20–25% starch, significant amounts of calcium, vitamin C, and phosphorous (but are poor in protein and other nutrients).

Mirabilis expansa (Ruiz & Pav.) Standl.

MAUKA, CHAGA

Nyctaginaceae (Four o'clock family)

Description. Perennial herbaceous plants with cylindrical, purplish stems, 0.6–1 m (2–3.3 ft) tall. Usually cultivated as an annual. Opposite, oval, somewhat fleshy leaves 4–6 cm (1.6–2.4 in) long by 2–4 cm (0.8–1.6 in) wide. Bright, variably colored flowers are produced in erect inflorescences. Spherical, single-seeded fruits turn black when mature. Plants produce below the soil surface several yellow conical storage roots, 20–30 cm (8–12 in) long.

Origin and Distribution. Native to the Andes mountain range of western South America, where the plant grows in cold climates between 2,800 and 4,500 m (9,000–15,000 ft). In pre-Columbian times, mauka was cultivated as an important high-altitude crop. Today this ancient food plant is grown only in very small areas of Peru, Bolivia, and Ecuador and is little known outside its natural range.

Food uses. Starchy tubers and the thickened, lower part of the stem are boiled or fried and used in stews, soups, or as a side dish. To make a sweet form of mauka, the roots and stems are covered with barley or buried in the ground for a month, when the starch largely hydrolyzes to sugar. These sweet-tasting tubers are usually mixed with syrup and served with tomatoes and fish. Young, protein-rich leaves and shoots are eaten in salads or boiled as a vegetable.

Comments. Some varieties of mauka have an astringent taste when freshly harvested. This is eliminated by exposing the tubers to cold Andean nights and sunny days for an extended time. Such treated tubers have a slightly sweet, agreeable flavor.

The nutritious tubers contain about 85% carbohydrate and 7% protein and are high in calcium, potassium, and phosphorous.

Nelumbo nucifera Gaertn.

LOTUS

Nelumbonaceae (Lotus-lily family)

Sliced rhizomes, which have a crunchy texture and a mildly sweet taste, are eaten raw in salads or as a snack filled with cheese or dipped in sauces.

Description. Aquatic perennial plant 1–2 m (3.3–6.6) tall. Circular floating or emergent peltate leaves with a waxy, strikingly water-repellent surface measuring 30–60 cm (12–24 in) in diameter. Long-stalked, emergent flowers, 20–30 cm (8–12 in) across, with 20–30 spirally arranged white, pink, or red petals and numerous yellow stamens. Fruits are dry, round capsules with numerous holes in the flattened top, reminiscent of spouts of watering cans. Plants grow via underwater rhizomes.

Origin and Distribution. Probably native to tropical Southeast Asia, from where it spread in prehistoric times to tropical regions of India and northeastern Australia. The plant grows wild in swamps as well as in lakes, ponds, and other inundated habitats. Often cultivated as an ornamental in water gardens.

Food uses. Sliced rhizomes, which have a crunchy texture and a mildly sweet taste, are eaten raw in salads or as a snack filled with cheese or dipped in sauces. They are widely used in Asian cuisine in stir-fries, curries, and stews and as a steamed or deep-fried vegetable served as a side dish. Hollowed-out rhizomes are often filled with meat or vegetables and baked. Young, tender rhizomes are sometimes pickled with garlic, vinegar, and chilies. Young leaves, flowers, and petioles are also eaten as vegetables. Seeds are eaten dried or candied.

Comments. The white flowered lotus is the national flower of India; the pink flowered lotus is the national flower of Vietnam. The lotus plant is considered a divine symbol in Asian religions. In Buddhism it is regarded as representing the purity of body, soul, and mind as well as sexual purity. Asian deities are often depicted sitting on a lotus flower. According to legend, Buddha was born on a lotus flower.

Oxalis tuberosa Molina

OCA

Oxalidaceae (Wood sorrel family)

These tubers are a staple food of the indigenous Quechua and Aymara people of the Andes.

Description. Perennial herbaceous plant with alternate, trifoliate leaves, 20–30 cm (8–12 in) tall. Flowers with 5 yellow petals with purple streaks, produced in small axillary clusters. Plants produce numerous carrot-shaped or cylindrical tubers, 5–15 cm (2–6 in) long, with several eyes. The color ranges from dark purple and orange to pink and yellow. The tubers have a pleasant nutty, potato-like flavor.

Origin and Distribution. Oca, which is not known in the wild, is probably native to the Central Andes of South America, where it is cultivated between 2,800 and 4,000 m (9,000–13,000 ft). It is well adapted to the harsh and cold conditions of the high mountains in South America and has been an important food for the Andean indigenous population for at least 8,000 years. It was introduced into Europe around 1830 and into New Zealand in 1860. Although it failed to become popular in Europe, it did so in New Zealand, where it is called "yam" (not to be confused with yam, *Dioscorea* sp.). Today it is grown to a small extent in temperate regions around the world.

Food uses. The tubers are commonly boiled, fried, or roasted. They are most often used in stews and soups, but in some places they are used to make marmalade and sweets.

These tubers are a staple food of the indigenous Quechua and Aymara people of the Andes. To preserve the roots, they are treated in a process similar to freeze-drying by exposing them to dry, sunny conditions during the day and subfreezing temperatures at night for several weeks. During this process, they dehydrate and shrink and become sweeter with a more intense flavor; they can be stored for many years without spoiling. Before being used they are immersed in water for several hours, rehydrated, and then used like fresh oca tubers.

Comments. After the potato (*Solanum tuberosum*, p. 271), oca is the second most important cultivated tuber of the high Andes. More than 50 varieties of this ancient crop are known to exist. The tubers contain mainly carbohydrate in the form of very fine starch and around 9% protein, depending on the variety.

Pachyrhizus erosus (L.) Urb.

YAM BEAN, JÍCAMA, MEXICAN YAM

Fabaceae (Bean family)

In Southeast Asia, these tubers are eaten raw as a snack or used in stir-fries, curries, and soups.

Description. Perennial evergreen vine reaching 3–7 m (10–23 ft) in length. Alternate, trifoliate, hairy leaves 20–30 cm (8–12 in) long, with a large central leaflet and 2 smaller lateral leaflets. Leaflets irregular in shape, often kidney-shaped, ovate, or rhomboidal with toothed margins. White, blue, or purple leguminose flowers are produced in pseudoracemes up to 50 cm (20 in) long. Fruits are legumes 8–16 cm (3–6.3 in) long with several flat, rounded or square, olive green to brown seeds. Cultivated varieties produce turnip-shaped storage roots up to 30 cm (12 in) long with yellowish-white, thin papery skin and creamy-white, starchy flesh.

Origin and Distribution. The yam bean is native to Mexico and Central America, where it grows in tropical lowlands and premontane, seasonally dry and humid forests up to 1,400 m (4,600 ft). The crop has been in cultivation in this region since approximately 1000 BC. The tuber was taken by Spanish sailors to the Philippines in the sixteenth century, from where it spread through Asia and Africa.

Food uses. Slices of raw tubers have a crisp texture and are slightly sweet; they are eaten raw in salads, often seasoned with salt, lime juice, and chili sauce. They are also cooked, fried, baked, or roasted in a wide variety of savory dishes. In Mexico, a juice made from raw tubers is a popular drink commonly sold from roadside stalls. In Southeast Asia, the tubers are eaten raw as a snack or used in stir-fries, curries, and soups. In Indonesia, where the root is known as *bengkuang*, they are consumed as an ingredient in spicy salads called *rujak*.

Comments. The green plant parts and especially the seeds contain the poisonous chemical rotenone, which is used as an insecticide and pesticide.

In the Andes of South America, the ahipa (*P. ahipa*) is cultivated for its tubers at elevations between 1,000 and 2,000 m (3,300–6,600 ft). The Amazonian yam bean (*P. tuberosus*) is characterized by its higher protein content and edible, protein-rich leaves. The tubers are cultivated in the lowlands of the Amazon basin and consumed raw and cooked.

Smallanthus sonchifolius (Poepp.) H. Rob.

YACON

Asteraceae (Sunflower family)

As with many other Andean tubers, storage roots of yacon are freeze-dried on cold, dry mountain nights followed by dry, sunny days.

Description. Herbaceous perennial 1.5–2.5 m (5–8 ft) tall. Alternate, cordate leaves finely pubescent and with winged petioles. Flower heads orange or yellow. Fruits achenes. Plants produce 4–20 tuberous brown, orange, white, or purple storage roots of conical, elongated, or irregular shape. The crisp flesh of the tubers, which weigh between 200 and 500 grams (0.44–1.1 lbs), is usually pale yellow or orange and has a sweetish flavor due to inulin.

Origin and Distribution. The plant is native to the Andes of South America from Colombia and Venezuela south to Argentina and Chile, where it grows between sea level and 3,500 m (11,500 ft). It was widely cultivated in pre-Columbian times. Yacon tubers were commonly depicted on textiles and ceramics of the Nazca and Moche cultures dating from 500 to 1200 AD. The plant is rarely cultivated outside its natural range.

Food uses. Tubers have a crisp texture and taste sweet. Often used raw in salads, they are also boiled, fried, roasted, or baked, and processed into juice, syrup, and desserts. As with many other Andean tubers, storage roots of yacon are freeze-dried on cold, dry mountain nights followed by dry, sunny days. This process enhances flavor, sweetness, and storage longevity. The young leaves are eaten as a protein-rich vegetable.

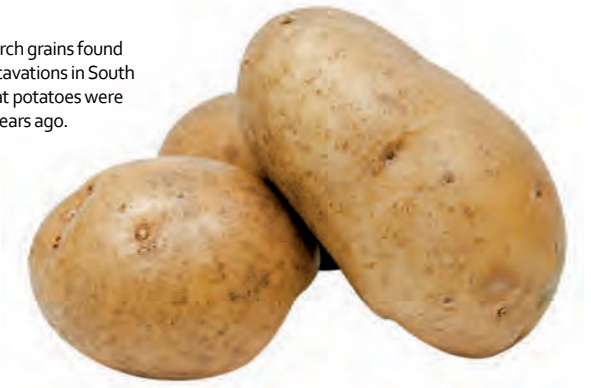
Comments. Yacon plants store a large percentage of carbohydrate in the form of inulin, a sugar that cannot be metabolized by humans, making yacon tubers and their processed products, including syrup and beverages, ideal for diabetics. Yacon can also serve as a low-calorie sweetener. The tubers are processed industrially to obtain inulin. The leaves have been used in traditional herbal medicine to lower blood sugar and as a liver tonic.

Solanum tuberosum L.

POTATO

Solanaceae (Nightshade family)

Carbon dating of starch grains found in archaeological excavations in South America indicate that potatoes were used at least 8,000 years ago.



Description. Short-lived perennial plant usually cultivated as an annual. Erect, herbaceous, 0.5–1.5 m (1.6–5 ft) tall. Alternate, compound pinnate leaves, usually with elliptic leaflets, can vary widely in shape and size. Fruits yellowish-green berries, 2 cm (0.8 in) wide with numerous tiny, flat seeds. Plants produce irregularly shaped, often round or oval, purple or yellowish to brown tubers, usually with crisp yellow or white flesh.

Origin and Distribution. Probably native to the southern Peruvian, Bolivian, and northern Chilean highlands of the Central Andes, where wild ancestors grow at elevations between 2,500 and 3,800 m (8,200–12,500 ft). Carbon dating of starch grains found in archaeological excavations in South America indicate that potatoes were used at least 8,000 years ago. Around 1570, the first potatoes were brought to Europe, where they were initially grown as ornamentals—but fewer than 100 years later the crop was cultivated in all European countries as an important food plant. Today the potato is the world's third major food crop and there are more than 4,000 varieties.

Food uses. The potato is a very versatile, carbohydrate-rich food, eaten boiled, baked, fried, or roasted in a wide variety of dishes. Potatoes are fermented and distilled to produce liquors such as vodka. In the Andes, people still preserve potatoes by freeze-drying when nights are cold and days dry and sunny. Such treated tubers, which can be brown or also white if soaked in mineral-rich streams, are locally called *chuño* and can be kept for 8 years or longer without spoiling.

Comments. Potatoes consist of 78% water, 18% starch, and 2% protein. Tubers with skin are also high in vitamin C and vitamins B1, B3, and B6. Although the potato cultivated worldwide belongs to just one botanical species, *S. tuberosum*, the tubers come in thousands of varieties with differences in size, shape, color, texture, cooking characteristics, and flavor.

Tropaeolum tuberosum Ruiz & Pav.

MASHUA

Tropaeolaceae (Nasturtium family)

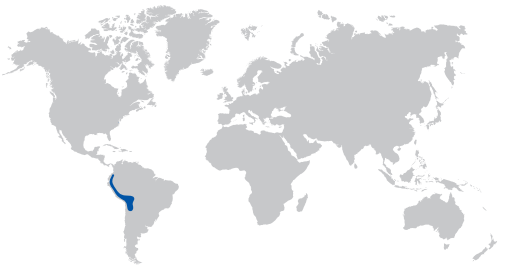
Description. Annual climbing herb with sprawling growth habit. Dark green, alternate, peltate leaves resemble garden nasturtium. Bisexual, solitary flowers orange to dark red. Tubers round or cone-shaped, 5–15 cm (2–6 in) long, often attractively colored in yellow, red, purple, or white. The flesh of the tuber is usually light yellow. Raw tubers have a pungent taste caused by isothiocyanates (mustard oil).

Origin and Distribution. Endemic to the central Andes of South America from Colombia to Chile and Argentina, where it grows between 2,500 and 4,000 m (8,200–13,000 ft). This tuber was domesticated at least 7,500 years ago and is often found at archaeological sites. Today it is widely grown and consumed in the Andes. It is rarely cultivated elsewhere. The plants, which can produce up to twice the yield of potatoes per hectare, are easy to cultivate, grow on poor soils, and are resistant to cold, droughts, and pests. The tubers can be stored in the ground until needed.

Food uses. Tubers are exposed to the sun and to cold nights for several days or boiled to reduce pungency and enhance sweetness. In certain areas of Peru and Bolivia, boiled tubers are covered with molasses and sold as sweets or served frozen as a dessert. The young, tender leaves and flowers are edible and used as potherbs.

Comments. There are more than 100 different varieties of mashua, differing mainly in tuber size, shape, and color. The plant is used in Andean folk medicine to treat bacterial and fungal infections. It has also been described by various sources as an anti-aphrodisiac, inhibiting sexual appetite in humans and animals. Laboratory tests have shown that rats experienced a drop of 45% in blood testosterone after being fed mashua tubers.

Mashua tubers have a high nutritional value. They contain about 16% protein including all the essential amino acids, 80% carbohydrate, and up to 480 mg (0.016 oz) vitamin C per 100 g (0.22 lbs) dry matter.



Ullucus tuberosus Caldas

ULLUCO

Basellaceae (Madeira-vine family)

The ulluco is native to the Andes Mountain Range, where it grows wild in Bolivia, Peru, and Ecuador.

Description. Perennial creeping herb 30–50 cm (12–20 in) tall. Fleshy leaves alternate, petiolate, heart-shaped, varying in color from dark green to almost reddish. Small flowers in axillary panicles produce dry, indehiscent nutlets of an obovate shape. The plant is grown for its subterranean, starchy tubers, which grow between 4 and 15 cm (1.6–6 in) in diameter, usually with irregular shape and white to yellowish flesh. The skin shows a great variation in color, including orange, yellowish, purplish, greenish, or brown.

Origin and Distribution. The ulluco is native to the Andes Mountain Range, where it grows wild in Bolivia, Peru, and Ecuador. It is cultivated mainly at elevations between 2,500 and 4,000 m (8,200–13,000 ft) in mountainous regions between Argentina and Colombia, where it is often the predominant root crop. This tuber has been cultivated in the Andean region for at least 5,000 years. It is the second-most important tuber grown in the Andes after the potato.

Food uses: The tubers, which have a pleasant, potato-like, nutty flavor with crisp texture, are used very much like potatoes. Considered a delicacy, they are usually boiled in stews and soups. They are also pickled and added to hot sauces. The high water content makes the tuber unsuitable for frying. The ulluco tubers are often treated by exposing them to cold Andean nights and dry, sunny days to produce dehydrated *chuño de olluco* or *llingli*. Treated tubers have a sweeter, more intense flavor. They can be kept for many years without spoiling. They are usually used in soups and stews or made into flour. The leaves are rich in proteins and eaten like spinach, raw in salads, or cooked in soups.

Comments. Small tubers are used for propagation. The time from planting to harvest is normally 6–8 months, with harvests ranging from 5 to 9 tons (11,000–20,000 lbs) per hectare. Cultivation of ulluco requires very little maintenance and it has few pest problems. Tubers are high in starch, protein, calcium, and vitamin C.

The ulluco is closely related to Malabar spinach (*Basella rubra*), widely cultivated in the tropics for its succulent leaves, which are commonly used as a vegetable.

Xanthosoma sagittifolium (L.) Schott

TANNIA

Araceae (Arum family)

Description. Herbaceous, perennial, monocotyledonous plants 2–2.5 m (6.6–8 ft) tall. Leaves heart-shaped, 50–100 cm (20–40 in) long, with the purplish petiole attached to the undersurface at the indentation of the lamina lobes. Leaf blades have a collecting vein along the margin of the leaf. Unisexual or bisexual flowers on a spike enclosed by a large cream-colored spathe. Fruits are berries containing 2–5 small hard seeds. The plant produces a starchy, spherical, or cylindrical corm that grows shallowly under the soil surface. Corms can grow to 35 cm (14 in) long and weigh several kilograms. The tender flesh is white, cream, yellow, or pink.

Origin and Distribution. Originally from tropical regions of Central and South America, where the plant grows wild in the understory of humid lowland rainforests. Tannia has been cultivated as a food crop in tropical America for millennia and is now grown in most tropical countries with high annual rainfall.

Food uses. Corms are boiled, steamed, fried, or roasted. Along the Caribbean coast of Central America, a stew called *rondon* is made from seafood, diced tannia and cassava, coconut milk, and spices. In Surinam, the shredded corms are prepared with chicken, fruit juice, salted meat, and spices in a popular dish called *pom*. In parts of Africa, a pastelike mash called *fufu* is made from cooked corms. This is sometimes slightly fermented before consumption. A very similar preparation is called *poi* in Hawaii. In Puerto Rico, "pastels" are made from tannia, meat, and plantains wrapped and cooked in banana leaves. Young, tender leaves are cooked like spinach.

Comments. Corms contain 20–25% nonallergenic and easily digested carbohydrate but are low in protein and vitamins. Tannia has acquired several local names, including malanga, belembe, yautía, ñampí, and cocoyam. To add to the confusion, these names are often also applied to other starchy vegetables like yam (*Dioscorea* sp., p. 262) and taro (*Colocasia esculenta*, p. 261).

4
Spices and Herbs

Spices are often associated with colorful markets in the tropics, especially in India and Southeast Asia, where many of them originated. For centuries, nutmeg, clove, cinnamon, black pepper, and other spices were transported vast distances, first by land and then by sea, to Europe, where merchants eager to make their fortune traded for these highly prized substances.

Now readily available, spices—and herbs—are as important to human food culture today as they ever were. Indeed, in certain countries like India or Thailand, it is impossible to imagine their cuisine without certain characteristic spices like chili peppers, tumeric, and ginger.

This chapter describes many of the most important tropical spices. Some, like black pepper and nutmeg, are common almost everywhere, while others are used only in certain corners of the world.

Alpinia galanga (L.) Willd.

GREATER GALANGAL

Zingiberaceae (Ginger family)

Description. Perennial, erect, herbaceous plant, 2–2.5 m (6.6–8 ft) tall. Alternate, lanceolate leaves, 40–50 cm (16–20 in) long by 8–12 cm (3–5 in) wide. Showy flowers in terminal spikes with white petals and deep red veining. Ovoid fruits, 2–3 cm (0.8–1.2 in) long, are capsules with numerous small seeds. Mature plants produce pale yellow and pink branched rhizomes with cylindrical subunits similar to ginger (*Zingiber officinale*, p. 314), but with characteristic rings. Rhizomes have a pungent taste with an aroma similar to a blend of black pepper and ginger.

Origin and Distribution. Native to tropical regions of Southeast Asia. Widely cultivated from India and Sri Lanka throughout Southeast Asia to southern China.

Food uses. Freshly grated or sliced rhizomes are used as an important culinary spice in Southeast Asia, especially in Thailand. The spice is also a common ingredient in stir-fries and curries. Galangal is used in the preparation of Thai curry paste and curry powder. Extracts of the rhizome are used to flavor vinegar and liqueurs. The seeds are sometimes used instead of cardamom (*Elettaria cardamomum*, p. 289).

Comments. The reddish-brown rhizomes of the lesser galangal (*A. officinarum*), native to China, have a spicy, aromatic taste.

Bixa orellana L.

ANNATTO, ACHIOTE

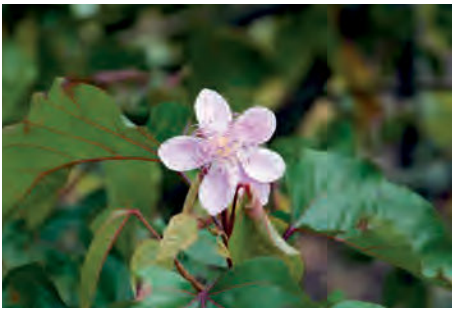
Bixaceae (Annatto family)

Description. Broad evergreen tree, 4–10 m (13–33 ft) tall. Alternate glossy leaves ovate to cordate, 10–20 cm (4–8 in) long by 5–15 cm (2–6 in) wide, with long petioles. White or pink flowers with 5 petals and numerous stamens. Ovoid to heart-shaped, dark red to brown fruit capsules are densely covered in soft bristles. Seeds are surrounded by soft, bright red arils.

Origin and Distribution. Probably native to tropical South America, especially the Amazon basin. Today the tree is cultivated throughout the tropics as a dooryard tree and in small plantations.

Food uses. The seeds have a mildly spicy, nutty flavor and are used as a spice and food colorant. The seed paste gives an orange or yellow color to rice, sauces, and chicken and fish dishes as well as typical Latin American foods like *empanadas* and *tamales*. The fat-soluble food coloring is widely used to add an orange-yellow color to butter, margarine, ice cream, and cheese. Annatto is a key ingredient in *tascalate*, a drink made from toasted corn and cacao typical of the Chiapas region of Mexico.

Comments. The red annatto coloring was used by indigenous tribes of South America as body paint and lipstick. The coloring pigments in annatto are fat-soluble bixin and water-soluble norbixin.



Boesenbergia rotunda (L.) Mansf.

FINGERROOT, CHINESE GINGER

Zingiberaceae (Ginger family)

Description. Perennial herbaceous plant, erect, 60–100 cm (24–40 in) tall. Pseudostems with 3–5 alternate, lanceolate leaves, 40–60 cm (16–24 in) long. Pink and purple flowers in inflorescences 10–15 cm (4–6 in) long, with 3 petals, each 4–6 cm (1.6–2.4 in) long. Fruit capsules are rarely developed. Plants produce fingerlike brown rhizomes, 20–35 cm (8–14 in) long, with an aromatic, spicy flavor.

Origin and Distribution. Native to lowland rainforests of Southeast Asia and southern China. Widely cultivated in tropical and warm subtropical regions of Asia, but very rarely elsewhere.

Food uses. The fresh or much less often dried rhizomes are used grated or sliced as a spice, especially in Thai, Malay, and Indonesian cuisine. They are often used in curries, especially fish curries, and also as a common ingredient in vegetable stews and fish soups. Grated rhizomes of fingerroot are often cooked with coconut (*Cocos nucifera*, p. 249) and kaffir limes (*Citrus hystrix*, p. 66). Fingerroot is an important ingredient in Thai curry paste. Rhizomes are sometimes preserved by pickling.

Comments. The rhizome is used in traditional medicine of Southeast Asia to treat wounds, swelling, and diarrhea. The plant is also known by the synonym *B. pandurata*.

Catha edulis Forssk.

KHAT

Celastraceae (Spindle tree family)

Description. Medium-sized evergreen tree or large shrub with rough, fissured bark, 20–30 m (66–100 ft) tall. Opposite, simple, leathery, elliptic-oblong leaves with finely toothed margins, 6–9 cm (2.4–3.6 in) long by 2–4 cm (0.8–1.6 in) wide. Small white flowers are produced in axillary umbels. Fruit a reddish-brown 3-valved capsule, 1 cm (0.4 in) wide, containing 1–4 seeds with large papery wings.

Origin and Distribution. Native to Ethiopia, Somalia and the Arabian Peninsula. Widely cultivated in eastern Africa from Egypt and Arabia to South Africa and east to Pakistan, India, and Sri Lanka. The plant grows naturally in seasonally dry forests and shrubland. Rarely cultivated outside Africa, the Middle East, and South Asia.

Food uses. Freshly harvested leaves and young shoots, which have a bitter-sweet, astringent taste, are chewed for several hours for their stimulating, euphoric, and mildly narcotic effects. Less often they are consumed to suppress hunger and thirst. Fresh or dried leaves are also smoked or used to prepare a stimulating tea.

Comments. Khat is strongly associated with eastern African and Arabic/Middle Eastern traditional cultures, where chewing khat is, for some, part of everyday social life and plays an important role in ceremonies and rituals. Khat, which is predominantly consumed by men on a daily basis, is a highly valued commodity of substantial socioeconomic importance.

Fresh leaves of *C. edulis* contain cathine, a phenethylamine-type substance related to amphetamines that causes stimulating and anorexic effects on the human body. Continuous use of khat can cause addiction, and excessive consumption can produce symptoms of intoxication and hallucinations.

Camellia sinensis (L.) Kuntze

TEA

Theaceae (Tea family)

Description. Evergreen shrub or small tree, 10–15 m (33–50 ft) tall (in cultivation usually 1–1.5 m [3.3–5 ft]). Alternate, dark green, lanceolate leaves 8–20 cm (4–8 in) long by 3–12 cm (1.2–5 in) wide with finely serrated margins. Fragrant white flowers, with numerous yellow stamens and 7–8 petals, are borne singly or in small clusters. Fruits are woody capsules 1.5–2 cm (0.6–0.8 in) long with 3 rounded seeds.

Origin and Distribution. The tea plant is native to humid, cool mountain climates of northern India, Tibet, northern Myanmar, and southwestern China, where it grows at elevations between 1,000 and 1,800 m (3,300–5,900 ft). The first recorded drinking of tea occurred in China and dates back to the tenth century BC. Tea is widely cultivated in mountainous regions of the tropics and frost-free regions of the subtropics.

Food uses. The young leaves and buds are harvested to make green or black tea, oolong tea, and white tea. Leaves for green tea are dried and untreated, whereas leaves for black tea are rolled to rupture the leaf tissue followed by a process of enzymatic oxidation, which produces the characteristic brown color and aroma. Different levels of fermentation produce different flavors and kinds of tea, as for instance the post-fermented oolong tea.

Tea, the most popular drink besides water, is consumed worldwide, often with milk, and sweetened with sugar and honey or aromatized with spices and herbs. In northern India and the Himalaya, tea is traditionally consumed with yak milk and salt. The seeds produce a slightly sweetish oil used occasionally for cooking.

Comments. Tea contains more than 700 different chemicals. The dry matter is made up of 3–6% caffeine, 0.1–0.2% theobromin, and 20–30% catechins. The two commercially most important varieties are Chinese tea (*C. sinensis* var. *sinensis*) and Indian tea (*C. sinensis* var. *assamica*) with well-known tea varieties like 'Assam' and 'Darjeeling'.

The largest producers of tea are China, India, Kenya, Sri Lanka, and Turkey.

Cinnamomum verum J. Presl

CEYLON CINNAMON

Lauraceae (Laurel family)

Description. Bushy evergreen tree with reddish, very aromatic bark, 10–12 m (33–39 ft) tall. Leaves opposite, leathery, shiny with prominent parallel veins. Small yellowish-green to cream-white flowers are produced in terminal and axillary panicles. Fruits are black drupes, 1–2 cm (0.4–0.8 in) long with a persistent calyx at base.

Origin and Distribution. *C. verum* is native to Sri Lanka and parts of southwestern India, where it is indigenous to tropical lowland rainforests. All species of cinnamon are native to South and Southeast Asia.

Food uses. Cinnamon has been a prized spice for millennia. The sweetly fragrant spice is used in a wide variety of bakery goods, candies, pickles, sauces, and beverages, including cinnamon tea and soft drinks. In India and the Middle East, whole pieces of cinnamon bark are used to flavor spicy meat dishes as well as fragrant rice dishes. It is an essential part of curry powder and other spice mixtures like the Arabian *baharat*. In Mexico, cinnamon is used to flavor chocolate.

Comments. Cinnamon is the dried inner bark of twigs and thin stems, revealed when the outer bark is removed. The bark contains cinnamaldehyde and several other volatile compounds responsible for the unique flavor. It is thought to be one of the oldest spices of mankind and according to legend was used in China during the reign of mythical King Shen-Nung around 3000 BC. In medieval Europe, it was considered one of the most valuable spices.

Cinnamon has a variety of traditional medicinal uses. It was applied to treat diarrhea, flu, and bacterial infections. Because of its antimicrobial activities it was used in ancient Egypt as an enbalming agent. Cinnamon oil, made mostly from Chinese cinnamon, was used in religious ceremonies and burned in temples as incense.

The leading species of cinnamon are Chinese cinnamon (*C. aromaticum*) and Ceylon cinnamon. Chinese cinnamon has a stronger, spicier taste than Ceylon cinnamon, which is sweeter and more refined. Sri Lanka is the leading producer of cinnamon, with 90% of world production.

Coffea arabica L.

ARABICA COFFEE

Rubiaceae (Coffee family)

Description. Small evergreen tree, 10–12 m (33–39 ft) tall. Opposite, dark glossy green leaves with elliptic-ovate blades, 7–20 cm (2.8–8 in) long. White, sweetly fragrant, hermaphroditic flowers are borne in small axillary clusters. Fruit an oval, fleshy drupe, 1–1.5 cm (0.4–0.6 in) long, ripening from green over yellow to a crimson red. Fruits usually contain 2 greenish-white seeds.

Origin and Distribution. Native to mountainous regions of southeastern Sudan, Ethiopia, and Yemen, where the plant grows wild as an understory tree in premontane to montane forests. The coffee plant requires a mild, subtropical climate without frost. In the tropics the plant is generally cultivated in humid highlands from 1,200 to 1,800 m (3,900–5,900 ft) elevation with average temperatures between 16 and 24 °C (60–75 °F) and annual rainfall of 1,500–2,800 mm (59–110 in). The cultivation of coffee began in Yemen around 900 AD, from there spreading over the Arabian Peninsula and eastern Africa and, in the sixteenth century, to Europe.

Food uses. The seeds of ripe drupes, after being separated from the pulp, are dried, roasted, ground, and brewed to prepare the ubiquitous stimulating drink consumed worldwide. Coffee extracts are used to flavor ice cream, sweets, pastries, and liqueurs. Coffee seeds are a source of caffeine, which is used as a stimulant and as an additive in diet pills and pain medicine. In Africa, a fermented drink from the pulp of ripe fruits is consumed, and the seeds are baked in butter to make rich flat cakes.

Comments. Coffee seeds contain 0.8–1.5% caffeine, which is mainly responsible for their stimulating effects on the central nervous system. *C. arabica* constitutes about 80% of world coffee production, followed by robusta coffee (*C. canephora*) at about 20% of world production. The leading coffee-producing countries are Brazil, Vietnam, Indonesia, and Colombia.

Coffea canephora Pierre ex A. Froehner

ROBUSTA COFFEE

Rubiaceae (Coffee family)

Description. Small evergreen tree with long, spreading branches, 8–12 m (26–39 ft) tall. Opposite, glossy, dark green leaves elliptic, 20–35 cm (8–14 in) long by 8–16 cm (3–6.3 in) wide with wavy margins. Fragrant white flowers in dense clusters of 40–60 flowers. Spherical to ovoid, dark red drupes 0.8–1.6 cm (0.3–0.6 in) long, with 1 or more commonly 2 greenish seeds.

Origin and Distribution. Native to Central and West Africa. The plant grows naturally in the humid understory of tropical rainforests and is adapted to a tropical climate with mean temperature between 22 and 26 °C (71–79 °F).

Food uses. The roasted seeds of robusta coffee, which contain twice as much caffeine as arabica coffee, are used to make the well-known stimulating hot or cold drink. The aroma of this coffee species, which has a strong, bitter taste, is considered inferior to *C. arabica*; the seeds are used mainly in low-grade coffee blends, espresso coffee, and instant coffees.

Comments. Robusta coffee constitutes about 20% of world coffee production. The plant is relatively easier to cultivate, requiring less care. It can withstand hot, tropical climates, is more disease resistant, and has a higher yield than arabica coffee. The species is also known by the synonym *C. robusta*. The plant is cultivated mainly in tropical lowlands of Indonesia, Vietnam, Brazil, and India.

Coffea liberica W. Bull ex Hiern

LIBERIAN COFFEE

Rubiaceae (Coffee family)

Description. Small to medium-sized evergreen tree, 8–15 m (26–50 ft) tall. Opposite, dark glossy green, leathery, elliptic leaves 20–40 cm (8–16 in) long by 10–20 cm (4–8 in) wide. Nearly sessile clusters of white flowers are produced along the branches. White corolla tube with 5–8 lobes. Cherry red, ovoid drupes 1.5–2.5 cm (0.6–1 in) long with 2 oval seeds.

Origin and Distribution. Native to Central and West Africa. The plant is adapted to a humid tropical climate and grows from sea level to about 1,000 m (3,300 ft) in equatorial regions. Liberian coffee is usually cultivated in the tropical lowlands of Africa, Southeast Asia (especially Malaysia and the Philippines), and to a much lesser extent in northeastern South America.

Food uses. The roasted seeds have a very strong bitter taste similar to that of *C. canephora* (robusta coffee, p. 283) and are used to make coffee. The quality of *C. liberica* is considered inferior to arabica coffee (p. 282) and is therefore used mainly in coffee blends. In Malaysia, the dried leaves, which also contain caffeine, are used to make a tealike hot beverage.

Comments. *C. liberica* accounts for about only 1% of world coffee production. It produces larger fruits and seeds than the other two coffee species and the plant is tolerant of poor soils and hot, wet tropical conditions. It was introduced in the nineteenth century into several coffee-producing regions, including Indonesia, after a fungal disease called coffee rust infected and killed many plantations of *C. arabica*.

Cola nitida (Vent.) Schott & Endl.

KOLA NUT

Malvaceae (Mallow family)

In Africa, kola nuts are traditionally chewed as a mild stimulant and to suppress hunger and thirst.

Description. Evergreen tree, 10–20 m (33–66 ft) tall. Leaves simple, alternate, 20–30 cm (8–12 in) long, broad-elliptic with wavy margins and a leathery texture. Unisexual flowers, produced in branched panicles, are 2–3 cm (0.8–1.2 in) in diameter with pale yellow sepals streaked with purple. Woody, star-shaped, dark green fruits with knobby, irregularly formed rind. Ripe fruits split open and display bright red seeds surrounded by a mealy white pulp.

Origin and Distribution. The tree grows naturally in the understory of wet lowland rainforests in tropical regions of West Africa. It is cultivated mainly in warm, humid climates of Central and West Africa. With the slave trade, the kola nut reached tropical America, where it was occasionally grown in Central and eastern South America. On the Atlantic slope of Central America, old planted kola trees can be seen as remnants in abandoned cacao plantations.

Food uses. In Africa, the nutritious kola nuts are traditionally chewed as a mild stimulant and to suppress hunger and thirst. At first they taste bitter but then begin to taste sweet because of the action of enzymes in saliva. Many African peoples use kola nuts in religious or social ceremonies. Dried and powdered seeds are cooked with milk or water, sugar, and spices.

Extracts of kola seeds are used commercially as a flavoring agent and a source of caffeine for soft drinks like Coca Cola. The red seeds are a potential source of food coloring.

Comments. Kola nuts contain about 45% carbohydrate, 10% protein, 3–5% caffeine, and 0.05% theobromin. The seeds of *C. acuminata*, a closely related species native to West Africa, are used both as a stimulant and as a spice. The tree is distinguished from *C. nitida* by its smaller leaves and fruits with a much smoother surface.

Coriandrum sativum L.

CORIANDER, CILANTRO

Apiaceae (Carrot family)

Description. Small annual herb, 50–60 cm (20–24 in) tall, with a long, slender taproot. Light green lower leaves deeply lobed and upper leaves finely cut with narrow linear lobes. Small white or pink flowers are produced in terminal umbels. Spherical hard fruits, 3 mm (0.12 in) wide with 10 longitudinal ribs.

Origin and Distribution. Native from southeastern Europe and northern Africa to western Asia (Caucasus region). This versatile plant has been cultivated for more than 3,000 years for both its foliage and the dry fruits used in flavoring. Frequently grown in cool mountain climates of the tropics and as an annual in temperate regions.

Food uses. Fresh leaves, which have a very distinct, strongly aromatic flavor, are used as a culinary spice, especially in Latin American, Middle Eastern, and Asian cuisines. They are used to flavor soups, salads, fish and meat dishes, chutneys, curries, sauces, and rice dishes. Cilantro leaves are an essential ingredient in *ceviche*, a Latin American dish made by marinating diced fish filets, onions, chili peppers, and spices in lime juice. Cilantro leaves are also used in the preparation of typical Mexican sauces as well as *guacamole*, a dish made from avocados, onions, chilies, and spices.

Whole or ground fruits are used to flavor bakery goods like bread and cookies and for pickling vegetables. In India, the fruits are used to flavor curry dishes. In Europe, the fruits are essential for flavoring certain types of beer and liquors, including gin. The roots of coriander plants are used in Thailand and other parts of Southeast Asia and China as a cooked vegetable and as a spice ingredient in curry pastes.

Comments. In tropical America, the very similar-tasting leaves of culantro (*Eryngium foetidum*, p. 290), also in family Apiaceae, are used the same way as coriander leaves.

Curcuma longa L.

TURMERIC

Zingiberaceae (Ginger family)

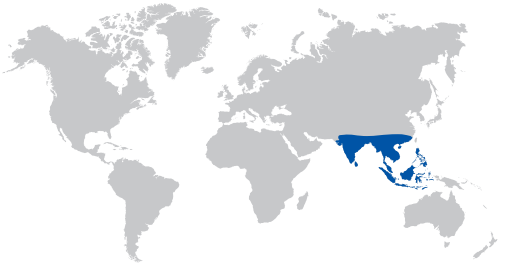
Description. Herbaceous perennial plant, 60–90 cm (24–36 in) tall, with 7–12 elliptical leaves. Blades are 30–40 cm (12–16 in) long, with leaf sheaths forming a pseudostem. Yellowish-white flowers in erect, central spikes, 10–16 cm (4–6.3 in) long and borne in the axils of the bracts. Flowers open one at a time. Fruits are capsules with numerous tiny seeds. The plant produces a fleshy, branched rhizome 6–12 cm (2.4–5 in) long. The rhizome is bright orange to orange-yellow in color and has an aromatic, spicy, somewhat peppery taste.

Origin and Distribution. Pinpointing the exact origin is difficult, since this important spice has been traded and planted in different parts of tropical and subtropical Asia for several millennia. Turmeric grows best on well-drained soils in humid, tropical conditions, from sea level to about 1,500 m (5,000 ft).

Its use dates back nearly 4,000 years to the Vedic culture in India, where turmeric was the principal spice. It is employed in some Hindu rituals, with the yellow color symbolizing the sun.

Food uses. Dried and ground turmeric is an essential ingredient in curry powder and curry paste, responsible for the characteristic yellow color. In Southeast Asia, fresh, grated turmeric is usually preferred over dried powder. The rhizomes can be seen in almost every market throughout tropical Asia. The spice is used to enhance the yellow color of some mustard varieties, and as a colorant in beverages, sweets, ice cream, bakery goods, cheese, butter, margarine, and cereals.

Comments. Turmeric contains about 5% essential oils and 5% curcumin, the component mainly responsible for the spicy taste and intense color. The plant has a long history as a traditional medicinal plant. Extracts of the rhizome have been used to treat skin and digestive disorders, wounds, and bacterial infections. Much recent scientific research is focused on turmeric for benefits in the treatment of cancer and Alzheimer's disease. Mixing turmeric powder with lime juice produces a bright orange paste called *kumkum* in India, traditionally used in Hinduism for ritual markings on the face.



Cymbopogon citratus (DC.) Stapf

LEMON GRASS

Poaceae (Grass family)

Description. Perennial herb, 0.6–1 m (2–3.3 ft) tall with drooping, linear, blue-green leaves up to 1 m (3.3 ft) long. Blades are stiff and have a rough surface. Inconspicuous flowers in panicles 40–60 cm (16–24 in) long. Fruit a small caryopsis.

Origin and Distribution. Probably native to tropical Asia from India to Indonesia and southern China. Its exact origin is unknown, because this plant has been spread by humans since prehistoric times. Cultivated worldwide in tropical and subtropical climates.

Food uses. Fresh leaves and leaf bases, which add a subtle, lemonlike aroma to food, are used as a condiment in soups, stews, and curries as well as meat and seafood dishes. Leaves are also sold dried and powdered. Lemon grass is very popular in Southeast Asian cuisine, especially in Cambodia, Indonesia, Vietnam, and Thailand, where the leaves are an important ingredient in many dishes such as the ubiquitous, spicy *tom yam* soup. In Thailand, freshly ground leaves are added to curry pastes. The leaves are also popular for making tea.

Comments. Leaves contain 0.2–0.5% volatile essential oils, mainly citral but also limonene and nerol, that give it an intense lemonlike aroma. *C. nardus* and *C. winterianus* (citronella grass) provide citronella oil, which is used as an insect repellent, in the cosmetic industry, and in aromatherapy.

Elettaria cardamomum (L.) Maton

CARDAMOM

Zingiberaceae (Ginger family)

Description. Perennial, herbaceous plant growing 3–4 m (10–13 ft) in height. Alternate, lanceolate leaves 20–90 cm (8–35 in) long by 8–16 cm (3–6.3 in) wide. Long, stalked flowers are produced directly from an underground rhizome and consist of 2 or 3 green sepals and a large labellum, which is white with thin purple streaks. Fruits 3-sided green capsules containing 15–20 aromatic black seeds.

Origin and Distribution. Native from India and Sri Lanka to Malaysia and western Indonesia. Cardamom grows naturally in the understory of tropical rainforests and requires a warm, humid climate. Cultivated throughout the tropics.

Food uses. Cardamom seeds, which contain about 8% essential oil and have a sweetly aromatic, pungent taste, are an important culinary spice in the Middle East and North Africa as well as South and Southeast Asia. In Asia it is used to flavor curries and a wide variety of often spicy meat and rice dishes as well as soups, sauces, and vegetable dishes. In the Arabian region, cardamom is traditionally mixed with coffee beans to produce a unique, aromatically flavored coffee. It is also used to flavor black tea. In Europe, the spice is used in bread and cookies such as German *Lebkuchen*. Throughout the Indian subcontinent, one encounters cardamom-flavored sweets, including *gajar halva*, a creamy dessert made from milk, grated carrots, palm sugar, and ground cardamom.

Comments. Cardamom fruits have long been used in traditional Indian herbal medicine for their antimicrobial activities. They are used to treat digestive disorders, lack of appetite, asthma, and cramps.

Two spice plants from Southeast Asia that taste similar to cardamom and are often used as substitutes are Siam cardamom (*Amomum krarvanh*) and Java cardamom (*A. compactum*).

Eryngium foetidum L.

CULANTRO, MEXICAN CORIANDER

Apiaceae (Carrot family)

The leaves of *E. foetidum* are commonly used as a potherb for seasoning a great variety of dishes, chutneys, sauces, and preserves.

Description. Perennial herb with a fleshy taproot forming a rosette low on the ground. Leaves, oblanceolate, 10 to 25 cm (4–10 in) long with serrate margins with tiny spines on each tooth, emit a very aromatic smell when crushed. Tiny, white to purple flowers in terminal, umbelliferous inflorescense with 5 to 6 lanceolate bracts with spiny points. Fruits are 2 mm (0.08 in) and split into two parts (mericarp) when ripe.

Origin and Distribution. Native to tropical America, where it grows from sea level to about 1500 m (5,000 ft). Culantro has been introduced to most tropical countries and has been naturalized in many regions. It is widely grown in Vietnam, Thailand, and India. The culantro plant requires a more tropical climate than its close relative coriander (*Coriandrum sativum*, p. 286), which is native to Southern Europe, Northern Africa, and Western Asia and thrives in a temperate or subtropical climate. Culantro plants prefer moist and shady growing conditions.

Food uses. The leaves of *E. foetidum* are commonly used as a potherb for seasoning a great variety of dishes, chutneys, sauces, and preserves. It is an important ingredient in *ceviche*, a Latin American dish of diced fish filets marinated in lime juice. In Central America and Mexico culantro leaves give a distinct flavor to the ubiquitous "salsa" sauce, a spicy mix of diced tomatoes, onions, chilies, garlic, and lime juice. Culantro leaves are said to have a stronger, more pungent taste than coriander and keep their taste longer once harvested and dried. In many tropical countries culantro and coriander are sold side by side in local markets.

Comments. The intense aroma of culantro leaves is caused by the high content of essential oils in all plant parts. It is a nutritious plant rich in vitamins A, B1, B2 and C, riboflavine, carotene, iron, and calcium. Culantro is also a home remedy for various ailments. It is used to stimulate the appetite, combat fever, and treat respiratory infections.

Lippia graveolens Kunth

MEXICAN OREGANO

Verbenaceae (Vervain family)

Mexican oregano is an essential ingredient in the spicy meat and bean dish chile con carne typical of Mexican cuisine.

Description. Evergreen shrub with pubescent branchlets, 1.5–2.5 m (5–8 in) tall. Opposite, grayish-green, ovate to elliptic leaves 2–4 cm (0.8–1.6 in) long, with bluntly serrated margins. Crushed leaves emit a strong, very aromatic smell. Small white to yellowish-green flowers are produced in headlike clusters.

Origin and Distribution. Native from southwestern United States south to Costa Rica. Widely cultivated within its natural range. The robust plant grows in tropical and subtropical climates under arid, semiarid, and humid conditions.

Food uses. The aromatic leaves are used fresh or dried as a culinary herb of great importance in Central American cuisine. The leaves, which have a stronger, sweeter aroma than Eurasian oregano (*Origanum vulgare*), are used to flavor a great variety of foods, including pizza, grilled meats, soups, stews, salad dressings, and dishes based on tomato, eggplant, and squash. Mexican oregano is often combined with garlic, chilies, and onions. It is an essential ingredient in the spicy meat and bean dish *chile con carne* typical of Mexican cuisine. Dried leaves are used to flavor vinegar and olive oil.

Comments. Herb teas prepared from the leaves are used in traditional Central American medicine to treat respiratory infections and as a stimulant. The genus *Lippia* is named after Augustin Lippi, an Italian naturalist and botanist born in the late seventeenth century. The plant is also known as redbrush lippia.

Moringa oleifera Lam.

HORSERADISH TREE

Moringaceae (Horseradish tree family)

Description. Medium-sized tree with a thick, succulent trunk and drooping branches, 8–12 m (26–39 ft) tall. Bipinnately compound leaves 30–60 cm (12–24 in) long. Elliptical to obovate leaflets 1–2 cm (0.4–0.8 in) long by 0.3–0.6 cm (0.12–0.24 in) wide. White to cream-colored, aromatic, large flowers, 2–3 cm (0.8–1.2 in) across, are produced in panicles. Pendent seedpods 30–50 cm (12–20 in) long contain 3 rows of winged seeds.

Origin and Distribution. Native to the foothills of the Himalaya mountains in northwestern India and parts of Pakistan. The tree grows naturally in semiarid, tropical, or subtropical habitats.

Food uses. Immature fruits, commonly called "drumsticks," are widely used as a vegetable in India and also in other parts of Asia and Africa. They are chopped, boiled, or fried and used in stir-fries, curries, soups, and Indian and Sri Lankan vegetable stews called *sambar*. The protein- and mineral-rich leaves are eaten as a boiled, spinachlike vegetable or used as garnish on various dishes. The roots, which have a spicy flavor like horseradish, are used as a spice in sauces and dips. The seeds of mature pods are eaten cooked as a vegetable or roasted as nuts. The high-quality seed oil is used for cooking and as a salad oil.

Comments. The family Moringaceae consists of only 1 genus with 10 species distributed in arid and semiarid regions of Africa and Asia. The seed oil of the closely related species *M. peregrina* is used in the production of cosmetics and skin-care products.

Murraya koenigii (L.) Spreng.

CURRY TREE

Rutaceae (Citrus family)

Description. Small, evergreen tree 4–6 m (13–20 ft) tall. Alternate leaves pinnately compound with 11–21 leaflets, each 2–4 cm (0.8–1.6 in) long. The leaves are very aromatic with a strong sweetish-savory smell when crushed. Fragrant flowers white. Fruits are reddish-black berries with poisonous seeds.

Origin and Distribution. The tree is native to tropical and subtropical regions of India and Sri Lanka, but is cultivated throughout warm regions of Asia for its fragrant leaves. Indian migrants and workers have taken this tree in recent times to South Africa, Malaysia, and other tropical and subtropical countries around the world.

Food uses. Curry tree leaves are extensively used in Indian and Sri Lankan cuisine. They are used similar to bay leaves as seasoning, mainly in the preparation of curries. In India, the leaves are used fresh or fried in oil or butter with meals like lentil or vegetable curry. In Sri Lanka, the leaves form an essential part of chicken and beef curries.

Comments. The curry tree should not be confused with curry powder or paste, which is a mixture of varying composition of coriander, turmeric, cumin, fenugreek, chili peppers, cardamom, and many other ingredients like ginger or black pepper, depending on the recipe. The term *curry* is also widely applied to many different dishes of Southeast Asia, including vegetable stews in India, any food cooked in coconut milk in Thailand, and spicy Sri Lankan dishes with meat, hot chili peppers, and toasted spices.

Curry leaves, which are rich in essential oil, are usually used fresh, because they lose their distinctive aromatic flavor within days after drying. The botanical name *M. koenigii* refers to two botanists of the eighteenth century: the Swede Johan Andreas Murray (1740–1791) and the German Gerhard Koenig (1728–1785).

Myristica fragrans Houtt.

NUTMEG

Myristicaceae (Nutmeg family)

The yellow fruit splits open when ripe, displaying a single oval brown seed surrounded by a bright red aril.

Description. Medium-sized evergreen tree with a dense, rounded crown. Alternate leaves leathery, elliptic, and shiny dark green on the upper surface. White, dioecious, 1-cm-wide (0.4 in) flowers are produced in the axils of the leaves. Yellow fruits are nearly spherical drupes that split open when ripe, displaying a single oval brown seed surrounded by a bright red aril (mace).

Origin and Distribution. Nutmeg grows naturally on the Banda Islands in the Moluccas of eastern Indonesia. Although grown in many tropical countries, it is cultivated mainly in Indonesia, India, Sri Lanka, and Grenada.

Nutmeg was introduced to Europe in the eleventh century by Arab traders. For several centuries the real origin of nutmeg was unknown to Europeans. During the Middle Ages, it was a prized and very costly spice, with trade controlled by the Portuguese until the seventeenth century, when the Dutch gained control of the so-called Spice Islands (Moluccas) in 1621. During the Napoleonic wars, the English brought nutmeg seedlings to their colony Grenada.

Food uses. The seeds and the aril (which is called mace) are used as culinary spices. They are used to flavor bakery goods, meat and pasta dishes, stews, soups, and liqueurs. In Asia, fresh nutmeg seeds are grated to season many savory dishes. In India, where it is called *jaiphal*, nutmeg is a very popular spice and a common ingredient in many sweet and savory dishes. In Arab countries, nutmeg and mace are used in delicately flavored meat dishes. In Western countries, the spice is added to potato, pasta, and meat dishes as well as sauces such as the French *sauce béchamel*. In Grenada, nutmeg-flavored ice cream is sold. In Indonesia, the pulp of the fruit, which has an acidic taste, is made into jam or cooked with sugar to make candy.

Comments. Nutmeg seeds contain 7–16% myristicin, a weakly psychoactive organic compound that in high doses can cause hallucinogenic effects with very unpleasant side effects, including nausea and headaches. Consumption of very high doses, much higher than used in any cooking, is toxic to humans and can even cause death.

The seeds contain up to 75% fat, which is used as an industrial lubricant. Distillation of ground nutmeg seeds produces an essential oil used in pharmaceutical and cosmetic products and perfumes.

Ocotea quixos (Lam.) Kosterm.

ECUADORIAN CINNAMON, ISHPINGO

Lauraceae (Laurel family)

Description. Slow-growing, medium-sized evergreen tree 8–13 m (26–43 ft) tall. Alternate, glabrous, lanceolate leaves measure 8–10 cm (3–4 in) in length. New leaves are salmon-colored. Small, apetalous, dioecious flowers are produced in panicles every two years. Fruits are dark green to black, oblong, 1-seeded berries, 2–3 cm (0.8–1.2 in) long, with a brightly colored, cuplike cupule at the junction with the peduncle.

Origin and Distribution. Native to Amazon lowlands of Colombia and Ecuador as well as parts of Peru and western Brazil. The tree, which grows naturally in the understory of humid rainforests, has been widely used as a spice in tropical South America since pre-Columbian times. Rarely cultivated and little known outside its natural range.

Food uses. Leaves, cupules, and bark have a strong, cinnamon-like aroma. They are used as a spice in modern South American cuisine, especially in desserts and drinks. The leaves can be used to make a delicious tea. Ecuadorian cinnamon is still commonly used to flavor a pudding called *mazamorra morada*, a popular traditional dessert in Ecuador and Peru made from purple corn and various fruits.

Comments. The tree, called ishpingo in the Quechua language, has been used for millennia and is still used today in religious ceremonies and in the preparation of food offerings. It is also known as American cinnamon. The active ingredients mainly responsible for the cinnamon-like taste are methyl cinnamate and trans-cinnamaldehyde. *O. quixos* is currently being investigated for its medicinal properties, including anti-inflammatory activity and the prevention of blood clots.

Pandanus amaryllifolius Roxb.

PANDAN

Pandanaceae (Screwpine family)

Description. Evergreen, herbaceous, shrubby plant with brown aerial roots, growing to 0.5–1 m (1.6–3.3 ft) in height. Linear, smooth leaves without spines are arranged in a fan shape. The plant virtually never flowers or produces fruit. The leaves have a strong but pleasant nutty aroma.

Origin and Distribution. The plant may be native to Malaysia, Indonesia, and New Guinea. Pandan is widely cultivated as a dooryard plant from India and Sri Lanka to Southeast Asia and southern China. Very rarely cultivated outside tropical Asia. It requires a humid tropical climate or a monsoon climate.

Food uses. Fresh, fragrant leaves are used as a culinary herb and spice in Southeast Asian as well as Indian and Sri Lankan cuisine. The leaves are often cooked together with rice and coconut milk, enhancing the nutty taste of the rice. In Thai cuisine, pandan leaves are occasionally used as very fragrant wrappers. Pandan chicken (*gai hor bai toey*) is a favorite in many restaurants: marinated chicken bits are wrapped in pandan leaves and deep-fried in a wok. In Southeast Asia, pandan leaves are commonly used to flavor desserts and drinks, puddings, and ice cream.

Comments. Pandan is the only species of the genus with fragrant leaves. Several other species, including *P. utilis*, produce edible fruits.

Paullinia cupana Kunth

GUARANÁ

Sapindaceae (Soapberry family)

Description. Perennial, shrubby vine, 8–12 m (26–39 ft) tall with large pinnate leaves with serrated margins. Flowers pure white with yellow anthers. Red to orange fruits, borne in small clusters, split open when ripe and display a black seed. This lends the fruit the appearance of an "eye," giving rise to many indigenous legends. The seeds are dispersed mainly by birds.

Origin and Distribution. The guaraná grows naturally in tropical rainforests of the Amazon lowlands of Brazil, northern Bolivia, Colombia, Ecuador, Peru, and Venezuela.

Food uses. The ground guaraná seeds contain 4–8% caffeine and other xanthine alkaloids like theobromine and theophyllline. Seeds are used in carbonated soft drinks and so-called energy drinks. They are a main ingredient in the Brazilian and Peruvian guaraná sodas. Guaraná is known to increase mental alertness and physical endurance and to combat fatigue. It is consumed as a health tonic, a stimulant, and a weight-reduction aid by millions of people. Because of its astringent properties, guaraná extracts are used in skin creams and other body care products.

Comments. Indians of the Amazon region have been using guaraná seeds for centuries, mainly for their stimulating effect and as medicine for the treatment of chronic diarrhea, headache, hypertension, and several other illnesses. Today 80% of guaraná is still produced by traditional methods by the Guaraní Indians in the forests of southern Brazil. Cultivation of this plant in its natural habitat is a good example of sustainable usage of tropical rainforests. The seeds are collected in the wild, roasted, and then processed with water into a paste that is then sold. Guraná is being researched for its phytochemical characteristics. It may help in the treatment of headaches and migraines, neuralgia, and rheumatism. The seeds have also shown antibacterial activities and an anitoxidant effect in humans. The popularity of guaraná as a dietary supplemant is growing rapidly worldwide.

Pimenta dioica (L.) Merr.

ALLSPICE

Myrtaceae (Myrtle family)

In Caribbean cuisine, allspice is used to flavor meat dishes, stews, and Jamaican jerk paste.

Description. Small evergreen tree, 8–14 m (26–46 ft) tall. Opposite, oblong, leathery leaves, 10–20 cm (4–8 in) long, give off an aromatic smell when crushed. Small white flowers with multiple long stamens are produced in axillary cymes. Fruits are dark brown ovoid drupes, 0.4–0.6 cm (0.16–0.24 in) long. The leaves and the fruits smell like a combination of cloves, black pepper, nutmeg, and cinnamon, hence the common name.

Origin and Distribution. Native to southern Mexico, Central America, and the Caribbean Islands. The tree requires a humid tropical climate. Although cultivated in many tropical regions, allspice is produced mainly in Jamaica and also, but to a much lesser extent, in some Central American countries.

Food uses. The dried, unripe fruits are used as a culinary spice. In Caribbean cuisine, allspice is used to flavor meat dishes, stews, and the typical Jamaican jerk paste, which is made from onions, spices, and very hot chili peppers. This paste is usually used to marinate chicken and beef. In Mexico, allspice is used to flavor traditional *mole* sauces that are often employed in savory dishes. In Europe, allspice is important for pickling cucumbers and other vegetables. The spice is also sometimes used as an ingredient in curry powders.

Comments. Allspice is one of the few spices used almost exclusively in the New World and parts of Europe. Although allspice is generally absent from South and Southeast Asian cuisine, the leaves have become a popular seasoning in southern India.

Essentials oils from the fruits are used in cosmetics and perfumes.

Piper betle L.

BETEL PEPPER

Piperaceae (Pepper family)

Description. Evergreen climbing plant, partly woody, growing up to 20 m (66 ft) in length. Alternate, ovate to cordate, glossy leaves with pointed apex 12–20 cm (5–8 in) long by 6–12 cm (2.4–5 in) wide. Small greenish-white monoecious flowers are produced in pendent spikes 10–12 cm (4–5 in) long. Fruits are small drupes containing a single seed 3–5 mm (0.12–0.2 in) wide.

Origin and Distribution. Probably native to Southeast Asia, from where it spread in prehistoric time to India and Sri Lanka. The plant grows in humid tropical climates. Betel pepper is cultivated in home gardens in tropical regions of Asia and to a much smaller extent also in Africa.

Food uses. The fresh leaves are usually chewed together with seeds of the betel nut (*Areca catechu*) or tobacco as a mild stimulant. The traditional betel quid consists of areca nuts, slaked lime, and sometimes tobacco and spices like cloves (*Syzygium aromaticum*, p. 305) wrapped in betel pepper leaves and then chewed to release the chemically active compounds.

Comments. In South and Southeast Asia the leaves of betel pepper are of great mythological importance. They are used as offerings in temples and often present at weddings, funerals, and religious ceremonies.

The leaves are also commonly used in traditional medicine to treat infections, stimulate digestion, and kill intestinal parasites. Leaves contain 0.5–1.3% essential oils like chavibetol, chavicol, and eugenol, which are mainly responsible for the stimulating and antiseptic properties of betel pepper.

Piper nigrum L.

BLACK PEPPER

Piperaceae (Pepper family)

Description. Perennial woody vine, climbing with roots up to 8 m (26 ft) tall. Leaves alternate, oval, 10–18 cm (4–7 in) long, with prominent veins and pointed apices. Tiny flowers are produced on pendulous, grayish-white spikes 10–15 cm (4–6 in) long. Fruits are bright red drupes, about 5 mm (0.2 in) in diameter.

Origin and Distribution. Native to the Malabar region of India. Pepper has been known in Indian cuisine for at least 4,000 years. Arabs brought black pepper to Arabia and Egypt, and from there it found its way into the Roman Europe. During the Middle Ages, black peppercorns were a highly prized trade item, often referred to as black gold. Trade with India was monopolized by Venetian traders, until Vasco da Gama found a new sea route to India by going around the southern tip of Africa in 1498. Today, the main producing countries are India, Vietnam, Brazil, and Indonesia.

Food uses. Peppercorns are used whole or ground as a spice in cuisines throughout the world.

Comments. Green, black, white, and red pepper all originate from the same plant. Green peppercorns are the immature fruits, which are harvested before turning red. They must be kept in brine, oil, or vinegar to prevent them from turning black through oxidation. Black pepper is obtained by harvesting fully grown but still green fruits, which are then dried in the sun. During this process the fruits turn black and wrinkle. Red peppercorns are fully ripe peppercorns; white pepper, which has the strongest pungency, is made from ripe fruits with the outer red hull removed.

The commercially most important form is black pepper. The pungent taste of pepper is caused mainly by the alkaloid-analog compound piperine. Black pepper contains up to 10% piperine and many other essential oils and compounds like limonene, and these are responsible for its distinctive taste. Pepper has also been used since ancient times as medicine against a variety of illnesses like insomnia, indigestion, and liver problems, among many others.

Piper sarmentosum Roxb.

VIETNAMESE PEPPER

Piperaceae (Pepper family)

Description. Evergreen, erect shrublet, 0.5–0.9 m (1.6–3 ft) tall. Alternate, glossy, ovate-cordate to oblong 3-veined leaves 6–9 cm (2.4–3.6 in) long and with long petioles. Small flowers with white bracts are produced in erect spikes 2–3 cm (0.8–1.2 in) long. Fruits are red berries.

Origin and Distribution. Native to tropical Asia from India and Sri Lanka to southern China and Southeast Asia. Widely cultivated in warm regions of Asia and especially in Southeast Asia, but rarely elsewhere.

Food uses. The leaves, which have an aromatic, slightly bitter taste, are eaten raw in salads or used to wrap savory snacks like *miang kham*, a traditional Vietnamese dish consisting of roasted coconut shavings, shallots, shrimps or fish, lime juice, and spices. Cooked leaves have a peppery taste and are often served as appetizers with meat, steamed rice, and vegetables. In Thailand, the leaves are used to wrap snacks that are typically served with fish sauce and palm syrup.

Comments. The plant, which has a variety of vernacular names, is also called wild betel, but should not be confused with the betel pepper (*Piper betle*, p. 299), which belongs to the same genus.

The leaves are used in traditional Asian medicine to treat diabetes as well as joint aches and bone fractures.

Plectranthus amboinicus (Lour.) Spreng.

INDIAN BORAGE

Lamiaceae (Mint family)

Description. Perennial herbaceous plant 30–60 cm (12–24 in) tall. Opposite, round to oval, simple, fleshy leaves with toothed margins 6–10 cm (2.4–4 in) long. Leaves emit a strong aromatic odor when crushed. Purple, tubular flowers are borne in erect racemes. Fruits single-seeded, achenelike nutlets.

Origin and Distribution. Native to southern and eastern Africa. Widely cultivated throughout the tropics and subtropics. Naturalized in parts of tropical Asia.

Food uses. The fresh or dried, strongly aromatic leaves are used as a spice. They are commonly employed in the preparation of poultry, lamb, and beef dishes. The herb is sometimes used as a substitute for the similar tasting oregano (*Origanum vulgare*) and Mexican oregano (*Lippia graveolens*, p. 291).

Comments. The leaves are used in folk medicine to treat colds, fever, stomach aches, and diarrhea.

The hausa potato (*P. rotundifolius*), native to eastern Africa and Madagascar, produces round starchy tubers that are boiled, fried, or roasted and used in curries and as a side dish; in Southeast Asia, the boiled and mashed tubers are mixed with palm sugar and coconut milk and served as a dessert. *P. esculentus* (finger potato), native to tropical Africa, is also cultivated for its edible starchy tubers. Although several species of *Plectranthus* bear the name "potato," they are not closely related to the true potato (*Solanum tuberosum*, p. 271), which belongs to the Nightshade family.

Saccharum officinarum L.

SUGARCANE

Poaceae (Grass family)

Description. Perennial grass 4–6 m (13–20 ft) tall with multiple solid stalks containing a juicy, soft fibrous mark. Leaves linear, 1.5–2 m (5–6.6 ft) long by 6–8 cm (2.4–3 in) wide with a prominent midrib. Flowers are produced in erect, silvery white, terminal plumelike panicles. Fruit is a single-seed caryopsis.

Origin and Distribution. *S. officinarum* is native to New Guinea and adjacent islands of the South Pacific. It spread in prehistoric times to northern Southeast Asia and South Asia. It was in India, between the sixth and fourth century BC, that the Persians, followed by the Greeks, discovered what they called "reeds that produce honey without bees." Beginning in the sixteenth century, sugarcane was cultivated in the colonies of European nations such as England, Portugal, and Spain, and rapidly began replacing honey, which had been the only available sweetener.

Food uses. Cane stalks contain 12–18% soluble sugars, mainly sucrose, the main source of common sugar. In tropical regions, pieces of cane stalks are chewed for the sweet sap, which is also mechanically extracted and sold as a nonalcoholic drink in markets and at roadside stands. In Latin America, the dried, brown sugarcane juice is formed into bricks called *tapa de dulce* or *rapadura* that are used as a sweetener and made into sweets. Jaggery, a solidified molasses, is used in tropical Asia as a sweetener and in cooking.

Molasses derived from cane juice is fermented and distilled to produce rum and sugarcane-based liquors like the Brazilian *cachaça*. The young, unexpanded inflorescences are eaten raw, steamed, or toasted.

Comments. Sugarcane is one of the world's largest crops, with Brazil the largest producer, followed by India, China, and Thailand. Ethanol distilled from sugarcane is used as biofuel.

The closely related species *S. barberi*, *S. spontaneum*, *S. robustum*, and *S. sinense* are often hybridized with *S. officinarum* to produce more disease-resistant and productive varieties.

Schinus molle L.

PERUVIAN PEPPER TREE, MOLLE

Anacardiaceae (Cashew family)

Description. Medium-sized evergreen tree, 10–15 m (33–50 ft) tall, monoecious, with pendent branches and a deeply fissured bark. All plant parts contain a transparent, sticky sap. Alternate, silvery, compound leaves with 20–40 linear leaflets, 2–5 cm (0.8–2 in) long. Leaves exude a spicy smell when crushed. Small yellow or whitish flowers are borne in pendent panicles 25–35 cm (10–14 in) long. Fruits are small reddish-pink drupes, 5–7 mm (0.2–0.28 in) wide with tiny, hard seeds; the fruits are produced in long, showy clusters that contrast with the silvery foliage.

Origin and Distribution. Native to dry regions of northern and western South America, where it grows between sea level and 3,000 m (9,800 ft) on sandy, well-drained soils. The drought-resistant tree is very common in the Andes from Colombia south to Argentina and Chile and was already widely cultivated in pre-Columbian times. Often planted as an ornamental.

Food uses. The ripe seeds, which have a sharp, pepperlike taste, are used as a condiment similar to black pepper (*Piper nigrum*, p. 300). The red flesh of the fruits, which has a fairly sweet taste, is fermented to make *chicha*, a traditional alcoholic, beerlike beverage made in the Andean region. The pulp also serves to make a sweet, nonalcoholic drink popular in Andean countries, called *upi*. In South America, the fruits are cooked with sugar to make a thick syrup called *miel de molle*. In Peru, the fruits are fermented to make vinegar.

Comments. Peruvian pepper has been used in traditional Andean medicine for its antibacterial, antiseptic, and antirheumatic properties. The leaves provide a yellow dye. In the wild, the ripe fruits are eaten by various bird species.

Syzygium aromaticum (L.) Merr. & L.M. Perry

CLOVES

Myrtaceae (Myrtle family)

Cloves are used in incense and for the manufacture of Indonesian cigarettes called *kretek*.

Description. Evergreen tree with a dense, conical crown, 10–20 m (33–66 ft) tall. Opposite, lanceolate to oval leaves, 8–12 cm (3–5 in) long, leathery, glossy, aromatic when crushed. Yellowish-white flowers are borne in terminal triparous cymes. Unopened flower buds, which consist of an elongated calyx, 12–18 mm (0.5–0.7 in) long, 4 spreading sepals, and 4 unopened petals that form a small sphere in the center, are bright red or pink in color and very aromatic. Fruits dark red with reddish pulp and a single seed.

Origin and Distribution. Native to the Molucca Islands of Indonesia. The tree is ultratropical, requiring constant high temperature and humidity.

Originally, cloves were grown almost exclusively on the so-called Spice Islands of Indonesia. During Roman times and in medieval Europe, cloves were a highly prized spice. For centuries, European seafaring nations like Spain, England, and Portugal fought to control the spice trade. Today cloves are grown commercially in many tropical countries, especially in Indonesia, by far the largest producer (and consumer), but also in Madagascar, Tanzania, and Sri Lanka.

Food uses. Cloves are the unopened and dried flower buds. They are used in a wide variety of dishes, especially of Southeast Asian, Indian, and Sri Lankan origin. Cloves are an important ingredient in Indian spiced tea, and they are used as a spice in bakery goods, sweets, marinades, liqueurs, soft drinks, and many other food products.

Comments. Cloves are used in incense and for the manufacture of Indonesian cigarettes called *kretek*. About 50% of the world clove production is used to make cigarettes. Essential oil of cloves is used in the perfume and cosmetics industry. Cloves are used as an anesthetic to relieve toothache pain, as an antiseptic, and as a stimulant of the digestive tract, among other applications. Cloves contain up to 21% of the essential oil eugenol, which is mainly responsible for the intense, spicy aroma. The English name for the spice has its origin in the Latin word *clavus*, or nail, describing the form of the flower bud.

Syzygium polyanthum (Wight) Walp.

INDONESIAN BAY LEAF

Myrtaceae (Myrtle family)

Description. Medium-sized tree 25–30 m (80–100 ft) tall. Simple, opposite leaves glabrous, elliptical to lanceolate, 8–16 cm (3–6.3 in) long by 3–7 cm (1.2–2.8 in) wide. Fragrant yellowish-white flowers are produced in panicles 4–8 cm (1.6–3 in) long. Flowers, which are cup-shaped with 4 petals, are pollinated by beetles and butterflies. Fruits are dark red to purplish-black globose berries containing a single seed.

Origin and Distribution. Native to southern Myanmar, southern Thailand, Cambodia, Vietnam, the Malay Peninsula, and western Indonesia. Very rarely cultivated elsewhere. It grows naturally as an understory tree in lowland and premontane rainforests with tropical monsoon climates.

Food uses. Fresh or dried leaves are used as a spice in many Southeast Asian meat dishes and to a lesser extent in rice, fish, and vegetable dishes. The spice is essential to Balinese cuisine. The leaves, which have a slightly sour but aromatic flavor, are slowly cooked with the food to release their full flavor.

Comments. In Indonesia and Malaysia, the spice is known as *daun salam*. The leaves, which are commonly sold in Southeast Asian markets, are usually dried for a few days to produce a stronger aroma. The bark provides a reddish-brown dye that is used for dyeing fishnets and bamboo mattings. The durable wood is used in construction and furniture making.

Theobroma bicolor Bonpl.

MACAMBO, PATAXTE, MOTELO

Malvaceae (Mallow family)

Description. Slender, erect, evergreen tree with drooping branches and light brown to gray fissured bark, 15–25 m (50–80 ft) tall. Alternate, oblong to ovate leaves, 12–16 cm (5–6.3 in) long by 8–12 cm (3–5 in) wide, with whitish-green, pubescent undersides. Deep red flowers with 5 sepals and 5 petals are produced in axils of leaves on younger branches. Large, ellipsoid, greenish-yellow to yellowish-brown woody fruits with longitudinal ridges and a fissured surface, 20–25 cm (8–10 in) long. Soft, cream-colored, sour-sweet-tasting pulp with several round, brown seeds.

Origin and Distribution. Native to Central and South America, where the tree grows naturally in tropical lowland rainforests. In pre-Columbian times the macambo was almost equal in importance to cacao (*Theobroma cacao*, p. 308). Today macambo is rarely cultivated except for a few small orchards in Peru and Mexico.

Food uses. The sweetened pulp is used to make milk shakes, ice cream, marmalade, and desserts. In South America, a bottled soft drink is made from the pulp, which is blended with water, ice, and sugar. In traditional Mexican cuisine the pulp is blended with sugar and red achiote seeds (*Bixa orellana*, p. 277) and made into a colorful dessert. The roasted seeds are used in pastries or used to make hot or cold chocolate-like drinks. In Peru, the boiled seeds are roasted over a charcoal fire and eaten like beans. A nutritious traditional drink called *chorote*, based on macambo fruits, maize, cassava, honey, and spices, has been popular in Mesoamerica since Mayan times.

Comments. The seeds contain about 34% fat, 13% protein, and about 14% fiber. In the wild, the fruits are eaten by monkeys, peccaries, squirrels, and other rodents.

Theobroma cacao L.

CACAO TREE, COCOA TREE

Malvaceae (Mallow family)

Description. Evergreen, often multistemmed tree, 6–16 m (20–52 ft) tall. Alternate, simple, elliptic leaves 20–40 cm (8–16 in) long by 5–16 cm (2–6.3 in) wide. Small white to reddish-white 5-petaled flowers are produced in clusters along older branches and on the trunk. Ovoid, usually purple, orange, red, or yellow berries are 10–30 cm (4–12 in) long. The thick fruit wall encloses a soft, juicy white aril with 30–50 purple or reddish-brown, hard, bitter-tasting seeds, 1–3 cm (0.4–1.2 in) long.

Origin and Distribution. Probably native to the Amazon basin, where it grows in the understory of tropical lowland rainforests. From there it spread in precolonial times to tropical regions of Central America, where ceramic vessels with residues of cacao have been found at archaeological sites dating back to the Early Formative period (1900–900 BC). Today the cacao tree is grown in many tropical regions, with Ivory Coast, Indonesia, Ghana, and Nigeria being the largest producers.

Food uses. After being fermented and dried, cacao seeds are roasted and ground into cacao paste, which is then separated into cacao butter and cacao powder. Cacao powder is used as a spice in sweets, bakery goods, drinks, and savory dishes. Cacao butter is mixed with milk powder, cacao powder, and sugar to make chocolate.

Mesoamerican peoples made nutritious drinks from cacao seeds blended with water, vanilla, chili peppers, and allspice. In Mexico, traditional sauces called *mole* are made from cacao, chilies, and other spices and vegetables.

Comments. Cacao seeds contain the alkaloids theobromin and caffeine, and about 50% fat; the fat is used in the production of skin creams and other cosmetic products. Cacao is rich in flavonoids that may have a beneficial effect on the cardiovascular system.

Mayan and Aztec people used cacao seeds as a currency that was accepted in some isolated parts of Yucatán well into the nineteenth century.

Theobroma gileri Cuatrec.

MOUNTAIN CACAO

Malvaceae (Mallow family)

Description. Small to medium-sized evergreen tree, 6–8 m (20–26 ft) tall. Alternate, elliptic leaves 20–30 cm (8–12 in) long with entire margins. Small dark red flowers are produced in small clusters along branches and in the axils of leaves. Fruits nearly spherical, orange-yellow to yellow with a thick rind covered in irregular ridges and grooves. A soft white pulp encloses several slightly curved, light brown seeds. In the wild, the seeds are dispersed by monkeys and other small mammals like agoutis.

Origin and Distribution. The species grows naturally in the understory of premontane rainforests of the eastern slopes of the Andes from Colombia to northern Bolivia. The mountain cacao is rarely cultivated except in botanical gardens and rare tree collections.

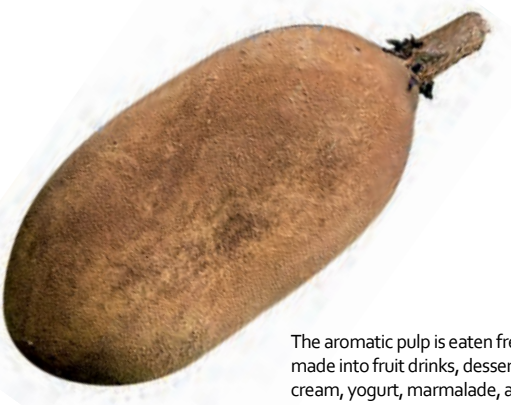
Food uses. The sweet, aromatic pulp is used to make juices, milk shakes, and ice cream. Most often the pulp of wild fruits is eaten out of hand. The seeds can be roasted to make a drink similar to chocolate.

Comments. This little known *Theobroma* species has some potential because of its edible pulp. The genus name *Theobroma*, meaning "food for the gods," is derived from the Greek words *theo* (god) and *broma* (food).

Theobroma grandiflorum (Willd. ex Spreng.) K. Schum.

CUPUASSU

Malvaceae (Mallow family)



The aromatic pulp is eaten fresh or made into fruit drinks, desserts, ice cream, yogurt, marmalade, and sweets.

Description. Small tree with dark brown bark, 8–14 m (26–46 ft) tall. Alternate leaves oblong-elliptic, 25–40 cm (10–16 in) long by 8–10 cm (3–4 in) wide. Young, emerging leaves are pink or salmon colored. Reddish flowers with thick, triangular sepals are borne singly or in small clusters. Brown, oblong or elliptic fruits, 15–20 cm (6–8 in) long and weighing up to 2 kg (4.4 lbs), with thick, fuzzy exocarp. Whitish, soft, fragrant pulp encloses 20–60 dark red seeds. The subacid to sweet pulp has a taste described as similar to a blend of chocolate and pineapple.

Origin and Distribution. The cupuassu grows naturally in the southern and southeastern parts of the Amazon basin of South America. It is rarely cultivated outside its original habitat. The tree requires a humid, tropical climate.

Food uses. The aromatic pulp is eaten fresh or made into fruit drinks, desserts, ice cream, yogurt, marmalade, and sweets. The pulp's unusual, pleasant taste raises its potential for future commercial use.

The seeds contain a white and fragrant fat and are used to make a type of chocolate called *cupulate*, similar to that made with seeds of the closely related cacao (*T. cacao*, p. 308).

Comments. The pulp has a hydrating effect on the skin, and pulp and seed fat are used in the manufacture of body lotions and skin-care products. The pulp is very rich in antioxidants, including polyphenols and flavonoids. They are also a good source of vitamins B1, B2, and B3 and minerals like calcium and iron. Fruits also contain caffeine, but less than cacao.

Theobroma speciosum Willd. ex Spreng.

CACAUÍ

Malvaceae (Mallow family)

Hybridization of cacaui with cacao has been suggested as a way to enhance disease resistance of commercial cacao plants.

Description. Medium-sized evergreen tree, 8–15 m (26–50 ft) tall. Alternate, elliptic-oblong leaves 18–38 cm (7–15 in) long by 8–18 cm (3–7 in) wide. Dark red 5-petaled flowers are produced in dense, cushion-like clusters directly on the trunk. Spherical to ovoid fruits with yellow-orange, velvety, sulcated skin. Fruits contain up to 20 seeds surrounded by a soft white pulp.

Origin and Distribution. Native from the Amazon and Orinoco lowlands of Brazil, Venezuela, Ecuador, Peru, and Bolivia north to Panama. Occasionally cultivated as a dooryard tree in the Amazon region. Fruits are often collected from wild trees. Rarely grown outside its natural range.

Food uses. The aromatic, sweet pulp is consumed fresh or made into a refreshing juice or milk shakes. The seeds are used like seeds of cacao (*T. cacao*, p. 308) for making chocolate considered by some to be of excellent quality.

Comments. The cacaui is a minor species among 22 species of *Theobroma* and closely related to cacao (*T. cacao*). Hybridization of cacaui with cacao has been suggested to improve disease resistance of commercial cacao plants.

Theobroma subincanum Mart.

CUPUI

Malvaceae (Mallow family)

Description. Medium-sized evergreen tree, 10–16 m (33–52 ft) tall. Leaves alternate, dark green, elliptic to lanceolate, glabrous, 20–30 cm (8–12 in) long. Small, dark red flowers are produced solitarily or in small clusters along smaller branches and in leaf axils. Greenish-yellow, ellipsoid to obovate fruits with a thick, hard exocarp covered in velvety hairs. A white, succulent pulp encloses numerous hard, brown seeds.

Origin and Distribution. Native to the Amazon basin from southern Colombia and Venezuela south to Brazil, Bolivia, and Peru. The tree grows naturally in the understory of humid tropical lowland rainforests, often close to streams and igapó river channels. The fruits are commonly sold in markets in the Amazon region. Rarely cultivated outside its natural range.

Food uses. The pulp of the fruit is highly valued for its delicious, sweet taste and is made into juice and milk shakes. The pulp can also be used to make ice cream, yogurt, and desserts. The seeds are roasted and used as food by native inhabitants of the Amazon region.

Comments. With its aromatic sweet pulp, the cupui, though popular in some places, is an underused member of the *Theobroma* genus, which is known mainly for the seeds of cacao (*T. cacao*, p. 308).

The seeds of *T. subincanum* could serve as a cacao butter substitute in the food and cosmetic industry, since cacao is susceptible to fungal diseases and parasites.

Vanilla planifolia Andrews

VANILLA

Orchidaceae (Orchid family)

Description. Evergreen, climbing vine growing 10–12 m (33–39 ft) in length. Alternate, succulent, oval to elliptic smooth leaves 12–22 cm (5–8.6 in) long by 4–8 cm (1.6–3 in) wide. Fragrant greenish-yellow flowers are produced in dense racemes. Fruits slender cylindrical pods, 15–23 cm (6–9 in) long, that split open when ripe, releasing numerous tiny black seeds measuring 0.4 mm (0.02 in).

Origin and Distribution. Native to humid tropical lowlands of Central America and Mexico. Vanilla was already being cultivated in pre-Columbian times; Mexican peoples such as the Totonacs were the first to grow vanilla along the Gulf Coast of Veracruz, Mexico. In the nineteenth century, French sailors brought vanilla to Madagascar, Mauritius, and Réunion, where plantations were soon started. Today vanilla is cultivated in many tropical regions; Indonesia, Madagascar, China, and Mexico are the main producers.

Food uses. Vanilla is used to flavor ice cream, bakery goods, sweets, puddings, preserves, beverages, and chocolate. In ancient Mesoamerica, the Mayans and the Aztecs used vanilla to flavor a drink prepared from water, cacao seeds, and spices such as chili peppers.

Comments. Vanilla is used in aromatherapy, candles, lamp oils, tobaccos, and the production of perfumes. Among the many aromatic compounds in vanilla, vanillin is mainly responsible for its characteristic smell and taste.

Different commercial varieties are distinguished by where the vanilla is produced. So-called Bourbon-vanilla, grown in Madagascar, Réunion, and the Comoros Islands, is considered the highest quality vanilla.

Synthetically produced vanilla lacks the full aroma of natural vanilla and is made from lignin harvested from wood chips.

Zingiber officinale Roscoe

GINGER

Zingiberaceae (Ginger family)

In Jamaica, ginger is used to flavor gingerbread and sorrel, a traditional Christmas drink.

Description. Perennial, herbaceous plant, 0.8–1.3 m (2.6–4.3 ft) tall with alternate, oblong-lanceolate leaves 25–35 cm (10–14 in) long. Pink and white flowers, turning yellow when mature, are borne in terminal, elongated inflorescences formed by overlapping green or red bracts. Fruits are capsules. Plants produce characteristic fleshy, underground rhizomes. These are irregularly shaped, branched, light brown, with a dull yellow, crisp, and fibrous flesh. The rhizome has a very aromatic, pungent taste.

Origin and Distribution. Probably native to tropical regions from southern China to Southeast Asia. Arab traders introduced ginger to the Mediterranean region, from where it spread to the New World with Portuguese and Spanish traders in the sixteenth century.

Food uses. Ginger is often used in Southeast Asian cuisine, especially in stir-fries and soups. In Thailand, sliced, grated, or chopped pieces of ginger are added to the popular *tom yam* soup. In India and Sri Lanka, ginger is usually eaten fried, being less pungent but having a rich, mild flavor. In Jamaica, the spice is used to flavor gingerbread and *sorrel*, a traditional Christmas drink.

Ginger is used to flavor soft drinks (Ginger ale and ginger beer), tea, coffee, sweets, liqueurs, and bakery goods like cookies and sweet bread. Dried ginger is an important ingredient in curry powder and paste. Ginger is often preserved by pickling or by keeping in vegetable oil.

Comments. Ginger has been used in traditional medicine for millennia. It is used to treat inflammation, infections, lack of appetite, gastrointestinal problems, and colds.

GLOSSARY

achene. A kind of simple dry fruit (of flowering plants) formed by one carpel. Achenes do not split open when ripe.

alternate. Refers to a single leave (or flower) attached to a node of a plant.

angiosperm. The most diverse group of flowering plants; angiosperms produce flowers and fruits, and contain seeds (often with an endosperm).

annual. Plant that has a lifecycle from germination to fruiting and seed, all taking place in a single year.

apical. Relating to the tip of the plant itself or of a plant part.

areole. On cacti, a small, hairy bump that produces a cluster of longer spines.

aril (arillus). Fleshy appendage to the seeds of a flowering plant. Arils are usually edible and aid the plant in dispersal of the seed.

aroid. Belonging to the family Araceae (philodendrons).

astringent. Referring to a substance or chemical compound that shrinks or constricts body tissues.

axillary. Positioned in the axil between a leaf (or bract) and a stem.

berry. In botanical terms, a fleshy, indehiscent fruit produced by a single flower, as in the tomato or blueberry.

bipinnate. Twice pinnate (also see **pinnate**).

blade. The flat portion of a leaf or any foliar organ.

bract. Scale or sheathlike structure corresponding to a leaf or a flower but without a blade. Bracts can be large and colorful, like the red bracts in *Poinsettia*.

buttress. Large, laterally flattened roots at the base of usually tall, shallow-rooted rainforest trees. These are mainly produced for the support of the plant.

calyx. Outer part of the angiosperm flower, formed by green or colored sepals, either separate or fused.

capsule. Simple, dry fruit consisting of two or more carpels (poppies, for example).

carpel. Innermost, leaflike female structure of an angiosperm flower, consisting of stigma, stylus, and ovary. Collectively, the carpels form a gynoecium.

cauliflorous. Refers to a plant that produces flowers and fruits directly on the trunk and on older, thicker branches (e.g., cacao and jackfruit).

composite fruit. Fruits such as pineapple that develop from multiple flowers (inflorescence).

compound leaf. A leaf with a blade that is divided into several, smaller leaflets.

cordate. Heart-shaped.

corolla. Parted of the angiosperm flower formed by petals, which are often brightly colored.

corm. Short, thick, underground part of the stem serving as a storage device for the plant.

cultivar. A plant variety that has been produced in cultivation through breeding and selection.

cyme. A flower cluster in which the central stem blooms first, with the lateral stems blooming later.

deciduous. Usually refers to trees or shrubs that lose their leaves towards the end of the growing cycle.

dehiscent. Fruits, anthers or sporangia that split open when reaching maturity.

dioecious. Having male (staminate) and female (pistillate) flowers produced on separate plants of same species.

drupe. An indehiscent fruit where the fleshy exocarp and mesocarp enclose a hard endocarp and the seed, as in peaches.

dry forest. Tropical or subtropical forest type with a distinct, often long dry season and a high percentage of deciduous plants. The plants often show special adaptions—including succulence, spines, or dwarf growth—for prolonged droughts.

elliptic. Having the form of an ellipse; often refers to leaves.

endocarp. Innermost part of the fruit wall (pericarp).

endosperm. Tissue within the seed that is formed by most flowering plants to provide nutrients for the developing embryo.

epiphyte. Plant that grows on another plant, without being parasitic. Common epiphytes in rainforests are ferns, orchids, and bromeliads.

evergreen. Having foliage that persists throughout the year.

exocarp. Outermost layer of the fruit wall (pericarp); examples include the skin of mango.

frugivore. Animal that feeds on fruit as its preferred food type.

glabrous. Shiny, glossy, having no hair.

globose. Having the shape of a globe, almost spherical.

glochid. Hairlike spines on the areoles of cacti; they detach easily.

gluten. Proteins found in wheat endosperm.

gymnosperm. Refers to a group of vascular plants in which the seed is not protected by an ovary or fruit. Pines, firs, and cycads belong to this group.

heartwood. The dense, hard, innermost wood of a tree trunk.

herbaceous. Refers to a plant that lacks a persistent, woody stem.

hermaphrodite. Plant that has male and female reproductive organs in one flower.

indehiscent. Refers to fruit that doesn't split open when ripe.

inflorescence. Reproductive part of a plant, consisting of flowers arranged in a group.

invasive plant. Non-native, aggressive plant species that spreads quickly in a new habitat, harming the native ecosystems.

lanceolate. Shaped like the head of a lance; in the form of a narrow oval, tapering towards the tips.

leaflet. Unit that makes up a compound leaf.

leguminous. Belonging to the bean family (Fabaceae), which includes beans, peanuts, and chickpeas.

mesocarp. Central layer of the fruit wall between exocarp and endocarp.

monoecious. Having separate male (staminate) and female (pistillate) flowers on the same plant.

naturalized plant. Non-native plants that have adapted successfully to a new environment and reproduce without human help.

oblong. Having an elongated shape.

obovate. An egg-shaped, simple leaf with the narrower end at the base.

opposite. Having two leaves (flowers, bracts) at each node.

palmate. Refers to a leaf that resembles an open hand, with lobes radiating from a common point at the base.

panicle. A many-branched type of inflorescence (as in oats, for example).

pantropical. Distributed throughout the tropics.

pedicel. A small stalk producing a flower in an inflorescence.

peltate. Refers to a shieldlike leaf with the petiole attached to the underside instead of to the leaf margin.

perennial. Plant that lives for more than two years, as is the case with most trees.

perianth. Outer part of the flower consisting of the calyx and the corolla.

pericarp. Tissue that forms the wall of the fruit and generally consists of three distinct layers (exocarp, mesocarp, and endocarp).

petal. Leaflike, often brightly colored, segment of the corolla.

petiole. Stalk that connects the leaf with the stem.

pinnate. Compound leaf with two rows of leaflets arranged on either side of the rachis.

pistillate. Female flower that lacks functional stamens.

pod. Dehiscent leguminous fruit that splits along two sides when mature, as in beans and peas.

primary forest. Forest consisting of native species without signs of human interference or natural disturbance through fire and wind.

proteolytic. Hydrolysis of proteins into smaller compounds through the activity of enzymes.

pseudostem. A false stem consisting of folded or rolled leaf bases (e.g., as in banana plants).

pubescent. Covered by soft hair.

pulp. Soft, often moist tissue of a fruit.

pyriform. Formed in the shape of a pear.

raceme. A simple, unbranched inflorescence with flowers on short pedicels.

rachis. Elongated stalk of an inflorescence or extension of the petiole that carries the leaflets.

rainforest. Usually evergreen, broadleafed forest type with high, evenly distributed rainfall throughout the year.

recurved. Curved backwards.

rhizome. Horizontal part of the stem, often growing underground and producing lateral shoots and roots.

secondary forest. Forest that has regrown after natural or human disturbance.

senescent. Final stage of plant development.

sepal. Leaflike, often green lobe of the calyx.

serrate. Shaped like the edge of a saw.

sessile. Directly attached to the base without a stalk.

spathe. Large bract enclosing the inflorescence, especially in palms and aroids.

spike. Inflorescence with numerous sessile flowers.

stamen. Male part of the flower consisting of the filament and the anther.

staminate. Male angiosperm flower that lacks functional pistils.

stipule. Small appendage at the base of the petiole of a leaf.

storage root. Modified, often enlarged root for storage of energy in the form of starch, protein, or fat.

subacid. Describes a somewhat acidic flavor, somewhere between sour and sweet.

succulent. Having thick leaves or stems to store water.

syncarp. A fleshy, compound fruit that is formed by the fruits of several flowers (e.g., as in the pineapple) or by several carpels of a single flower, as in raspberries.

tendril. An elongated appendage of a plant that aids in climbing and support.

tomentose. Covered with woollike hair.

translucent. Somewhat transparent.

trifoliate. Having three leaflets.

tuber. A thickened part of an underground stem or rhizome that stores energy.

tubercle. Round nodule or small, wartlike projection.

ultratropical. Relates to plants living only in the lowlands of the innermost tropics, and requiring constant high temperatures.

umbel. Inflorescence with numerous stalked flowers radiating from a single point, as in dill and fennel.

variety. Botanical taxonomic rank below species and subspecies. Also used as a legal term to describe a cultivar (plant variety).

vein. Vascular structure in a leaf for support and transport of water and nutrients.

vernacular. Common name for a plant.

whorled. Arrangement of multiple leaves or branches around a single node.

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Rolf Blancke was born and raised in Germany. He began his professional career with an apprenticeship in a tree nursery and then studied botany at the University of Osnabrück, where he earned a master's degree in biology. His studies soon took him to Costa Rica, where he met his wife Juana. Today they live in Puerto Viejo, Talamanca, on the Caribbean coast of Costa Rica. There, they own a small hotel and organize rainforest excursions. When not working, Rolf trains for triathlons and takes care of his plant collection. On his farm, he grows more than 150 species of tropical fruit trees and spices. To arrange a tour, you can contact him at: tropicalfruitandspicegarden@gmail.com.