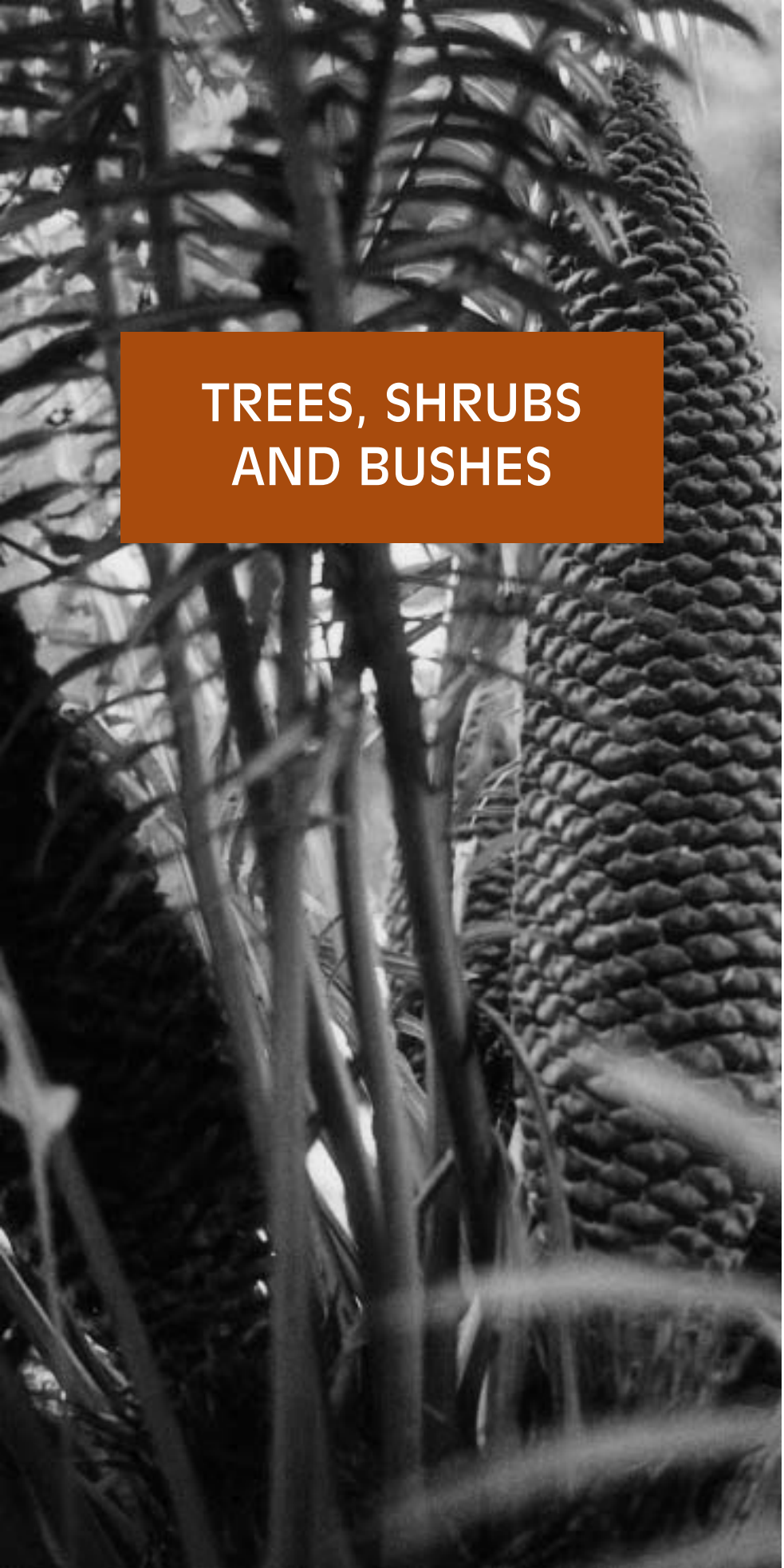

TREES, SHRUBS AND BUSHES

The tree is a lignified plant species, having a trunk and reaching a height of at least 7 m. Shrubs are smaller in size, and have a true trunk that branches above a certain height. If the plant is lignified but branched at its base (i.e. no true trunk), and does not grow higher than 4 m or so, it can be called a bush.

Cultivated trees are numerous in Vanuatu and are an integral part of the cultural systems. The best known among them is breadfruit, which very probably was first domesticated in this region of the world, and coconut which is a palm. Mango, which is present everywhere, was introduced at the very beginning of European contact, then papaya which is naturalised in the countryside, citrus of which there was already one autochthonous (or indigenous) species (*Citrus macroptera*), custard apple and its relatives, and avocado, to name but a few. Some, such as macadamia, are very recent introductions, and others such as lychee have never taken well.

The majority of bushes are likewise of ancient presence. Island cabbage (*Abelmoschus manihot*) is the main vegetable of Oceanians, while kava (*Piper methysticum*) and polyscias (*Polyscias* spp.) are ritual plants that are present in all gardens and villages.

Genus
Abelmoschus

Family
Malvaceae

The genus comprises about ten species, most originating from the Indo-Malayan region. *A. manihot* was present in Vanuatu before European contact.

Species present
Abelmoschus manihot (L.) Medik
Island cabbage, aibika, bele, edible hibiscus

This bush is one of the ancient plants of Vanuatu, diversified by local farmers and widely eaten in rural areas.

References
Barrau (1962), Borrell (1989), **Borssum-Waalkes (1966)**, Charrier (1984), French (1986), **Hamon & Van Sloten (1995)**, Henderson & Hancock (1989), Ochse & Bakhuizen van den Brink (1980), Peekel (1984), PROSEA (1994), Purseglove (1991), Smartt & Simmonds, eds (1995), Weightman (1989), Westwood & Kesavan (1982), Zeven & de Wet (1982).

Complementary food plant, local

Abelmoschus manihot

Island cabbage, aibika, bele, edible hibiscus

History

Island cabbage (aibika) is an ancient plant in the Melanesian subsistence crop complex. Originally from the Indo-Malayan region, it is found in southern China, from Malaysia to Fiji, and in New Caledonia where it is called *chou canaque* (Kanak cabbage). Curiously, it was only introduced to Polynesia quite late. In Vanuatu it is present in all types of garden, associated with other crops. It is sold in the markets throughout the year.

Description

Bush on average 1.5 m high, branched from the base. Leaves alternate, variable in shape and colour, with long green or red petioles. Flower solitary, broad, with five petals that are yellow with purple bases. **Style** separated into five small terminal branches with a purple base. The fruit is pear-shaped and is a five-sided capsule, measuring 4–6 cm x 2 cm and containing numerous seeds.

Abelmoschus manihot

Morphological variability

In each community in Vanuatu about a dozen varieties occur. Morphological variation is in petiole colour (red, white or green), leaf colour (light to dark green), and in the shape of the leaf blade which is dissected (cut into) to a greater or lesser extent. This variability is being preserved by vegetative means as farmers take cuttings from new forms that they find in the gardens. These new forms result from mutation of existing varieties or from recombination through sexual reproduction, and since the seeds germinate spontaneously in the gardens they thus provide new plants. As a result, in Vanuatu as a whole there are several hundred distinct morphological varieties, and further selection continues.

Cultivation and production

Island cabbage (aibika) likes humidity, fertile soils and low altitudes. It is an **autogamous** plant that is propagated by cuttings but can produce fertile seeds. Thus wild plants, escapes from ancient areas of cultivation, may come up again in newly cleared gardens. Usually two to three cuttings (30–60 cm) are planted in a hole, slightly sloped. Growth is very rapid, and after two months a number of leaves can be harvested each week. After one year the bush is fully developed and the leaves can be cut more often and more extensively, which increases the branching of the plant. Island cabbage is available throughout the year. It continues to grow beyond one year, but tends to develop too much vegetative growth after three years of age. It is then necessary either to prune it back where it is or to abandon it and replant elsewhere. It is often planted around the edges of gardens where it then serves as a hedge and a windbreak. Its two main pests are the Giant African Snail (*Achatina fulica*) which eats the buds of recently planted cuttings, and a small polyphagous beetle (*Adoretus versutus*) which likes the tender leaves and turns them into lacework full of holes.

Alimentary uses

Island cabbage (aibika), whose leaves become gluey after cooking, is the favourite vegetable of the ni-Vanuatu. They cook it in different ways. Most often it is cut into very thin strips, boiled in a little salted water and then flavoured with coconut milk. The broad leaves of certain cultivars are used as the outer covering of small *lap-laps* of banana or cassava, cooked in a *marmite*. The leaves may also be cooked with pieces of meat in an oven of hot stones. They are sometimes fried on the stove. Whatever mode of cooking is chosen, the leaves are rarely cooked by themselves and they mix well with onions, other green leaves, coconut milk, fish and meat. The leaves are rich in protein, calcium and vitamins A and C.

Other uses

It is sometimes used as a medicinal plant in Papua New Guinea, Indonesia and other Oceanian islands. In Vanuatu the hot stems are applied to fungal infections of the feet. Women in labour drink a decoction of aibika to ease labour, and it is also said to stimulate lactation.

Genus
Annona

Family
Annonaceae

The genus comprises about 50 species originally from tropical America, of which about a dozen have edible fruits. Three are present in Vanuatu.

Species present
Annona muricata L.
Soursop

Annona reticulata L.
Bullock's heart

Annona squamosa L.
Sweetsop, sugar apple

Of the three *Annona* species introduced to Vanuatu, only one – the soursop – is widely distributed in the archipelago and regularly eaten. The other two – the bullock's heart and the sweetsop – are much rarer and less popular, though their fruits are sometimes sold in markets.

References
Barrau (1962), Coronel (1994), French (1986), Hill (1952), Le Bellec & Renard (2001), Neal (1929), Ochse & Bakhuizen van den Brink (1980), OMS (1998), Pétard (1986), Purseglove (1991), Tate (2000), **Thakur & Singh (1967)**, Verheij & Coronel eds (1992), Viard (1995), Weightman (1989), Zeven & de Wet (1982).

Complementary food plant, introduced

Annona muricata

Soursop

History

This large green fruit originates from central America where it is grown up to the coastal valleys of Peru, then spread through the tropical world by early explorers. Europeans introduced it to Vanuatu at the end of the 18th century. Nowadays it is cultivated sporadically throughout the archipelago but there is no real commercial production, though the fruits are picked for sale in markets on a casual basis.

Description

Small tree not exceeding 8 m in height; branches low. Leaves simple, oblong, smooth, green and shiny. Flowers solitary or in pairs, **cauliflorous**, yellowish green; sepals dark green and thick, forming a globular cover around six large petals that have a characteristic odour, arranged in two rows, pale yellow. The fruit is an **ovoid syncarp**, slightly kidney-shaped, dark green, covered with curved protuberances that look like spines; fruit 15–35 cm long and weighing up to 2 kg; white, juicy flesh surrounding numerous black seeds.

Morphological variability

The degree of morphological variability in Vanuatu has not been studied in detail. Villagers distinguish forms with sweet and juicy fruits and those with drier fruits that are more acid.

Cultivation and production

In Vanuatu the soursop is present in villages, gardens and along paths leading to the gardens. The tree is very robust, thriving in poor soils and able to withstand cyclones and other inclement conditions. It often comes up spontaneously, but can be propagated with young plants that have come up spontaneously or through cuttings. The tree bears fruit from the third year onwards, and it fruits throughout the year.

No particular care is given to the trees but they still bear heavily, and it is not uncommon to find unpicked fruits that have dropped to the ground – to the delight of pigs which love to eat them, and disperse their seeds. The production from these spontaneous orchards is sometimes sold commercially.

Alimentary uses

This fruit benefits from being picked slightly before maturity. It is then placed where it can ripen over the next days until it becomes soft. It is peeled and cut into large quarters and eaten raw outside mealtimes. It is sold in urban markets. It can also be made into delicious ice creams, cordials and even jams.

Other uses

Medicinal properties are not known in Vanuatu.

Food plant occasionally eaten, introduced

Annona reticulata

Bullock's heart

History

Originally from the West Indies, distributed in tropical America and then throughout the tropical world, it was introduced to Vanuatu at the end of the 18th century by missionaries who no doubt brought it from Australia.

Description

Small tree not more than 10 m in height. Long, narrow leaves, light green. Flowers with thick petals, yellow-green. Fruit round, reddish green, with a smooth skin that is set with slight depressions; fruit 7-12 cm in diameter; pulp creamy in texture, with large brown seeds.

Morphological variability

What little variability there is relates to the size and texture of the fruits rather than their shape or colour.

Cultivation and production

The bullock's heart is less common than the soursop but occurs in all the islands, particularly in coastal areas. It grows well in poor or acid soils, but does not like high humidity. Even though it is not cultivated in the true sense, spontaneously growing plants are tended, and it is sometimes planted near villages. It is grown from seed or from young wild seedlings.

Alimentary uses

The taste is somewhat insipid and the fruit is not much sought after. It is eaten occasionally between meals. It can also be used for making sorbets. It is found regularly in urban markets.

Other uses

Medicinal properties are not known in Vanuatu.

Food plant occasionally eaten, introduced

Annona squamosa

Sweetsop, sugar apple

History

The sweetsop is originally from the West Indies but then spread through tropical America. The Spanish, who maintained contact between Mexico and the Philippines for 300 years, introduced the tree there, and the species finished up by reaching all tropical regions. James Paddon and the Presbyterian missionaries introduced it to Tanna in the years 1850–1860. It has doubtless been reintroduced a number of times since.

Description

Shrub less than 6 m in height. Leaves oblong, narrow and smaller than those of the bullock's heart. Flowers with thick petals, green with purple at the base, 2.5 cm long. Fruits heart-shaped or shaped like a pine cone, epidermis green-yellow, covered with fleshy scales which separate at maturity, 7–10 cm in diameter; pulp granular, creamy in texture and white in colour, surrounding very numerous brown seeds, glossy.

Morphological variability

In Vanuatu two varieties are distinguished: one with fruits that are light green when mature and the other with violet fruits. The latter is very fragrant.

Cultivation and production

The sweetsop is the least common of the *Annona* species present in Vanuatu. It likes dry climates and tolerates cyclones well. It is generally propagated from seed, preferably pre-germinated, and it grows slowly. These small trees, which fit well in the Melanesian garden, bear few fruits. It is thus recommended that they are planted at high densities and that the branches are pruned to increase the number of branches that can bear flowers and fruits.

Alimentary uses

The fruits are occasionally eaten between meals, mainly by women and children. They are very fresh tasting when they are just picked. Sorbets can also be made from them.

Genus
Artocarpus

Family
Moraceae

The genus comprises about 50 species, originally from Southeast Asia and the Pacific. Fewer than a dozen bear edible fruits. Two are present in Vanuatu.

Species present
Artocarpus altilis (Parkinson) Fosberg
Breadfruit

Artocarpus heterophyllus Lam
Jackfruit (minor species: see CD-ROM)

While jackfruit is an introduced tree that is very rare in Vanuatu, breadfruit is one of the most important local plants in Melanesian arboriculture. Its diversity is very great, the number of cultivars with seeds is greater than those without, and it is likely that Vanuatu played a key role in the process of diversification of this species.

References
Barrau (1962), de Candolle (1883), French (1986), Neal (1929), Ochse & Bakhuizen van den Brink (1980), Parham (1972), Purseglove (1991), Ragone (1988, 1991, 1997), Verheij & Coronel eds (1992), Viard (1995), Walter (1989), Walter & Sam (1999), Weightman (1989), Zeven & de Wet (1982).

Staple food plant, local

Artocarpus altilis

Breadfruit

History

This species without doubt originated in Papua New Guinea, and was spread by humans throughout the Pacific islands well before the European era. Breadfruit is one of the great plants that Oceania can offer to the world. The early explorers, fascinated by this fruit that they thought could feed the slaves in the first American colonies, introduced it very early on to the West Indies. The beginning of this dispersion proved difficult. An initial cargo destined for Jamaica and collected from Tahiti by the *Bounty* disappeared at the time of the well-known mutiny on the ship. A second happier voyage finally carried the species to the West Indies, but the slaves

didn't like its taste! Despite these early difficulties breadfruit was finally adopted into the life of the tropical regions, and nowadays it is widely grown. Vanuatu is an important centre of diversification of the species.

Description

Tree 15–20 m high, with a massive trunk. Leaves simple, rounded or oval, deeply divided into 6–9 lobes, dark green and glossy; petiole short and robust. Male inflorescences elongate, female inflorescences spherical or oblong. The breadfruit is a syncarp formed by fusion of fruits arising from each of the female flowers. The fruit is variable in size and colour, generally oval, plump and yellow. It exudes latex more or less abundantly, and contains large brown seeds, variable in number.

Morphological variability

The diversity is enormous. It is more pronounced in the northern islands (Banks, Maewo, Pentecost, Malekula, Epi) than in the southern ones. The morphological variability relates to the size of the tree, the colour and shape of the leaves and the degree to which they are divided into lobes, the shape, colour and size of the fruit, the texture of the epidermis, the colour of the flesh and the number of seeds. Agronomic variability further distinguishes varieties according to the number of seeds, the fruiting season, and the productivity. Finally, variability in usage distinguishes the fibre content and the pliability of the flesh, the time required for cooking, the taste and the length of time over which the fruit can be kept. Each community has its own collection comprising from 10 to 120 different cultivars. It is not impossible that some forms without seeds (aspermic), which are rare in Vanuatu, had been introduced from Polynesia by the people of Futuna or the Wallisians of Forari.

Cultivation and production

The species grows up to 600 m in altitude, in cleared and sunny places such as villages, coconut plantations, footpaths and gardens. Cultivars with seeds predominate in Vanuatu, and the species is propagated either by seeds or by transplantation of suckers. The latter method is preferred because it allows the characteristics of the mother tree to be preserved and carried on.

Alimentary uses

In season, breadfruit is eaten very much in Vanuatu. It is prepared and cooked in different ways according to the cultivar. Some are grilled on a wood fire and then eaten as they are, or peeled, cut and then pounded with a pestle after the seeds have been removed (because children like to nibble the seeds hot). Once mashed the pulp is spread out on a wooden platter and then sprinkled with coconut milk; this is a *nalot* which is most often made for a morning meal.

Other recipes also exist. For example, the mashed-up pulp is divided into small balls threaded together in a bamboo container and gently cooked again in coconut milk. In earlier times breadfruit was also preserved in different ways. In Banks it was dried. Elsewhere it was fermented in pits dug in the soil or in natural holes in the coralline crust. Nowadays these preservation practices are tending to disappear. The young leaves, rolled up and boiled, are eaten as vegetables.

Other uses

There are numerous uses for breadfruit. The latex is used to trap birds, caulk canoes and cover injuries to yams. The wood is chosen for making canoes, for oars and for balancing arms. It is also used for carving the magnificent drums of Ambrym. It is also good firewood. In earlier days the inner bark or bast was pounded flat in order to provide a textile called *tapa*. Finally, the leaves and bark have medicinal properties.

Genus
Averrhoa

Family
Oxalidaceae

The genus, originally from the Indo-Malayan region, contains two main species of which one is present in Vanuatu.

Species present
***Averrhoa carambola* L.**
Carambola, star fruit

The star-shaped, acid fruit is not eaten much in rural areas. It is mainly used by people of European or Asian descent in urban areas.

References
Barrau (1962), French (1986), **Hutchinson (1959)**, Neal (1929), Parham (1972), Pétard (1986), Popenoe (1974), Purseglove (1991), Verheij & Coronel, eds (1992), Viard (1995), Zeven & de Wet (1982).

Food plant occasionally eaten, introduced

Averrhoa carambola

Carambola, star fruit

History

Originally from the Indo-Malayan region, the species is nowadays present throughout the tropical world. Introduced to Oceania and Vanuatu at the end of the 19th century, it is rare nowadays.

Description

Small tree with a short trunk, 5–8 m tall, crown shaped like a parasol. Leaves composite, with 3–5 pairs of oval leaflets. Flowers in the shape of a small bell, pink or red, 8 mm long. Fruits smooth-skinned and slightly translucent, with five pronounced ribs, yellow-gold at maturity. When cut across the fruit looks like a five-pointed star, giving it one of its common names. Seeds oval, flattened, brown, about 1 cm.

Morphological variability

In Vanuatu carambola fruits have varying degrees of sweetness, without any real distinguishing of varieties.

Cultivation and production

The tree is propagated from seeds washed with soap, or from cuttings. It bears fruit after three years, and in the Pacific it fruits

once a year. A single tree can produce a harvest of several dozen kilos of fruits. These are very attractive and sell easily at the markets. They keep well after harvest – about ten days at ambient temperatures.

Alimentary uses

The fruit is eaten raw when fully ripe, though it is mainly used to decorate desserts or is mixed with other fruits in a fruit salad. It has a slightly acid but fragrant taste. The minority population of Asians also eat the immature fruit cooked. It is not much eaten by the ni-Vanuatu, and is seen most often on the tables of Europeans or served in international hotels in the capital. It may sometimes be bought in the Port Vila market.

Genus
Cajanus

Family
Fabaceae

The genus is distributed in Asia (18 species) and Africa (1 species) by way of Australia (15 species of which 13 are endemic). Only one species is present in Vanuatu.

Species present
Cajanus cajan (L.) Millsp.
Pigeonpea

References
De Candolle (1883), Neal (1929), Néné *et al.* eds (1990), Ochse & Bakhuizen van den Brink (1980), Parham (1972), Purseglove (1991), Smartt & Simmonds, eds (1995), **Van der Maesen (1986,** 1990), Viard (1995), Weightman (1989), Zeven & de Wet (1982).

Food plant occasionally eaten, introduced

Cajanus cajan

Pigeonpea

History

Originally from India, pigeonpea is undoubtedly descended from a wild ancestor [*Cajanus cajanifolius* (Haines) Van der Maesen]. It reached Asia via Syria early on, and was taken to the east coast of tropical Africa by the ancient Egyptians. It reached Australia and much later the Pacific. Widely cultivated in India, the plant has been the subject of genetic selection and agronomic studies throughout the world. It reached Vanuatu via Australia, and it is used for temporary shade because of its very rapid growth. Its seeds can also be eaten.

Description

Shrub with erect bearing, reaching 4 m in height. Leaves silvery on the undersides, trifoliate; leaflets lanceolate, **acuminate**, slightly downy; petiole grooved. Flowers yellow, sometimes tinged with red or violet, 2 cm long. The fruit is a brownish, flattened pod, with depressions between the seeds, pointed. Seeds from 2–8 in number, variable in shape, size and colour.

Morphological variability

The species comprises a number of cultivars varying in height and structure of the plant, the number

Cajanus cajan

of seeds per pod, and the size, colour and taste of the seeds. Some cultivars fruit synchronously. In Vanuatu the majority of morphotypes are of erect bearing and have yellow flowers, but some prostrate varieties have been introduced recently.

Cultivation and production

The shrub is easy to grow, and is propagated by sowing of seeds or by cuttings. The varieties in Vanuatu show very rapid growth, and can reach 3 m high in one year and produce fruit. They are susceptible to nematodes and to root rots, leaving them prone to being blown over in strong winds. According to variety the fruits reach maturity between five and twelve months, and the plant is productive for 4–5 years. The seeds do not keep well once they have been harvested, and are attacked by weevils that perforate the pods and feed on the **cotyledons**.

Alimentary uses

The seeds are harvested when mature and cooked in bamboo containers with a little salt, boiled or grilled in their pods to be eaten as they are, or as an accompaniment to a dish of root crops. This vegetable is sometimes sold in the markets. In other countries the young leaves and the young green pods are also eaten, and it is a good forage plant for horses, cattle and even silkworms. In Vanuatu it is only fed to chickens.

Other uses

Pigeonpea is often used as a shade tree, but it is frequently attacked by a fungal disease (*Corticum salmonicor*) and above all by nematodes. There is then a risk that these pests will invade cultivated crops such as cocoa and pepper.

Genus
Carica

Family
Caricaceae

The genus comprises more than 20 species, all originating from tropical America, six of which bear edible fruits. One species, which is important from an economic viewpoint, is present in Vanuatu.

Species present
***Carica papaya* L.**
Papaya, pawpaw

Papaya is a common fruit in Vanuatu. For a long time it had no great prestige among the local people, and it was used for feeding to pigs. The continual availability of the fruits and their nutritional value have, however, made papaya a valued food, which is eaten more and more often.

References
Badillo (1971), Barrau (1962), de Candolle (1883), *Encyclopédie des aliments* (1997), French (1986), Le Bellec & Renard (2001), Lebot (1986), Manshardt & Wenslaff (1989), Neal (1929), Ochse & Bakhuizen van den Brink (1980), Pétard (1986), Popenoe (1974), Purseglove (1991), Storey (1969), Verheij & Coronel, eds (1992), Viard (1995), Weightman (1989), Zeven & de Wet (1982).

Complementary food plant, introduced

Carica papaya

Papaya, pawpaw

History

Papaya has never been found in the wild state, and it is thought that it arose from hybridisation of species in the area from Mexico to Nicaragua. When it was found by the Spanish it had already been cultivated for a long time and had become diversified. In the 16th century the Spanish introduced it to Manila (Philippines), from where it reached Malacca and then India. Its spread throughout the tropical world has been rapid because it is easy to propagate from seed. In the 19th century it was already well established in Oceania, and it is a common plant nowadays in Vanuatu.

Description

Shrubby tree up to 6 m in height, without branches; long trunk covered with heart-shaped scars of leaf bases. Terminal cluster of simple leaves, arranged in spirals, palmate with 7–11 lobes deeply cut in; petiole narrow and long (25–100 cm). Plant dioecious (though some varieties are monoecious). Male inflorescence long, containing many tiny flowers; female inflorescence **axillary**, short and with few flowers. Flowers scented and trumpet-shaped, yellow or cream. Fruits cylindrical, pear-shaped or oval, large (7–50 cm long, and reaching up to 10 kg), dark yellow or orange when ripe, pulp thick, bright yellow or orange. Numerous seeds fastened to the inner wall of the central cavity, black and covered with **mucilage**.

Morphological variability

The majority of varieties are dioecious and cross-pollination is obligatory. The progeny are extremely variable in the shape of the fruit and the colour of the flesh. Towards the end of the 1970s, a program of genetic improvement at the University of Hawaii focused on hermaphrodite varieties, under the name of Solo, that produce 70% of plants that are completely hermaphrodite, and the rest female plants with fruits whose shape is not well-liked. The fruit of Solo is small and oblong or pear-shaped, with delicate and sweet flesh. Cultivars exist that have yellow or white flowers, and yellow or red flesh, these last being the most favoured. In Vanuatu the papaya has fruits that are pear-shaped or very elongate, with yellow or orange flesh, and also the Solo variety although that is rarer. The seeds of Solo Sunrise and Solo Waimanalo, the two commercial varieties most often grown, have to be imported regularly from Hawaii because the farmers do not bag the flowers, and cross-pollination with other varieties quickly leads to less desirable forms.

Cultivation and production

The plant likes sun and fertile soils, but is intolerant of frost and excessive moisture which leads to root rot produced by a species of *Phytophthora*. In Vanuatu the tree is spread by common mynahs (*merles de Moluques*) and by fruit bats which distribute the seeds. It is found everywhere along footpaths, in gardens and in villages, and a good part of the fruit that is produced rots *in situ* or is eaten by birds. Papaya is grown from seeds either broadcast or for preference planted in plastic bags in seedbeds. The young plants are planted two or three together in the same hole, and must be shaded and protected from wind. After six months, when the sex of the plant is apparent, female trees are removed in the case of Solo and some male plants are kept in the case of dioecious varieties. The fruits are harvested 8–14 months later, when traces of

orange appear on the green epidermis. A single papaya tree can produce 30–50 fruits per year, spread throughout the year. Trees can live for up to 25 years, but productivity declines with age and they are usually cut down after four or five years – or they fall over themselves because nematodes kill some of the roots. The fruits are picked with care because damage causes rapid rotting. Papayas are sold in markets throughout the year, but disappear in the months following a cyclone.

Alimentary uses

This delicious fruit is eaten in all tropical regions, just as it is, or with lemon or lime juice, or in a fruit salad, or it may be made into a drink, a jam, an ice or candied fruit. It is the same in Vanuatu where it is eaten raw when ripe, outside mealtimes. When the papaya is still green it is used like a vegetable, cut into pieces and then boiled or cooked in the oven. The flesh may also be grated or cut into pieces and served as a salad, dressed with vinaigrette or lime or lemon juice or mixed with grated coconut. In Santo, and no doubt elsewhere, it is cooked in a *marmite* with stewed chicken. When almost ripe the fruits may also be cooked directly in a wood fire or stuffed with canarium nuts and cooked in an oven of hot stones. Very ripe fruits are usually given to pigs. Papaya is recommended for young children because of its easy digestibility and its content of vitamin C, vitamin A and potassium.

Other uses

In Vanuatu pieces of meat are sometimes wrapped in leaves of papaya to tenderise them. Attempts at producing papain[14] have not been satisfactory because of the poor performance of the plant material available. The seeds have the reputation of being anthelminthic and of inducing abortions. The fibres in the trunk may be made into rope. The tree is also used to shade young pepper plants, or as a medicinal plant. Because of their short life span and vulnerability to cyclones, papaya trees are never used for demarcating boundaries of land.

[14] A proteolytic enzyme used for tenderising meat, in the manufacture of chewing gum and cosmetics, in the tanning of hides and in the manufacture of silk and wool.

Genus
Caryota

Family
Arecaceae

The genus comprises a dozen or so species distributed from India to Vanuatu. One species occurs in Vanuatu.

Species present
Caryota ophiopelis Dowe
Caryota, snakeskin palm

This is a plant used in times of food scarcity by people in Tanna.

References
Cabalion (1989), **Dowe (1989)**, French (1986), Purseglove (1988), Stewart (1994).

Plant used in times of food scarcity, introduced

Caryota ophiopelis

Caryota, snakeskin palm

History
The species was introduced to the southern part of the archipelago (Anatom and Tanna) in the middle of the 19th century or even later.

Description
A medium-sized palm, 6–12 m high, with a smooth trunk. Leaves bipinnate, long (3 m in length); leaflets in the shape of a fish tail, upper margins dentate. Inflorescence in the centre of the crown, not branched, pendant, bearing groups of three flowers (2 male and 1 female). Fruits round, smooth and yellow, containing 1–3 seeds.

Morphological variability
Not known.

Cultivation and production
In earlier times this palm grew in the wild state in wet forests. Nowadays the communities of Tanna protect it and grow it to a limited extent from seed or by transplanting young seedlings. After Cyclone Uma, which caused great devastation to gardens in 1987, the elders of the island were able to teach the younger generations once more how to use this palm for food.

Alimentary uses
Caryota is entirely a plant for use when other food is not available. Flour is extracted from its trunk in a similar manner to sago. The flour is mixed into a paste with water, and this is then cooked on hot stones.

Other uses
Caryota is also an attractive ornamental plant.

Genus
Citrus

Family
Rutaceae

The taxonomy of *Citrus* is a very controversial subject, and depending on author it varies from 16 to 159 species. It is mainly distributed in Asia. Ten species of *Citrus* occur in Vanuatu, four of which produce fruits that are eaten as they are, and the others are used for juice.

Species present[15]

Citrus aurantiifolia (Christmann & Panzer) Swingle
Lime

Citrus aurantium L.
Bitter orange, Seville orange (minor tree, see CD-ROM)

Citrus grandis (L.) Osbeck
Pomelo

Citrus hystrix D.C.
Kaffir lime, Makrut, combava (minor tree, see CD-ROM)

Citrus limon (L.) Burm. F.
Lemon

Citrus macroptera Montrouzier
Local orange (foraged species, see CD-ROM)

Citrus medica L.
Citron (minor tree, see CD-ROM)

Citrus paradisi Macf.
Grapefruit

Citrus reticulata Blanco
Mandarin

Citrus sinensis (L.) Osbeck
Sweet orange

Citrus species, introduced to Vanuatu at the end of the 19th century, have almost all been adopted enthusiastically by local people. Lime, lemon, grapefruit, orange and mandarin have become an integral part of cultural systems, and their cultivation is increasing widely. These are the only species that have any real economic status. The others – bitter orange, pomelo and cumquat – are not widely distributed, though they appear regularly in markets. The Kaffir lime and citron are very rare.

[15] See also *Fortunella japonica* (Thunb.) Swingle: cumquat (minor tree, see CD-ROM).

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Complementary food plant, introduced

Citrus aurantiifolia

Lime

History

Lime arose from hybridisation of two species of *Citrus* (*C. grandis* and *C. medica*), and is a species of *Microcitrus*. It originates from the north of India and surrounding regions. It is rare among *Citrus* species in that it appeared in a tropical region. It was brought to France and Italy in the 13th century by the Crusaders. From there the Spanish took it to tropical America and then it spread to all tropical regions. Although some tentative commercial production has been undertaken in Malekula, proper cultivation of this plant for export remains to be established.

Description

Bushy shrub, 5-6 m high, furnished with spines. Leaves small; margins dentate; petiole slightly winged. Inflorescences axillary; small, white, scented flowers. Fruits small (3-6 cm in diameter), round, green but becoming yellowish when fully ripe; skin thin and clinging closely to the flesh; pulp greenish, very acid and strongly scented, containing small, oval seeds.

Morphological variability

Several varieties exist, one of which (Tahiti) has large fruits.

Cultivation and production

The tree grows in poor soils and requires little attention. Pruning every year is recommended. It likes heat and grows best in coastal regions, but is found up to 2,000 m altitude. It reproduces by seeds and spontaneously, but it is preferable to propagate it by **marcotting**. Trees reach maturity quickly and fruit throughout the year. Main producers are Mexico, Jamaica, Dominica, Trinidad and Brazil.

Alimentary uses

Lime is a typical ingredient in Asian cuisine, and is mainly grown for its juice which is used to flavour food dishes, sauces,

marinades and cocktails. In Indonesia the young leaves may be finely chopped and mixed in satay sauce. In Vanuatu limes are sold in markets throughout the year, and their juice is used to flavour salads and various dishes. It is used less in rural areas, where it is only occasionally used in preparation of local dishes. Villagers use it to make a lime juice drink.

Other uses

The juice is sometimes used as a shampoo against head lice.

Plant eaten occasionally, introduced

Citrus grandis

Pomelo

History

Originally from Thailand, Malaysia and the Andaman Islands, this species spread early to China, India and Iran from where it reached Europe around the 12th century. The pomelo seems to have been present in certain Pacific islands such as Fiji before the arrival of Europeans, unless it was brought in by the very early Portuguese or Spanish navigators. It was brought to Vanuatu by the first missionaries at the end of the 19th century.

Description

Tree 8 m in height, with spiny branches. Leaves oval, broad (up to 12 x 20 cm), hairy underneath which distinguishes this from other *Citrus* species; petiole winged, 7 cm across. Flowers solitary or in small clusters, cream, large (3-7 cm in diameter). Fruits round, slightly flattened at either end, yellow, greenish or slightly rose-tinted, large in size (10-30 cm in diameter), **pericarp** thick, easily peeled away, smooth or wrinkled; pulp greenish or pale yellow, made up of large juicy vesicles. Large, yellowish seeds.

Morphological variability

According to cultivar the pulp may be more or less juicy, very sweet or acid, and contains a very variable number of seeds. For more than twenty years the agricultural station at Tagabe has been propagating and distributing varieties of the Sarawak type, which is sweet with white flesh, and Decumana varieties which have pinkish flesh and are more acid.

Cultivation and production

Nowadays plants originating from marcots are planted throughout the archipelago. Pomelo trees are regularly found in villages in Vanuatu, along footpaths or in areas of cultivation where they are ready to slake the thirst of those working in the gardens. The problem with vegetative propagation by marcotting is that in the absence of seed nurseries and strict phytosanitary controls, certain diseases such as tristeza have

been widely spread around the archipelago. Trees growing from marcots also tend to have most roots very near the soil surface, and the absence of a deep central root leaves the trees very vulnerable to cyclones.

Alimentary uses

Pomelos are eaten raw after being peeled and cut into segments. They are also used for juice, for fruit compotes and for sorbets, and the young leaves are sometimes infused to make a morning drink.

Complementary food plant, introduced

Citrus limon

Lemon

History

The exact centre of origin of lemon is still unknown. It is certainly found in the region of northern Myanmar, southern China and north-western India. Some authors have suggested that the lemon resulted from hybridisation between the lime (*Citrus aurantifolia*) and the citron (*Citrus medica*), or between *C. medica* and another species of *Citrus*. The species has been cultivated in China for 2,500 years. Arabs have known it since the 10th century, and they introduced it to Africa after spreading it around the entire Mediterranean region. It spread to the rest of Europe in the 12th or 13th century with the Crusaders, and Christopher Columbus carried it to Haiti on his second voyage. Later it spread throughout the world, and it was introduced quite early to the Pacific.

Description

Shrub 6 m high with thick spines. Leaves oval, not more than 10 cm long; dentate margins; petiole without wings, with a characteristic junction with the stem. Flowers solitary or in small clusters, recognisable by the pink colour of the buds and then the purple colour that tinges the undersides of the white petals. Fruits oval, with a small apical swelling, yellow when ripe; pericarp thick, adhering to the flesh, rugose; pulp yellow and acid, with oval seeds.

Morphological variability

Commercial cultivation and numerous genetic improvements to the species have produced several varieties, among which Eureka, Lisbon and Villafranca are the most widespread.

Cultivation and production

Commercial cultivation of the lemon began first of all in Italy and Spain. Since 1890 California has been an important producer, followed by Italy and Greece. In Vanuatu lemon is cultivated or grows spontaneously in all the villages, particularly along the paths leading to the garden areas. Wild seedlings are looked after so that their growth is encouraged.

Alimentary uses

Lemon is grown for its juice and the zest of its peel. It may be preserved in oil or pickled in brine, and it is made into marmalade, chutney and lemon butter. In Vanuatu lemon, which is very high in vitamin C, is sold throughout the year in the markets. It is mainly used for juice, which can be made into lemonade, or to flavour certain dishes. As with lime, it is not used much in traditional dishes.

Complementary food plant, introduced

Citrus paradisi

Grapefruit

History

The centre of origin of this species is not known. It has never been found in the wild state, and it appeared in the West Indies before the end of the 18th century. It is probably derived from pomelo, either by hybridisation with sweet orange or by genetic mutation. It was introduced to Florida where it quickly became a major commercial crop for the United States. It was introduced to the Pacific including Vanuatu in the 19th century, and since then has been grown on all the islands.

Description

Tree without spines, crown round, 6–8 m tall. Leaves intermediate in size between those of pomelo and orange (6 x 11 cm), petiole with broad wings. Flowers solitary or in small clusters, white, 4–5 cm in diameter. Fruits round, pale yellow or pink-tinted, large in size (8–15 cm in diameter), skin thick but not as much so as that of pomelo; pulp pale yellow, with segments that are difficult to separate, with small vesicles. Seeds white, **polyembryonic**.

Morphological variability

Cultivars are numerous. There are forms with yellow fruits and forms with pink fruits; forms with or without seeds. The best known is Marsh, with yellow flesh, containing fewer than 10 seeds per fruit. The cultivar Thompson or Pink Marsh is known as pink grapefruit. The varieties distributed by Tagabe agricultural station are Marsh and Shambar.

Cultivation and production

Grapefruit likes warmth and well-drained, sandy soils, since it is very susceptible to root rots. Marcotting and grafting are the most commonly used methods for propagation, and the tree bears fruit after four years. Annual pruning is necessary to remove suckers and shoots and to stimulate flowering. Its sale in markets is increasing.

Alimentary uses

Almost 60% of world production is used for juicing, and the remainder is sold as fresh fruit. Grapefruit, which is less common in

Vanuatu than pomelo, is eaten between meals. Westerners, particularly those of Anglo-Saxon origin, eat it in preference for breakfast or as an entrée.

Complementary food plant, introduced

Citrus reticulata

Mandarin

History

This species is one of the three ancestral species of *Citrus* (together with *C. grandis* and *C. medica*). Appearing first in southern China, the mandarin has for a long time been the most important citrus. It has been cultivated there for 4,000 years and has become greatly diversified. Its name comes from the term Mandarin as applied to humans. Some say that the colour of the fruit resembles that of the robes that were worn by these highborn nobles, while others say that in earlier times only Mandarins were allowed to eat this delicate fruit. It reached Europe quite late, at the very beginning of the 19th century, and the United States 50 or so years later. It later spread throughout the tropical and subtropical world, reaching Vanuatu at the end of the 19th century.

Description

Small tree less than 10 m in height, sometimes without spines. Leaves elliptical or lanceolate, narrow, glossy, small (6 x 3 cm); margins serrated; petiole very slightly winged. Small, white, axillary flowers. Fruit rounded, slightly flattened and depressed on the underside, yellow or orange when ripe, small in size (5–8 cm in diameter). Skin thin, slightly embossed, not adhering to the orange pulp which separates easily into segments. It contains small seeds.

Morphological variability

The numerous cultivars may be classed into several groups and several botanical varieties. Traditionally the following are distinguished:

- the Satsuma group cultivated in Japan;
- the Mandarin group with yellow-orange fruits of which the variety Imperial is cultivated in Australia;
- the Tangerine group with dark orange fruits, to which belongs the Algerian clementine.

In Vanuatu several varieties of mandarin occur, but the most common is Raiatea which was introduced by missionaries and can be recognised by its erect bearing in the shape of a cone.

Cultivation and production

The fruit is very popular in Vanuatu. It is found in all the villages, and is sold in large quantities in the markets. It is always propagated through seedlings not by marcotting,

and this makes it much more resistant to cyclones. It is quite tolerant of shade, and it has its place in traditional gardens as a border around the plots. It is a hardy plant and no serious diseases are known.

Alimentary uses

Most of the time mandarins are eaten raw, but they may also be made into marmalade. Chinese cuisine utilises the dried peel. The ni-Vanuatu, both adults and children, love this fruit, and eat it raw between meals. It is generally picked and put straight into bags, and left to ripen for a while inside the homes before being eaten. The leaves are infused to make a morning drink.

Complementary food plant, introduced

Citrus sinensis

Sweet orange

History

The orange is a native of southern China and northeast India, where it has been cultivated for over 4,000 years. It has not been found in the wild state, and is thought to be derived either from the bitter orange or from hybridisation between the mandarin and the pomelo (*C. grandis*). Europe has had varieties of orange of mediocre quality from as early as the end of the 14th century, since the Arabs spread the species from Persia to North Africa via Spain. However, it was the Portuguese at the beginning of the 16th century who collected better varieties from China, and grew them in orangeries to protect them from the harshness of the European climate. Christopher Columbus introduced orange seeds to Haiti on his second voyage. From there the species reached the United States, the West Indies and Mexico, and then the rest of the tropical and subtropical world. Captain Cook introduced it to Polynesia, and it reached Fiji in 1832. In 1840 the first Samoan missionaries carried it with them to Aniwa. Since then the species has proliferated in this island where it has become an important element of produce. It is widely cultivated throughout the archipelago.

Description

The tree, 6–8 m tall, has spiny branches set at an acute angle to the trunk, and a narrow crown. Leaves oval, dark green, of medium size (5–15 x 2–8 cm); margins slightly wavy; petioles with short, narrow wings. Flowers white, scented, small (2–3 cm in diameter). Fruits rounded, orange or green, 4–12 cm in diameter; skin 5 mm thick, adhering to the flesh which separates into segments. The number of seeds is very variable.

Morphological variability

The numerous cultivars can be separated into three broad groups: the traditional oranges that we have just described, the navel oranges which are seedless and originate from Brazil, and the

blood oranges with flesh that is red or red-streaked that appeared in Europe around 1850. The best known cultivars are Valencia, Maltese, Jaffa (Israel), Sunkist (United States) and Outspan (South Africa). In Vanuatu four varieties of orange are found: Late Valencia, with fruits that are relatively large but which only rarely turn orange and become yellow when they are exposed to strong light; Joppa, whose tree has an upright bearing and fruits of smaller size; and two navels (Washington and Thomas) whose flesh is quite yellow. They were introduced from Tahiti in 1960. The famous orange trees of Aniwa came from a population resulting from seedlings. In appearance the fruits are very like the variety Valencia and develop a good colour, the Aniwa fruits tending to be yellower than the Valencia which is more orange. When they grow in natural forest they have an upright stance which makes them difficult to harvest. Their longevity is not more than twenty years or so.

Cultivation and production

Orange trees nowadays grow spontaneously in the islands of Vanuatu where the species has become naturalised. They are also planted for demarcation of plots of land, along the edges of tracks and ways leading to gardens, and they appear in all the villages. In the 1980s, commercial cultivation of orange was attempted in order to provide a supply for the markets of the capital. The orchards of Aniwa were devastated by Cyclone Uma in 1987, but began to produce again some years later. In the meantime orchards were developed in Anatom, and they have been in full production since then.

Alimentary uses

Oranges are eaten between meals throughout Vanuatu. They are also used for juicing and for making marmalade and sorbets. In European and Asian cuisine they are used as ingredients. Finally, the leaves are regularly picked for infusion as a morning drink.

Genus
Cocos

Family
Arecaceae

The genus comprises a single species, present since ancient times in Vanuatu.

Species present
Cocos nucifera L.
Coconut

Together with breadfruit, coconut is one of the most important fruit trees of Vanuatu. First cultivated as a food, it became by the start of the 20th century one of the most important commercial crops of the country. Although the coconut is primarily a food plant and a commercial crop, it also has numerous other uses.

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Staple food plant, local

Cocos nucifera

Coconut

History

The true ancestor of coconut arose millions of years ago on the shores of the Sea of Thetis[16]. When the supercontinent of Gondwana broke up and the resulting continental plates began to move apart, the floating nuts continued to colonise the shores of the continents, islands and archipelagos that were progressively created. It is naturally established in the islands of the Indo-Malayan region and the Pacific as far as the Marquesas Islands. Then humans began to protect the coconut palms and spread the species, gradually selecting forms to obtain the coconuts that we know today. Austronesian peoples carried the nuts to Madagascar, Arabs took them to the coasts of East Africa, the Portuguese to the coasts of West Africa (in 1498) and the Spanish from the Philippines to Mexico around 1540. Since the time of the great seafarers of the 16th century the coconut has been carried to every tropical shore and has become

[16] The ancient sea that separated the old Asian and Australian continents.

established there. The Pacific region possesses the greatest known diversity of coconuts, as well as the greatest diversity of insects associated with them. Carbon-14 dating has shown that the coconut existed in Vanuatu well before the arrival of the first humans, and it certainly would have contributed to the settlement of people in these islands. Nowadays coconut is a typical plant of the Vanuatu coastline, and since European contact the development of commercial plantations together with scientific research for genetic improvement has been substantial.

Description

Palm tree 20–30 m high; trunk sinuous, cylindrical, bearing scars left by the bases of the palm fronds, with a crown at the top consisting of 25–30 leaves of different ages; base swollen and surrounded by roots. Leaves growing from a terminal bud, lanceolate, entire when young but dividing down to the central leaf rib when adult. When fully grown each leaf frond measures 4–6 m and each leaflet 50–120 cm in length; petiole broad and stout. Inflorescence branched into about 20 **spikelets** appearing at the centre of a long spathe (1 m), each spikelet bearing about 30 small, pale yellow male flowers and some large female flowers. Cluster of fruits situated beneath the fronds, **drupes** 20-30 cm long and weighing up to 2 kg. Each comprises an hard **exocarp** (**epicarp**) which is smooth and variable in colour (green, brown, yellow or orange), a fibrous brown **mesocarp**, an ovoid **endocarp** which is hard and woody, dark brown and with three "eyes" at the base, and an oily white seed hollowed out in the middle into a cavity that contains the coconut water.

Morphological variability

Coconuts comprise homogeneous populations that can easily be differentiated on the basis of morphological and agronomic characters. There are three main groups: the Pacific, the Indo-Atlantic and the intermediate Indian Ocean types. The Pacific group, to which the Vanuatu coconut belongs, extends from Sumatra to French Polynesia, and it is very much diversified. Two other subdivisions of coconut are also recognised – the tall types (95% of the world population) that have trunks with swollen bases and the dwarf types that have bases that are not swollen. The dominant variety in Vanuatu is Vanuatu Tall or New Hebrides Tall. The genetic variability of coconuts in Vanuatu has been greatly underestimated, and recent collecting surveys have found over 20 distinct populations. Growers distinguish varieties by features such as the colour of the nuts, the height, the length and colour of the fronds, the colour of the inflorescences, etc. On average there are 12 different vernacular names per village. The uses are also quite diversified, some varieties being preferred for their coconut water while others are chosen for the aroma of their milk or the taste of their flesh.

Island cabbage or aibika (*Abelmoschus manihot*) planted in a garden.

TREES, SHRUBS AND BUSHES

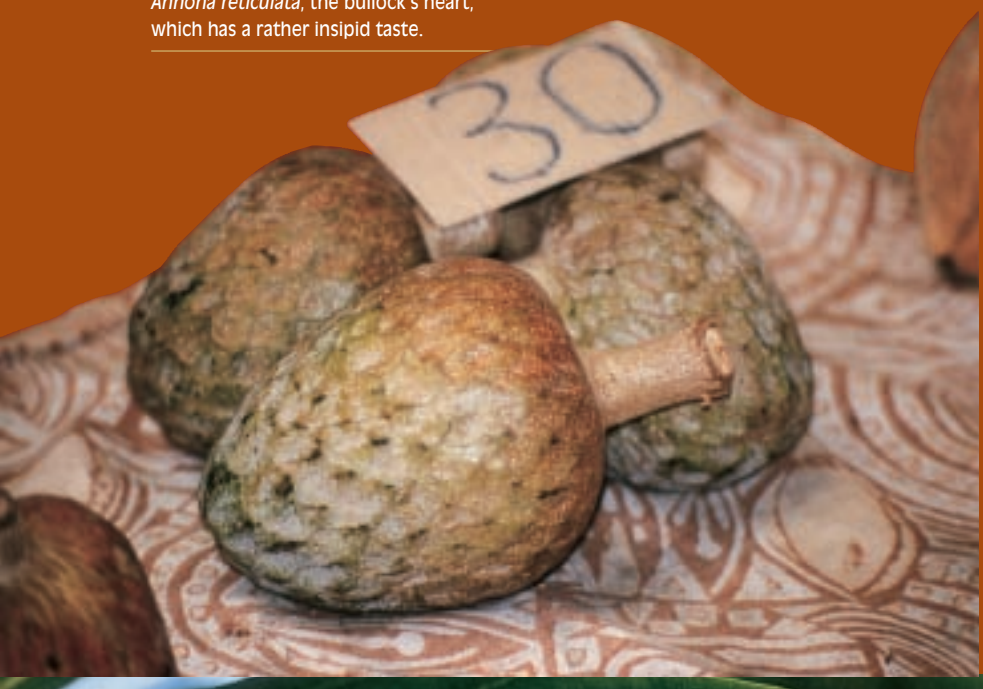
Island cabbage (aibika) for sale in the market: the vegetable par excellence of the ni-Vanuatu.

Annona muricata, the soursop, a very popular fruit.

© D. Greindl

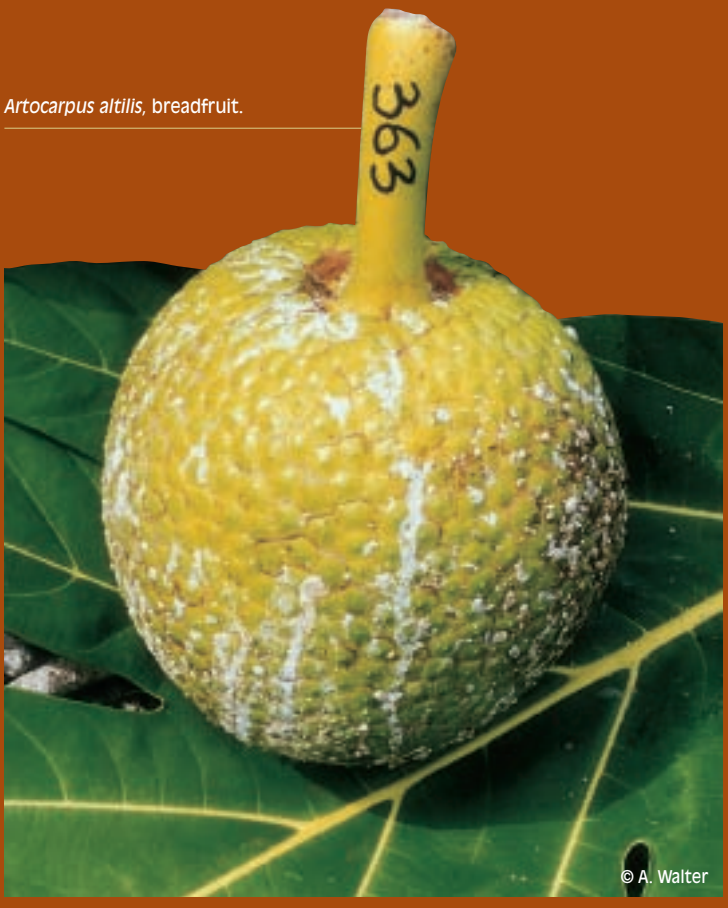
Cultivar of island cabbage or aibika (*Abelmoschus manihot*) called "octopus fingers" because of its long, fine leaves.

Annona reticulata, the bullock's heart, which has a rather insipid taste.



Annona squamosa, the sweetsop or custard apple, the least common of the Annona species in Vanuatu.

Artocarpus altilis, breadfruit.



Breadfruit is one of the most significant plants in Melanesian arboriculture. Its diversity is very great.

Breadfruits (*Artocarpus altilis*), baked on hot coals, to be eaten just as they are.

Parcels of *nalot* which are most often prepared for a morning meal. Breadfruit pulp is pounded, then sprinkled with coconut milk.

Artocarpus altilis, breadfruit tree.

Carambola or star fruit (*Averrhoa carambola*), a somewhat acid fruit.

Pods of *Cajanus cajan*, the pigeonpea.

Papaya or pawpaw *(Carica papaya).*

A common fruit in Vanuatu, the papaya is tasty and affordable.

Caryota ophiopelis: leaves and fruits

© V. Lebot

Citrus aurantifolia: lime.

Lime, lemon, grapefruit, orange and mandarin nowadays form part of the ni-Vanuatu cropping system, and their cultivation is increasing rapidly.

Citrus paradisi, grapefruit.

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Citrus reticulata, mandarin, is very popular in Vanuatu.

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Citrus grandis, pomelo

Citrus sinensis, sweet orange, is found in all the villages.

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Coconut *(Cocos nucifera)*.

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Young coconuts with their fibrous outer coat removed for sale.

Coconut together with breadfruit is one of the main fruiting trees. Its commercial cultivation is important.

Preparation of coconut milk. The coconut flesh is grated and then squeezed to extract the milk.

Cycas (*Cycas rumphii*) is a very ancient plant that is present throughout the archipelago.

The cycas, which is very toxic, is a plant for times of food scarcity that requires long preparation before it can be eaten.

Cycas, the symbol of Vanuatu, is one of the great ritual plants.

Litchi sinensis, a not very common tree in Vanuatu.

Basket of mangoes *(Mangifera indica)*.

Mango trees are much appreciated for their fruit and shade. The tree is found in abundance.

Sago palm fruits (*Metroxylon warburgii*). A starchy material is also extracted from the sago palm, which is used to prepare a traditional dish, sago.

Persea americana, avocado, is quite rare in villages.

Piper methysticum, used to make kava, the traditional drink of the Pacific.

Polyscias fruticosa, planted as a hedge.

Polyscias are ancient plants that adorn the surrounds of villages and houses.

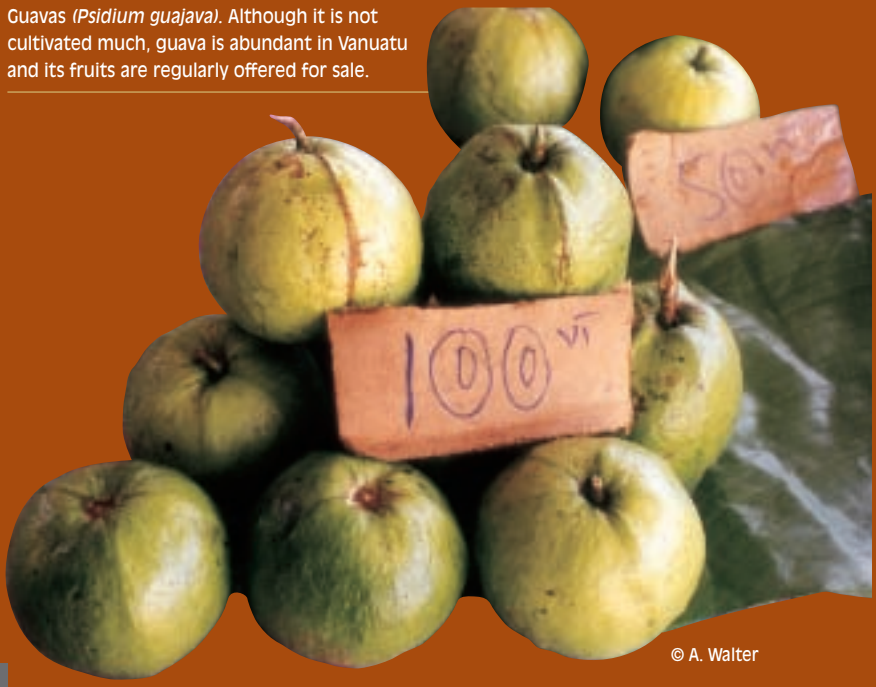
Polyscias scutellaria.

© F. Tzerikiantz

Above: *Pseuderanthemum pelagicum.*

Left: *Pseuderanthemum carruthersii.* Poorly known, these plants are very close to polyscias, with which they are mixed in hedges.

Guavas *(Psidium guajava).* Although it is not cultivated much, guava is abundant in Vanuatu and its fruits are regularly offered for sale.



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Cultivation and production

In ancient times coconuts would simply have been picked from the wild, but they were very quickly cultivated by the local populations. Even aboriginal peoples in Australia, who did not practise agriculture, from time to time planted coconuts. The tree grows up to 600 m altitude. In Vanuatu before the arrival of Europeans the species was part of the stock of fruiting trees that were planted along tracks or in areas set aside near villages. Nowadays in rural areas coconuts are still planted in these places and around gardens and houses, or even in forests at low altitudes for slaking the thirst of passers-by. It is more and more used for occupying land that is under legal dispute, and at the end of their cultivation cycle the farmers plant into their gardens young plants that identify the owner of the land. In earlier times the nuts were exchanged by people of coastal areas for taro or other products from inland areas. Finally, a modern practice in Vanuatu is to graze cattle under coconuts in plantations. Coconuts were first grown in a plantation in 1840, and from the end of the 19th century in Vanuatu. Nowadays coconut groves cover about 90,000 ha of which about 30% are used for eating and the remainder is made into copra when the price is good. The average yields are low, of the order of half a tonne of copra per hectare. This poor performance is attributed to little upkeep of the coconut plantations and low-yielding local varieties.

Although coconut yields poorly above 400 m altitude, it grows particularly well in the infertile coralline soils of the coast, where few other crops will grow. In contrast, growing it inland creates problems because of its dominant root system and its shade which inhibits good growth of various other crops. Although the coconut remains an important food crop, copra is a commodity heading rapidly to ruin and the coconut plantations are senescent. The number of coconut palms in need of replanting is estimated at over 600,000 per year in order to regenerate the existing coconut plantations.

In Vanuatu a viral disease called coconut foliar decay is endemic, and is transmitted by the insect *Myndus taffini*. It does not affect production of local cultivars which are totally resistant, but exotic cultivars suffer serious mortality. Many insects damage the leaf tissue, young and mature, reducing the photosynthetic capacity of the plant and hence its yield. Flying foxes, which are large, fruit-eating bats, cause serious damage when they eat the young inflorescences.

Alimentary uses

Coconuts are eaten at various stages of maturity. When they are still young and soft the rich flesh is given to children, and when they are mature they are eaten as they are, or grated in order to extract the coconut milk that is used for seasoning dishes. The milk may be cooked slightly (when it gets a clotted

appearance), or for a very long time in order to extract the oil. Both preparations may then be used as sauces to dress *lap-lap* and the small balls of breadfruit paste called *nalots*. The coconut water from the central cavity is drunk as it is. Finally the germinating nut, which becomes round and spongy, is nibbled between meals. The heart (i.e. the terminal bud) is edible. In Santo the spathe is completely burned to ash that contains mineral salts. This ash is then diluted with water and filtered, to provide a salty liquid for cooking.

Other uses

The non-food uses of coconut are numerous: lubricating oil, fats for making soap and cosmetics, fuelwood, ropes, brooms, timber for making artisanal objects, and so on. In Vanuatu the fronds are used for making roofs, matting for the ground, and baskets; the leaf ribs with the leaves removed are fastened in bundles to make brooms. The roots and bark have medicinal uses. The trunk is used in the construction of dwellings, and more recently for making small furniture and artisanal objects. The wadded fibre is sometimes used in canoe-making. The hard shell of the nut is used as a drinking vessel for kava, and sometimes for making spoons. The coconut flesh, dried in the sun or in drying ovens, provides copra whose oil is used in making margarine. Before being replaced by soybean oil in the 1960s, it was the main source of vegetable oil.

Genus
Cycas

Family
Cycadaceae

The genus comprises 40 or 50 species distributed from India to northern Australia, with some representatives in Madagascar and East Africa.

Species present
Cycas rumphii Miquel
Cycas, cycad

Cycas is only eaten in times of famine by the communities of Epi. But it is an ancient plant and one of the major ritual plants of Vanuatu.

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Food plant in times of famine, local

Cycas rumphii

Cycas, cycad

History

A very ancient tree, fossilised traces of which have been found in ancient geological strata. *C. rumphii* is found in the wild or spontaneous state from Madagascar to Polynesia and Micronesia, via Southeast Asia and northern Australia. Native to Vanuatu or carried by the very first migrants in their canoes, the tree is present everywhere in the archipelago, generally in a cultivated state.

Description

Cycas rumphii resembles a palm tree, with a cylindrical, woody trunk 5 m in height. Leaves **pinnate**, grouped at the top of the trunk, long, made up of 50–150 pairs of narrow leaflets, smooth, shiny green, 25 cm x 1.5 cm. Plant **dioecious**. Male flowers arranged in a long cone, thick and yellow, arising annually. The female plant produces modified brown leaves (sporophylls) and a row of oval structures (ovules) producing oval seeds at maturity, red or orange, 3–4 cm in diameter.

Morphological variability

Unknown.

Cultivation and production

The trees are planted as isolated individuals, by transplanting young shoots. The young plant grows very slowly, and therefore needs regular attention so that it is not overgrown by weeds.

Alimentary uses

C. rumphii is highly toxic, but despite this it is used as a food plant in times of famine by many communities, from Papua New Guinea to Fiji and Guam. In order to make it safely edible, it requires long preparation. The pith of the trunk and the seeds may be used. With both of these it is necessary first to grate the plant material, then wrap it in leaves and macerate it in water for several days, with regular changes of water. The resulting flour is collected by straining, and is dried and then cooked in an oven of hot stones to make a type of pudding. In Vanuatu the seeds are not used, and the trunk very little (by some communities, such as in Epi, following Cyclone Uma). It is only a food plant for times of famine.

Other uses

In Solomon Islands the plant is used in medicine for treatment of yaws and tropical ulcers, and in the Philippines for sores, itching and skin disorders. Its seeds threaded on to a string make a toy for children. A symbol of Vanuatu that is present on its flag, *Cycas rumphii* is one of the symbols that a man of high rank must buy in order to attain a still higher position. He pays with pigs with recurved tusks, and plants it close to the *nakamal*[17] during a grand ceremony. In forests or close to villages, lines of cycads or isolated plants may be observed. The tree is also very decorative. In earlier times its fronds were used as a calendar. When a meeting was scheduled each participant in the meeting would detach, from one side of the leaf, a leaflet each day until the day marked as that of the appointment. Likewise the large leaves were used to count the number of guests during a customary feast, by pulling off one leaflet for each person present. And when a place is to be declared taboo and access is to be forbidden, two crossed cycad leaves are placed across the entrance (a ban whose symbol is respected by all).

[17] Bislama term for a building (clan hut) for men.

Genus
Litchi

Family
Sapindaceae

The genus, which is monospecific, is originally from the northern part of Southeast Asia, but has been diversified in China.

Species present
Litchi sinensis Sonnerat
Lychee, litchi

Although its fruits are very popular the tree is not very common in Vanuatu, where it grows poorly. Some fine specimens nevertheless produce fruits which may be sold in the markets. However, harvesting is mainly restricted to family and friends.

References
Bose *et al.* (1999), *Encyclopédie des aliments* (1997), Menzel (1983, 1984, 1990), Mitra (1999), Popenoe (1974), Verheij & Coronel, eds (1992), Viard (1995), Weightman (1989), Zeven & de Wet (1982).

Plant occasionally eaten, introduced

Litchi sinensis

Lychee, litchi

History

The lychee is originally from the northern part of Southeast Asia, and has been cultivated there for around 2000 years. Introduced to China[18] a long time ago, this delicious fruit is highly valued there. It was customary for the mandarins to offer this fruit to their ruler. Lychee travels very poorly, and it took until the end of the 19th century to reach other tropical regions such as Vanuatu. Its perishable seed does not survive long times in transit, and the climatic requirements of the plant make its fruiting problematical. It is nowadays found in many regions, up to slight altitude.

Description

Tree 10–15 m in height. Leaves composite with two to four pairs of elliptical leaflets, **coriaceous**, 12 x 3.5 cm. Flowers grouped in large **panicles**, yellow-green, small in size. Fruits rounded, 3 cm in diameter; epidermis thick and **rugose**, green or pink; **aril** translucent with a fragrant taste; the nut is brown and elongate.

[18] It is often stated that it originated there.

Morphological variability

Numerous cultivars exist, and are distinguished by the shape and size of the fruits, or of the trees that bear them. There has been much crossing of the genetic diversity in research stations in attempts to produce new varieties. The trend particularly is to select small nut size and varieties that are early or late.

Cultivation and production

In the tropics the tree does not bear well unless the dry season is cool but without frost. Its flowering is often much greater than its fruiting. The lychee likes heavy and humid soils. It is propagated by cuttings and bears fruit after 4–6 years. In Vanuatu the tree is planted in ornamental gardens of urban homes, and scattered around the rural villages where it is less common. Production is usually just for home consumption, and few fruits reach the markets. It is worth noting that the lychee is a tree that is long-lived, and in certain countries can produce high yields (150 kg of fruits per year).

Alimentary uses

The fruits are eaten raw after the thick outer coat has been removed.

Genus
Mangifera

Family
Anacardiaceae

The genus comprises about 60 species distributed from Sri Lanka to Micronesia. In Vanuatu there is one species.

Species present
Mangifera indica L.
Mango

Mango, introduced early into the archipelago, has been widely adopted by the local people. Nowadays it is a common tree that grows abundantly in all the islands, near the sea, within the villages, along tracks, around gardens and in plantations.

References
Bompard (1993), **Bompard & Schnell (1997)**, de Candolle (1883), Kostermans & Bompard (1993), de Laroussilhe (1980), Mukherjee (1949, 1972), Popenoe (1974), Purseglove (1991), Schnell & Knight (1993), Singh (1960), Verheij & Coronel, eds (1992), Viard (1995), Weightman (1989), Zeven & de Wet (1982).

Complementary food plant, introduced

Mangifera indica

Mango

History

Mango grows in the wild state in the foothills of northeast India, Myanmar and Bangladesh, probably also in the foothills of the Himalayas in Sikkim, and in Southeast Asia. It was domesticated independently in Myanmar and in northeast India by divergent processes of domestication. The Indian forms, the great majority of which are monoembryonic, were selected and propagated by vegetative means during the Mogul era (1526–1858). The Indians took them to neighbouring countries, the Malayan Peninsula and the Philippines, but also to the Hindu states of Southeast Asia. However, the polyembryonic native forms undoubtedly existed in Southeast Asia even before the introduction of the Indian forms, and these forms were also ones that were domesticated in the region. The Persians introduced the mango to East Africa in the 10th century AD. Then, during the era of great exploration, the Portuguese discovered the fruit and spread it to West Africa, the Pacific and then Mexico in the

18th century. Mango was introduced to Vanuatu from the island of Réunion and New Caledonia, and then reintroduced several times by missionaries, by people returning from working in plantations, and by seafarers. The most important populations of mangoes are found in Tanna, Malekula and on the west coast of Santo.

Description

Large tree 20–40 m in height, with a dense crown. Leaves produced by vegetative shoots, arranged in spirals, simple, elliptical or lanceolate, red in the juvenile state then green and shiny, coriaceous, 8–40 x 2–10 cm; petiole thick, expanded at the base. Panicle terminal, branched, long (6–40 cm, bearing subsessile, polygamous flowers, scented, calyx yellowish, 5 creamy petals streaked with yellow or purple, then rosy. Fruits variable in shape and size, orange. Endocarp, or nut, flattened, fibrous, woody and large in size.

Morphological variability

The number of cultivars is significant and each region of the world has chosen its own range according to the shape, the size and the taste of the fruits. These are generally rounded or ovoid, to some degree flattened, varying from yellow-orange to orange-red, spotted with brown or not, according to cultivar. The flesh is more or less thick, juicy or fibrous. The greatest diversity is found in India, Southeast Asia and the Philippines. Four groups are customarily distinguished:

- a group with polyembryonic seeds and oblong fruits, common in Southeast Asia
- a group with mono-embryonic seeds and round fruits, common in India
- a group intermediate in shape, also common in India
- a group known under the name of Sandersha-Haden encompassing hybrids developed in Florida and Hawaii

Apart from these groups, numerous varieties exist as a result of local selection or selections made during agronomic research. In Vanuatu there is great morphological variability, but many are trees that have not been selected and are of poor quality, and the variability has not been studied in any detail. There is a potential market, including exports, for varieties of good quality – non-fibrous, sweet and of good size.

Cultivation and production

Although mango is mainly a plant of the lowland tropics, it can grow at altitude as long as it is not subject to frost. It prefers regions with clearly marked seasons, including a dry season which favours flowering and fruiting. For this reason it is particularly adapted to the

leeward coasts of the islands of Vanuatu. It tolerates a wide variety of soils as long as they are neither too alkaline nor too acid. Propagation of mango is by planting the entire nut, or the seed removed from the endocarp. It may also be by marcotting or grafting. The young seedlings are transplanted into pots when the first leaves have become green, and then into the chosen piece of ground six months later. In Vanuatu the nut is sometimes planted directly into the soil, or more often wild seedlings that are well developed are transplanted. A very good crop is generally borne every three or four years, although this varies according to cultivar. The tree is grown on the sea-coast, on the edges of villages and around the gardens.

Alimentary uses

In Vanuatu the fruits are eaten raw when they begin to ripen and when they are fully ripe, after being peeled. The flesh is often sucked out of a small hole made in the epicarp. During the season the consumption of these fruits is high, and large quantities are found in the markets. The young leaves are also used to make infusions. Some local enterprises are beginning to sell dried mangoes or mangoes preserved in sugar syrup.

Other uses

In some countries the seeds are fed to cattle. In Vanuatu this tree with its attractive crown is often grown as a shade tree. Small wooden benches are constructed at the foot of the tree, and the villagers can chat there shaded from the sun.

Genus
Metroxylon

Family
Arecaceae

The genus comprises five species distributed from Thailand to Samoa. One edible species is present in Vanuatu.

Species present
Metroxylon warburgii (Heim.) Beccari
Sago palm, sago

In earlier times used by a number of communities, such as those in Santo, sago is nowadays only prepared as food in times of food scarcity.

References
Barrau (1958, 1959, 1962), Christophersen, ed. (1971), Connell & Hamnet (1978), Dowe (1989), McClatchey & Cox (1992), **Rauwerdink (1986)**.

Plant in times of famine, local

Metroxylon warburgii

Sago palm, sago

History

This palm is found from Santa Cruz to Samoa, but its centre of origin is limited to Indonesia and Papua New Guinea. It was almost certainly introduced to Vanuatu in ancient times, and it is rare from Vanuatu onwards. It was introduced to Rotuma by the Melanesians, and from there it spread to the central islands of Polynesia.

Description

Monoecious, arborescent palm, trunk 7 m long. Leaves composite, long (3 m); leaflets straight, narrow and long; petiole with a broad, concave base, furnished with large spines on its outer surface. Large, erect inflorescence at the top of the palm; its primary branches enclosed in a spathe, and its secondary branches bearing alternate **spikes** set with pairs of flowers, one male and one female. Fruits pear-shaped, 10 x 7 cm, covered with overlapping scales; base depressed.

Morphological variability

This cultivated species has several cultivars according to the height of the tree and the size of the fruits.

Cultivation and production

The sago palm is found in small groups in areas that are slightly marshy or are close to water-courses. It is propagated by its fruits or by transplanting young shoots. The tree grows for at least eight years before producing one single inflorescence. The fruits reach maturity after three years, and the tree then dies, having only the single growing axis.

Alimentary uses

Before the inflorescence appears, the trunk of the sago palm is filled with starchy matter which is extracted for the preparation of sago. To do this it is necessary to fell the tree, cut the trunk down the middle and scrape out the inside to obtain a dense powder which is washed with water. The flour thus obtained after sedimentation is dried. It is then cooked in an oven with hot stones or made into *lap-lap*. In earlier times this food was prepared in the centre of Santo, in Torres, in Banks and no doubt in other places. Nowadays only a few elderly people still know sago, which can be used as a foodstuff in times of food scarcity.

Other uses

In Vanuatu the sago palm is most of all grown for its leaves, which are used for making 'tiles' of plant material that are used to cover the roofs of traditional houses. Its fruit is used for making the bowls of pipes.

Genus
Persea

Family
Lauraceae

The genus comprises about 50 species, most originating from Latin America. Ten or so bear edible fruits. A single species is present in Vanuatu.

Species present
Persea americana Miller
Avocado

Introduced at the same time as other fruits, avocado does not enjoy the same popularity with the local people. It is very common in urban and peri-urban areas and is sold in large quantities in the local markets, but it is much less common in the villages where it is only eaten occasionally.

References
Bergh (1969, 1986, 1992), Coronel (1994), Ochse *et al.* (1961), Purseglove (1991), Schroeder (1958), **Scora & Bergh (1992)**, Smartt & Simmonds, eds (1995), Storey *et al.* (1986), Verheij & Coronel, eds (1992), Zeven & de Wet (1982).

Plant occasionally eaten, introduced

Persea americana

Avocado

History

This strange fruit, not juicy but with oily flesh, appeared in Central America. Some think that it was spread 10,000 years ago by large herbivores that fed on its flesh and then passed out the large seeds in their droppings. This extinct fauna has left behind it a fruit that has been used by the native populations for 8,000 years. They progressively selected better cultivars. Although the fruit was taken to southern Spain in 1610, it was not spread around the tropical world before the end of the 19th century. Doubtless some adaptation was needed for people to take to this fruit with fatty flesh and such a characteristic taste. Introduced to Vanuatu at the beginning of the last century, avocado has still not spread much through the islands, and remains concentrated around towns, most often in the gardens of expatriates. Nevertheless, the local populations are now cultivating it increasingly for sale in the markets.

Description

Tree 10–20 m in height. Leaves arising in successive bursts of growth, arranged in spirals towards the ends of branches, oblong, variable in colour and size. Inflorescences with numerous flowers, each with a calyx of six pale yellow **tepals**, arranged in two rows. Fruits pear-shaped or globular, variable in size (7–20 cm long), with an epicarp that is more or less thick, variable in colour (from light to dark green, chestnut brown or purple), with oily flesh varying from yellow to green, containing a large, round, brown seed.

Morphological variability

Three sub-species of avocado have been distinguished:

- Mexican (subspecies *drymifolia*): native to mountain regions of Mexico, it is adapted to high altitude (1,500–3,000 m) and very resistant to cold. Bears small, very fatty fruits, with a big seed that is loose inside a large cavity; skin fine and smooth; reaching maturity 6-9 months after flowering;
- Guatemalan (subspecies *guatemalensis*): native to the chain of mountains of Central America, it is adapted to medium altitude (1,000–2,000 m). Bears large, less fatty fruits, with a small seed that adheres to the flesh and with a thick and rugose skin; reaching maturity 9-12 months after flowering; peduncle long;
- West Indian (subspecies *americana*): despite its name it did not originate in the West Indies but in lowland areas of Central America. It is adapted to sea-coasts and is fairly tolerant to salinity. It bears big fruits with a large seed that is loose inside a central cavity, and has a fairly thick but smooth skin. The peduncle is short.

The differentiation of these three subspecies is not very clear. Moreover, the subspecies *guatemalensis* may have resulted from hybridisation between two wild species of *Persea*. Hybrids are obtained by crossing these three subspecies, and about 700 cultivars of avocado exist around the world, either selected locally by indigenous populations or created in agricultural research stations.

In Vanuatu, several varieties of avocado exist according to the size and the shape of the fruit and the colour and the taste of the flesh. At the beginning of the 1980s the Tagabé Agriculture Station introduced selected varieties (Duke, Hass, Gottfried, Dickinson, Anaheim, etc.) that were well adapted to local conditions, and distributed them to the farmers of Efate. Since then the fruits have appeared in the Port Vila markets.

Cultivation and production

Fruiting is irregular and depends on whether or not there are heavy rains that knock off the tiny

flowers before the fruits are set. No serious diseases are known in Vanuatu. However, the fruits must be picked carefully to avoid mechanical damage and bruising. In orchards the trees are planted 9 m apart, in a triangular pattern, to maximise development of good vegetative growth. The production seasons are relatively short, and it is therefore necessary to grow several varieties, early and late, to extend the period of harvest.

Alimentary uses

Avocado is eaten raw after being peeled or by scooping the flesh directly out of a fruit cut in half. It may be improved with various dressings, mixed with salads, added to soups or used as a butter to spread on sandwiches. It can also be used for making sauces or even sorbets flavoured with lemon juice. On the other hand it does not cook at all well. Its nutritional qualities are great and well recognised: it contains about a dozen vitamins and mineral salts, dietary fibre and mono-unsaturated lipids (intake of which protects against cardio-vascular problems). It is a good food for weaning children.

Genus
Piper

Family
Piperaceae

The genus, which is pantropical, comprises close to 1,200 species, the majority of which originate from the New World. On the other hand the majority of species of pepper come originally from Southeast Asia. Two alimentary species of *Piper* occur in Vanuatu – an introduced pepper and a native species that provides a calming beverage.

Species present
Piper methysticum Forst. f.
Kava

Piper nigrum L.
Pepper (minor climbing plant: see CD-ROM)

Kava is one of the most ancient cultivated plants of Vanuatu where it has been domesticated, while pepper is a recent introduction. While not strictly a food plant, kava provides a ritual beverage that bears the same name.

References
Chew Wee-Lek (1972), Hubert (1987), Lebot & Aradhya (1992), PROSEA (1999), Purseglove (1991), Smartt & Simmonds, eds (1995), Waard & Zeven (1969), Zeven & de Wet (1982).

Complementary food plant, local

Piper methysticum

Kava

History

Kava was domesticated from a wild ancestor, *Piper wichmannii*, in the north of the Vanuatu archipelago. It was probably in the province of Penama that the first varieties, improved by vegetative means, were selected and distributed throughout the archipelago. Kava was later found by Polynesian seafarers and spread to all the islands that they colonised. It is also found in Ponape and in some isolated places in Papua New Guinea. Missionaries and colonial administrators never ceased trying to forbid its consumption[19], but achievement of Independence by the various nations using kava and a desire to reaffirm cultural identity has led to restoration of its use, and nowadays its consumption is increasing rapidly. Kava is henceforth the traditional beverage of the Pacific.

[19] The colonial authorities stigmatised the plant itself, suspecting it of being a drug, and seeing it also as a ritual symbol of a traditional culture.

Description

Bushy or shrubby plant, from 1–4 m in height according to variety. Leaves alternate, simple, delicate, **entire**, heart-shaped, 8–25 cm long; petiole 2–6 cm. Species dioecious. Inflorescences opposite to the leaves. Flowers unisexual, small, without either calyx or corolla, sessile. No fruits or seeds.

Morphological variability

In Oceania 115 distinct morphotypes have been counted, 82 of which are in Vanuatu. The cultivars are distinguished according to their growth habit, the length of the internodes, the thickness and colour of the stems (light green to purple and almost black), and the shape and colour of the leaves. But it is the functional characteristic of the plant – the kavalactone content – that provides the variability of greatest significance.

Cultivation and production

Kava is sterile and is therefore propagated by cuttings of stems placed directly into the ground after the soil has been quickly dug over. Plants are set 1–3 m apart in all directions, and are often intercropped with subsistence crops. Upkeep is limited to weeding (especially when the plants are young), to mounding up once or twice a year to put more soil around the plant base and thus promote growth of young stalks, and to pruning of senescent or suckering stems. Harvesting takes place after three years, and care is taken to minimise damage to the roots which are richest in kavalactones. Kava dieback is caused by a virus (CMV) together with some co-factors that have not yet been identified. It is best to grow the kava in very fertile patches of soil because weak plants are vulnerable to the disease. It is necessary to prune the stems regularly, once or twice per year, to promote branching. No other serious problems are known, but the nutritional needs of the plant are important. Regular composting is advised.

Alimentary uses

The fresh root is ground up, mixed with water, then squeezed and filtered in order to obtain a fresh extract which oxidises and deteriorates quite quickly. This kava extract is drunk each evening in the hundreds of *nakamals* and kava bars that are spread around the country. It is rich in fibre, starch, minerals (K, Ca, Mg, Fe, Zn, Mn) and in protein (3.6%), and it is low in calories. The kavalactones have a relaxing effect.

Other uses

The active principles of kava provide a veritable panacea in traditional medicine. It is used to treat rheumatism, influenza, aches and pains and other afflictions.

Genus
Polyscias

Family
Araliaceae

The genus comprises 150 species present in the Old World tropics, mainly in the Pacific islands. Vanuatu is home to 8 species.

Species present
Polyscias cissodendron (C. Moore & F. Mueller) Harms

Polyscias cumingiana (K. Presl.) Fernandez-Villar.

Polyscias fruticosa (L.) Harms

Polyscias guilfoylei (Bull.) Bailey

Polyscias multijuga (A. Gray) Harms

Polyscias samoensis (A. Gray) Harms

Polyscias schmidii Lowry

Polyscias scutellaria (Burman f.) Fosberg

In Vanuatu the polyscias are ancient plants, present well before European contact. They are regularly seen planted as hedges around villages and houses. They provide a source of edible leaves that are readily to hand, and are usually eaten within the family. A few bunches are sometimes found in markets. The village people do not make any particular distinction between the different species although they recognise them as different forms. We thus treat all the species together here.

References
Brown (1935), Henderson & Hancock (1989), **Lowry (1989)**, Lowry *et al.* (1986), Ochse & Bakhuizen van den Brink (1980), Philipson (1979), PROSEA (1994), Smith (1985), Smith & Stone (1968), Stone (1965a, b), Womersley (1978), Yuncker, ed. (1971).

Plants occasionally eaten, local or introduced

Polyscias spp.

Polyscias

History

The polyscias of Vanuatu reflect the relationship that the flora of that country has with the floras of neighbouring countries. Thus *P. schmidii* comes from New

Polyscias fructicosa

Caledonia, *P. samoensis* from Samoa, *P. multijuga* almost certainly from Fiji and Tonga, while *P. cissodendron*, *P. cumingiana* and *P. fruticosa* are spread from the Malayan Region to the western Pacific and *P. scutellaria* is almost certainly native to Vanuatu and Solomon Islands. Present in all the villages, the majority are cultivated for their edible leaves and as ornamental plants.

Description

Shrubby trees 2–5 m in height, branched at the base, with jointed stems. Leaves composite, entire or greatly dissected. Inflorescence **apical**, in the form of an **umbel** carrying flowers that are hermaphrodite or unisexual. Fruit fleshy, surmounted by a persistent calyx. The distinction of the species is principally according to whether the leaves are unipinnate or

bipinnate (or even **tripinnate**). Among the species with bipinnate or tripinnate leaves are:

- *P. guilfoylei*: leaflets elliptical, very weakly dentate, dark green or yellow, marked with white on the margins;
- *P. fruticosa*: leaflets markedly dentate or completely divided, sometimes giving them the appearance of a feather duster, very elongate (up to 30 cm). Flowers in bunches, small, yellowish.

All the other species are unipinnate, and are separated into species with a smooth petiole and no sheath at the base and those with a sheath at the base.

In the group without a sheath are found:

- *P. cissodendron*: leaves not exceeding 40 cm in length, composed of about ten oval leaflets, dark green. Fruits joined for more than half their length;
- *P. schmidii*: large leaves reaching 90 cm in length, made up of about 20 oval leaflets, almost sickle-shaped. Fruits not joined, flattened and elliptical.

The group with a sheath includes:

- *P. multijuga*: long leaves (50–100 cm) made up of about 20 oblong leaflets. Small flowers, sessile, with two styles, arranged in bunches on a long **raceme**. Small purple fruits, laterally flattened;
- *P. samoensis*: very close to *P. multijuga*, distinguished by its flowers and fruits that are pedicellate (longer than 7 mm);
- *P. scutellaria*: leaves (13–40 cm) composed of three to five oblong leaflets whose margins are often curled over, dark green; sheath at the base of the petiole. Small flowers with three to five styles, grouped in racemes. Small, round fruits which are rare;
- *P. cumingiana*: long leaves (40–75 cm) made up of 5–15 green leaflets, or golden yellow leaves that are completely dissected.
- *P. guilfoylei*, which is a cultivated species, can sometimes have unipinnate leaves with leaflets that are very dissected.

Morphological variability

The variability of each species is very great, amplified by cultivation and selection. When planted in the shade polyscias are usually green; when planted in the sun, as they usually are, the foliage becomes pale yellow, golden yellow or red in certain forms. The village people do not distinguish between the different species, but they do recognise numerous cultivars within the overall group.

Cultivation and production

The plants are cultivated everywhere, planted in hedges in the villages, on the low walls of the irrigated taro pits and around the gardens. They are propagated by cuttings, and with continual pruning they come to form thick barriers of vegetation around the villages and large thickets close to the houses.

Alimentary uses

Since all the species are grouped together by the villagers under a single vernacular name, it is quite difficult to know exactly which are eaten and which not. However, *P. fruticosa* and *P. scutellaria*, followed by *P. guilfoylei* and *P. samoensis*, are the ones that are found most often being cultivated for alimentary use. The young leaves add flavour to meat cooked in an oven of hot stones, or to fish. They are also boiled in small bamboo containers or in *marmites* and then seasoned with coconut milk. They are also added to certain soups. Fish and pork are sometimes wrapped in polyscias leaves before being cooked. Available throughout the year, and though eaten in small quantities it is nevertheless an important vegetable.

Other uses

The plant is ornamental, and promotes lactation. It is used for treatment of certain illnesses such as ciguatera poisoning.

Genus
Pseuderanthemum

Family
Acanthaceae

Species present
Pseuderanthemum carruthersii (Seem.) Guillaumin

Pseuderanthemum longifolium (Forst. f.) Guillaumin

Pseuderanthemum pelagicum Seem.

Pseuderanthemum repandum (Forst. f.) Guillaumin (not a food plant)

Pseuderanthemum tubercula Radek (not a food plant)

Pseuderanthemum whartonianum Hemsley

Very close to the polyscias with which they are mixed in the hedges and used in the same manner, the *Pseuderanthemum* species are very poorly known. The various species are treated together here.

References
Henderson & Hancock (1989), Parham (1972), Peekel (1984).

Plants occasionally eaten, introduced and local

Pseuderanthemum spp.

History

Numerous species of *Pseuderanthemum* exist. Many among them are endemic to restricted regions, while others have moved with human migrations. They are poorly known.

Description

Bushy plant. Leaves lanceolate, green, red or bicoloured according to cultivar, variable in size; margins entire or dentate, even wavy. Terminal spike bearing white or mauve flowers, bell-shaped with a long neck, the lower lip often spotted with red. Cylindrical capsule bearing a beak-like structure, constricted between the seeds.

Morphological variability

It is at least as large as that of *Polyscias* species.

Cultivation and production

The cultivation and production of *Pseuderanthemum* is identical to that of *Polyscias*.

Alimentary uses

Only *P. carruthersii*, *P. longifolium*, *P. pelagicum* and *P. whartonianum* appear to be eaten. The tops of the stems and the young leaves are occasionally picked in all the villages. They are never cooked in the oven but may be boiled or fried to go with taro, the association of these two foods being much valued. They may also be munched raw, or mixed with cooked taro leaves. Women who are about to give birth eat them regularly with baked taro; they must never be salted (or the quality will deteriorate).

Other uses

Pseuderanthemum species are used as hedge plants and ornamentals, and also provide wood for making rods for pulling hot stones out of traditional ovens. The leaves and bark of *P. whartonianum* are medicinal.

Genus
Psidium

Family
Myrtaceae

The genus comprises 100–150 species. Two are present in Vanuatu.

Species present
Psidium guajava L.
Guava

Psidium cattleianum Sabine
Strawberry guava (foraged species; see CD-ROM)

Introduced to Vanuatu, the guava is little cultivated but a few spontaneously growing species may be found everywhere. The fruits are regularly eaten and are sold in the markets. Here, like everywhere else, it is a pest in grazing areas and among crops. The strawberry guava is present in Vanuatu but is very rare.

References
Bourgeois *et al.* (1998), Coronel (1994), **Ellshoff (1994)**, Ellshoff *et al.* (1996), Ochse *et al.* (1961), Purseglove (1991), Rehm & Espig (1984), Ruehle (1948), Swarbrick (1997), Zeven & de Wet (1982).

Plant occasionally eaten, introduced

Psidium guajava

Guava

History

Guava is originally from tropical America, probably Brazil; it was cultivated early on and improved in the West Indies. At the beginning of the 16th century the Portuguese introduced it throughout the Pacific as far as the Philippines, and the Spanish took it to India. It then spread and became naturalised throughout the tropical world. In Vanuatu it is abundant, especially in the southern islands, and it has become a problem for many farmers because its vigorous and uncontrolled growth is hard to eradicate.

Description

Shrub or tree 6–8 m in height, branching from the base of the trunk. Leaves opposite, elliptical, pubescent on their lower surfaces, about 11 x 5 cm; petiole 1 cm in length. Flowers solitary, white, small; calyx persistent; stamens very numerous, 1–2 cm long. Fruits globular, ovoid, greenish or bright yellow, variable

in size (4–12 cm long); flesh white, yellow, pink or red. The seeds are enclosed in the flesh, and are hard, small and very numerous.

Morphological variability

There are about 150 varieties known around the world, according to the size of the fruit, the colour and taste of the flesh and even the vitamin C content. Numerous wild and cultivated morphotypes exist in Vanuatu.

Cultivation and production

Guava is a hardy plant that requires little attention, and is suited to various climate and soil types. It is not very resistant to frost but tolerates high humidity. It is grown from seed or by vegetative propagation. The seeds, which remain viable for up to a year, are sown in seedbeds and then transplanted after 7–8 months. Vegetative propagation is by marcotting and by suckers obtained by injuring the roots or grafts. The first fruits are produced 3–4 years after sowing; they require protection against various phytosanitary problems to which they are very susceptible. The trees may produce for around 30 years. In Vanuatu guava grows most often in a spontaneous state.

Alimentary uses

Guava is a fruit that can be eaten raw or cooked. It can be made into jam, jelly, and the famous guava paste that is made by gently cooking the de-seeded flesh with sugar. The fruit is five times higher in vitamin C than an orange. In Vanuatu guava is mainly eaten raw between meals. In Tanna the people use it as a staple food in times of food scarcity. The sweetest guavas provide excellent juice for children after a little boiled water has been added to it. It is a delicious fruit that is low in calories and high in potassium and in vitamin C.