

Toloa Rainforest Reserve

a guidebook for visitors

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This publication is also available in Tongan.

Tupou College appreciates your interest in the Toloa Reserve.
Please visit again.

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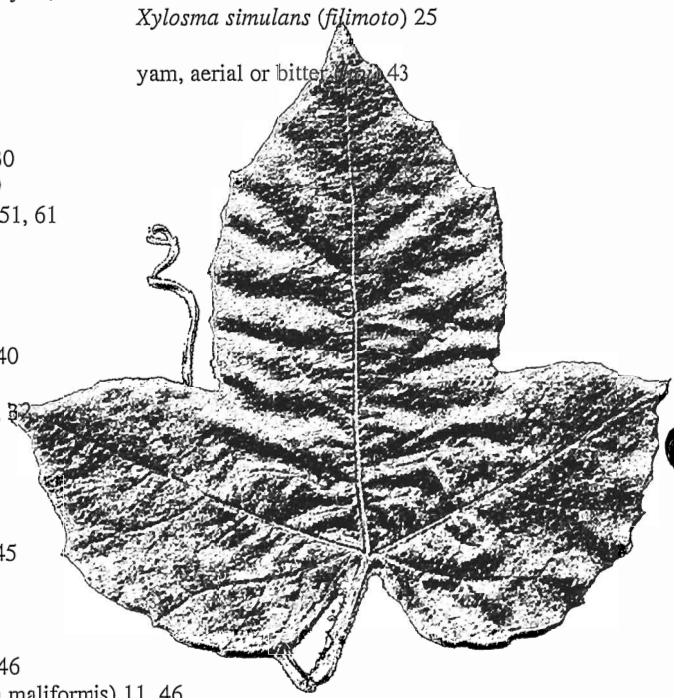
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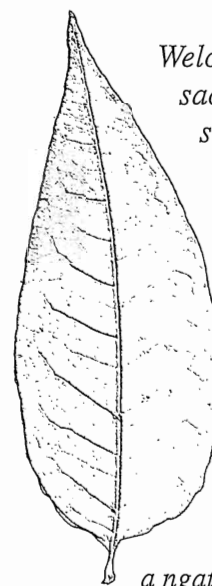


a vaine 'ae kumā leaf

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Welcome to the Toloa Rainforest Reserve, a traditionally sacred place that remains very special today. Take time to slow down and quieten as you enter the forest and become attuned to the sounds, smells and sights of the varied and abundant life around you. The greater time and attention you devote to your senses, the more you will gain from your visit. You will be rewarded by return visits at different times of the day. Experience it at dawn, for instance, or even at night. Tupou College has provided this booklet as a guide and souvenir to enhance your visit to the Toloa Rainforest Reserve, a precious remnant of tropical lowland forest.



a ngatata leaf

Most of the world's tropical rainforest is found within 10° latitude of the equator where the climate is hot and wet. Tonga is a tropical country, by virtue of being north of the Tropic of Capricorn. Toloa is about 21°15'S.

A rainforest is an area of dense vegetation with 3 distinct vertical layers:

1. a low zone of ferns and herbs (small, non-woody plants);
2. a middle zone of dense shrubs (relatively short, woody plants with branches forming near to the ground);
3. a high zone of tall spreading trees forming a canopy.

Each layer also has its own species of insects and animals. Inter-twined through the three zones are many different lianas (woody climbing vines) and epiphytes (plants growing on other plants) such as fungi that live on nutrients in the air and on the bark of trees. Most rainforest trees have shallow roots (less than one metre deep) and once the forest is cut down, the soil is not as fertile as you might expect.

The Toloa Rainforest Reserve is described as a lowland tropical forest of a kind that typically grows inland, 2-4km from the sea. In its natural, undisturbed state, this kind of forest has a dense canopy covering 91% of the forest at an average height of 11m. The Toloa forest is distinguished by the presence of *ngatata* and *fekika vao* trees in its canopy (Wizer, Burrows, Sykes, Drake & Savage, 1999).

Rainforests are extremely important for a number of reasons. Since 1850, the average temperature of the world has risen by approximately 1°C. Overwhelming scientific opinion now attributes this unprecedented global warming to human activities that add to the 'greenhouse gases' in the atmosphere (e.g., carbon dioxide, methane and chloro-fluoro-carbons). These atmospheric gases have doubled in the last 100 years. Trees and forests counteract this process by absorbing carbon dioxide and turning it into oxygen, which we can breathe.

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Clearing forests and burning wood and other fuels contribute directly to global warming. Over half the world's rainforests were cleared between 1945 and 1995 and clearing continues apace; an area of rainforest the size of a soccer field is cut down every second.

Global warming will cause serious problems that could be disastrous for Tonga. An increase of only a few degrees is causing polar ice to melt and sea levels to rise, leading to the flooding of low coastal areas such as Sopo and Kolovai on the western side of Tongatapu. Already there is clear evidence of major glaciers melting, such as those on Mount Kilimanjaro in east Africa.

Weather-related disasters are already increasing. The logging of trees can cause natural disasters, both indirectly through global warming and directly through erosion, landslides and flooding. Every year about 100,000 people are killed in so-called natural disasters and the livelihoods of a further 200 million people are affected. The world's poorest and most marginalised people are the worst affected.

Rising global temperatures also change precipitation and other climate conditions. Deserts will expand while crop yields and water supplies dwindle. As the sea rises, so will the ground water under atolls such as Tongatapu, destroying the fresh bore water supply and leading to increased salination of the soil until it can no longer sustain most forms of plant life. Thus the lower islands of Tonga may be uninhabitable long before they are inundated.

Changing climates could also threaten human health and harm birds, fish and many types of ecosystems, including forests. The preservation of rainforests is also vital because they contain most of the planet's bio-diversity (literally over 50% of all plant and animal species) and have millions of insect and plant species that have not yet been studied by scientists. There are thirteen rare plants in Tonga that are endemic (not found anywhere else). Thus, a mature forest serves as a carbon sink, a habitat for wildlife, a soil-builder and a green space with enriched local bio-diversity. It is also a place of unmatched cultural and scientific significance. Our own species derives direct benefit from all these.

History of Toloa forest

The island of Tongatapu is a coral atoll. Over thousands of years coral has grown on the top of a submerged 'seamount' (a mountain under the sea – Tongatapu is not itself volcanic, though there is evidence that it has at some point in its geologic history been covered in volcanic ash from an eruption near by). With the right oceanic conditions, a coral reef will, over a long period of time, continue to grow until it reaches the surface of the water. It slowly grows out too, creating a platform.

Low sand islands form when storm waves push sand and broken coral onto such a coral platform until land appears above high tide. New coral on the edge of the reef keeps growing out, while the older coral in the centre of the island dies and collapses, often sinking back down under the sea. This is why many atolls enclose a lagoon, such as we have on Tongatapu. If you fly to Ha'apai or Vava'u you should have a clear aerial view of coral atolls in various stages of formation.

Over time, organic matter washes up on new islands until they are able to support plant life and, eventually, birds, reptiles and mammals. Scientists think that plant life first emerged in south-east Asia, then spread to Indonesia and Papua New Guinea. Those plants well adapted for the long journey eventually reached Polynesia. Plants spread when their seeds are carried by the wind, or by birds and animals or by ocean currents. Many island plant species, such as coconuts, have buoyant, saltwater-resistant nuts and pods that allow them to float on the sea for months and still grow when they reach land. Others have sticky seeds that cling to the feathers of sea birds or migratory birds or else their fruits may be edible and are thus carried to other islands in birds' intestines. Through perhaps millions of years of evolutionary change, plants in Tonga have adapted to local conditions, including height above sea level, slope, soil, climate, temperature, rainfall and winds.

In contrast, iguanas and geckos are thought to have arrived from the east, floating on driftwood from as far away as South America. Various insects and other invertebrates may have

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caught a ride with the birds, reptiles or plants, or may have flown or been blown here by the winds. Having arrived on the atoll of Tongatapu, the plants and animals evolved together over thousands of years to form a complex, interdependent ecology ideally suited to the local climate and environment. Te Toloa Rainforest was once part of a continuous forest covering the entire island. We can assume that it once was connected with other remnants of forest that survive, such as the one at Lafalafa.

The first humans to live in Tonga are thought to have arrived just over 3,000 years ago. At that time, all of Tongatapu was covered in lush tropical rainforest. Tongans are thought to have come originally from Asia, travelling from Malaysia, through Indonesia and Melanesia, eventually reaching Tonga (Crane, 1991). These intrepid migrants were sailors, farmers, fishers, traders, warriors and artists.

The earliest Tongans developed a way of life dependent on the forests that were already well-established when they arrived. They learned which parts of which plants were edible. They discovered which plants offered medicinal remedies, many of which are still in use today. They found which timbers made the best houses and sea-going canoes. They used wood, leaves, fruit, bark, roots and flowers for many social and cultural purposes ranging from clothing and mats to musical instruments. Today Tonga's dynamic indigenous culture is part of everyday life.

Since humans first arrived in Tonga, they have had an impact on its native forests. The early Tongans introduced new species of plants, animals and insects, both deliberately and inadvertently. At the same time they hunted native birds and reptiles, sometimes to extinction. Europeans first made an impact on the culture and environment of Tonga from the late 18th century (and greatly influenced traditional medical practices, Whistler, 1992a). Plant species introduced by both indigenous and subsequent immigrants have changed the landscape enormously. Today, more than half of Tonga's plants are introduced, as are a number of species in the Toloa forest. Many of these introduced species have become a serious pest.

“the first humans to live in Tonga are thought to have come from Asia, through Melanesia, over 3,000 years ago.”

From the earliest times, people cleared the forest to make way for crops and houses. Traditionally, farmers retained many high forest trees and allowed the soil a regular fallow period in which to regenerate. There is evidence that some of the sub-canopy trees of the Toloa forest may have been cleared at some stage for traditional cultivation, while the oldest trees are well over a hundred years old. Felled timber was used for building, fencing, fuel, making boats, tools, weapons and for many other purposes. Modern methods of agriculture incorporate no period of fallow. Forest is cleared completely to make way for broadacre mono-cropping of export crops such as *hina* (squash pumpkin).

As the human population has grown (increasing five-fold in the 20th century) and lifestyles in Tonga have moved away from an affinity with and dependence on the forest, the survival of rainforest has become less important to humans. Consequently,

rainforests in Tonga, as elsewhere, have disappeared at an alarming rate. Today, about three-quarters of the land area of Tonga has been cleared for farming.

An even greater proportion of the main island of Tongatapu has been cleared, for farming and other purposes. Only 3.3% of the island is still host to native forest, and most of that is on the coast (Wiser, Burrows, Sykes, Drake & Savage, 1999). How is it that this small pocket of inland rainforest at Toloa has survived?

Some have speculated that the native forest at Toloa has been preserved because it was a site of spiritual significance in ancient times (Ineich & Zug, 1996). Toloa was the first capital of the dynasty known as the Tu'i Tonga ('Tongan king') from which the present royal family is descended. There is a legend concerning a Tongan woman named 'Ilaheva who lived at Popua (where the New Zealand High Commissioner's residence now stands). A nearby casuarina (*toa*) tree grew high up to the heavens. A god named Tangaloa Eitumatapu climbed down the tree and made her pregnant. Her child, 'Aho'eitu, was semi-divine and became the first Tu'i Tonga. He ruled from Toloa from about 950 C.E.

**“How has this small
pocket of rainforest at
Toloa survived?”**

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"Legend has it that a god climbed down the toa tree and made her pregnant ..."

The mounds, or *sia*, found around Toloa (e.g., those on which the Tupou College principal's house and the farm manager's house are built) may be evidence that it was once a place of royal residence. *Sia* are part of a

traditional method of catching pigeons. A mound is built – a mammoth task when done by hand without modern tools – and *kotone* trees are planted on top of the mound. The *kotone* attract *lupe* (native pigeons) which are caught with *kafa* nets (made from coconut husks) and then tamed. These tame birds are then used as a decoy to attract other *lupe* to the *sia*. Pigeon trapping was traditionally a sport of kings, and thus the presence of the mounds supports the oral tradition of Toloa's ancient significance. The Free Wesleyan Church has been custodian of the rainforest that survived at Toloa since the 1920s, using the surrounding area (between 600 and 700 acres) for food gardens. In 1948 Tupou College moved to the site. In this modern period even more of the forest has been lost. Some time in the 1960s a good deal of the forest to the north was cut down by the College for cattle pasture and crops. In the mid-70s even more was lost to the south when the airport

"the highest canopy areas of the forest were cut down to extend the runway ..."

authority compulsorily acquired the land to extend its runway, although the College opposed this felling. Some of the highest canopy areas of the forest were cut down at this time. These assaults on the Toloa Rainforest constitute the most extensive deforestation in Tongatapu in the past thirty years.

The Tongan word '*apasia*, which now means reverence to God, is derived from '*a'apa-i'-sia*, which meant being quiet near a *sia* mound for fear of frightening the king's pigeons – an infraction with potentially dire consequences.

There was a time, of course, when rainforests needed no human intervention to thrive and flourish. However, rainforests all over the world are under threat from human activities and those that survive require the active protection of our species. By visiting the Toloa Rainforest Reserve,

we hope that you will gain a greater understanding and appreciation of tropical rainforest and that you will be inspired to support the conservation of this and other forests.

Today, the Toloa Rainforest is the largest remaining forest on Tongatapu. It covers about 19 hectares (46 acres) in area. Tupou College is committed to a conservation and reafforestation project that will enlarge the forest by a third (about 15 acres), making a total of about 25 ha (61 acres). This conservation project has involved fencing off the forest to protect it from the damage caused by poaching, vandalism, litter and vehicles and by domestic and feral animals (e.g., pigs, goats, cats and chickens). Care is taken to encourage the regeneration of forest trees and shrubs and to vigilantly clear weeds (defined contextually as any species that threatens to displace or destroy natural forest species, e.g., pawpaw trees and passionfruit vines).

Over the coming years the forest will be extended by planting out species from within the existing forest and by re-introducing throughout the forest species that are currently rare or absent. There are a variety of plant species that are presently under-represented in the Toloa Rainforest Reserve. They include tall-canopy species, sub-canopy species, shrubs, herbs and vines. These rare species have priority in the reafforestation project. The present-day isolation of the Toloa Rainforest means there is little opportunity for these rare species to re-emerge and establish themselves naturally. They must therefore be found elsewhere and re-introduced to the Toloa Rainforest. Tupou College has gathered seed and seedlings of the required species from elsewhere on Tongatapu and beyond, propagated them in the College nursery and is planting them throughout the Reserve in an effort to restore natural species diversity.

Highest priority is given to the tall-canopy species that are

There are introduced species of **honeybee** in Tonga (known as *hone*), but possibly a native variety as well. There are wild honeybees active in the Toloa Rainforest Reserve, though they are becoming rarer (possibly due to disease). There are a number of hives established in tree hollows within the forest. The bees feed on many kinds of flowers and produce a red-hued honey. The honeycomb is eaten on its own or boiled with vinegar and garlic to treat high blood-pressure.

It is worth making a night-time trip to the forest at full moon to see an insect known as *matu*. It is a kind of fire-fly, luminous at night when its wings are spread in flight. About 2.5cm long, it makes a clicking or whispering noise with its head. The sound and light produced by the *matu* are sometimes mistaken for the presence of devils.

invertebrates

Spiders (as well as ticks and scorpions) have no backbone, but they have eight legs and are therefore arachnids, not insects. There are many different kinds of spiders in the Toloa Rainforest, some quite large and colourful, constructing intriguing silken webs. Spiders tend to be considered an omen of good luck in Tonga and to kill one is to court misfortune. They are generally harmless.

Millipedes are segmented arthropods adapted to dark, moist habitats such as rainforest. You will see many shiny red ones, called *unufekula*, on the forest floor in the Toloa Rainforest. They can have up to 100 pairs of legs. Because of these numerous legs, they walk slowly with a wave-like motion of the legs down the body. Millipedes eat decaying vegetation and thereby enrich the soil. They are harmless; when threatened or handled, they curl up into a ball (though a yellow secretion emitted by a threatened *unufekula* can irritate the skin). In contrast, the fast-moving Tongan **centipede** known as a *molokau* has a painful bite and is to be avoided. They are nocturnal but are sometimes seen by day in damp places.

invertebrates

reptiles

Moko

Blue-tailed skink

A small, slim and scaly skink, grey on top and pale underneath, with a distinctive blue tail. It has a pointed nose and black eyes. It is common in the Toloa Rainforest Reserve, where it feeds on small insects like moths and is itself eaten by *sikotā* (kingfishers).

They move very quickly, but if you sit still in the entrance *fale* (shelter), you are sure to see them.

Pili

Dandy skink

(*Emoia trossula*)

Now uncommon on Tongatapu, it is more common on 'Eua. It has not been sighted in the Toloa Rainforest Reserve for some years. A preserved specimen is kept in the Tupou College science laboratory and may be viewed on request. It is probably related to the Giant Tongan Skink (see p. 61), although rarely exceeds 16cm in length.

Insects

& other Invertebrates

By far the most numerous creatures in the tropical Pacific are insects. Insects are distinguished by having six legs and no backbone. Those you may notice in the Toloa Reserve include **ants**, **butterflies**, **mosquitoes** and **ladybirds**.

Many insects are very useful to other species, including humans, because they pollinate plants. Some insects (and countless micro-organisms in the forest) eat dead plants or animals and others eat dung, serving a critical function in the life cycle of other plants and animals. Other insects are a problem for humans, because they cause damage to crops or can carry disease (e.g., mosquitoes, which in Tonga can carry dengue fever and filariasis).

essential to create the habitat and micro-climate necessary to the survival of all other forest life, both plants and animals. High-canopy trees must be re-planted and nurtured over the long term (upwards of 50 years, barring major natural disaster) to replace canopy that is lost or damaged. You will notice areas of canopy loss when you come to a clearing in the forest and can see the sky (a good opportunity to spot flying foxes).

High-canopy trees are vulnerable to cyclones, which either blow them down or rain sea-water onto the canopy, which 'burns' the trees. Cyclone Isaac damaged the Toloa forest in February 1982 as did Cyclone Cora in December 1998. The *ngatata* (rattle tree) is an important canopy species throughout the forest. Many *ngatata* were killed in the 1982 cyclone and

the canopy in those areas has never re-grown. After a cyclone, fallen trees are removed for fire-wood and where the sun shines through the break in the canopy, grasses and vines spring up and take over (e.g., *saafa* and *pula vaine*), preventing re-growth of young trees.

Thus, a vital element of forest management is to follow-up any cyclone damage with consistent weeding and tending of new trees. Native vines like *vālai* and *tutu'uli* are preserved, while other problem vines must be controlled by manual cutting (e.g., the 'moon-flower' *Ipomoea alba* and the passionfruit species *Passiflora foetida* and *Passiflora maliformis*). The re-growth of the canopy – over decades – will eventually suppress the weeds naturally.

For many years Tupou College has employed a part-time 'ranger' for the forest, a man who is the most experienced and knowledgeable living expert on the Toloa Rainforest Reserve.

Sepuloni Folau was himself a boarder at Tupou College in the 1970s. Coming from a neighbouring island, he could not go home at weekends, but spent them camping in the forest where he gained a lifelong affinity with the forest, its flora and fauna. He has a great wealth of traditional wisdom about forest species, handed down the generations. Today he is an agricultural scientist and technical teacher at the school. Perhaps you will be lucky enough to have a guided tour with Sepuloni.

Over 200 species of plants have been identified in the Toloa Rainforest Reserve (by Ian McCracken in a survey conducted for the Tonga Trust in 1998).

A selection of these is presented here, both indigenous and introduced species, with some details of their cultural and medicinal significance.

Species are listed according to their type and alphabetically by their Tongan name. Please refer to the index (page 66) to find particular species by their English or scientific names.

A bibliography is provided on page 64.

Feta'u

Calophyllum, Alexandrian laurel or beach mahogany
(*Calopyllum inopyllum*)

A large tree common in coastal forests and slopes, growing up to 25m in height. It has small white flowers (1.3-3cm across) with numerous yellow stamens, cracked bark and sticky yellow sap. It has large leaves up to 25cm long and small fruit 2-3.5cm long, which are green-yellow when ripe. These hard-shelled fruit are also buoyant and well-adapted to dispersal by sea.

The *feta'u*'s hard wood is highly prized for making canoes, bowls, houses, furniture and gongs (*lali*). Oil extracted from the seed is mixed with coconut oil and used in massage and hair care. The leaves are boiled for the treatment of eye and skin infections (*pala*).

harmless to humans and will avoid them if possible; thus it is rarely seen in the wild.

There is a story in the nearby village of Ha'asini (towards the airport) that the *fōkai* represents the return of a well-loved chief who was killed in an attack along with his people. To these villagers a sighting of the *fōkai* predicts a significant event, whether a death or a good harvest.

Moko lahi ('big lizard')

Giant Tongan Skink
(*Tachygyia microlepis*)

Known from only two specimens caught in the early 19th century that are now held in the National Museum of Natural History in Paris, the *moko lahi* may be extinct. Over 30cm in length, the Giant Tongan Skink is the largest known to have existed in the Pacific and is now thought to be extinct on Tongatapu, although was probably sighted near the Toloa Reserve as recently as 1985. Little is known about the *moko lahi*, but it probably lived underground, coming out only at night or after a heavy rain. It may once have been caught for food, but

today it is unknown to most Tongans.

There are beliefs concerning sightings of the *moko lahi*, similar to those about the *fōkai*. A sighting of the *moko lahi* is believed to be a portent of some significant family event such as a death or a marriage. The *moko lahi* is easily distinguished from the arboreal (tree-dwelling) *fōkai*, because it lives on the forest floor and is a dark-grey, brown or green colour (from whence comes its nickname, "the grey ghost". The *fōkai* is bright green.) As a ground-dweller, the introduction of cats, rats and even foraging pigs must have had a devastating effect on this *moko*.

Should you see this or any other rare creature noted in this guide, try to record careful observations of its appearance, behaviour and location (e.g., take a photo and make notes) and report your findings to a zoological authority, such as the Tongan Wildlife Centre in Veitongo (a.k.a. the 'Bird Park'). Under no circumstances should you attempt to capture or harm any native creature in the forest.

Tonga has a small number of indigenous land reptiles, namely its remarkable banded iguana and several species of geckos and skinks. There are eleven known species of lizard on Tongatapu today. Geckos are small, nocturnal, insectivorous reptiles; harmless but noisy. The means by which geckos manage to cling to virtually any surface has long eluded science, but new theories posit sub-molecular adhesion involving the microscopic hairs on each of a gecko's tiny toes. Some Tongan geckos are very common and seen frequently indoors while other rarer species are threatened by cats, rats, chickens, pesticides and superstitions which lead some people to fear and harm them. Some larger skinks prey on smaller species (Gill & Rinke, 1990).

As recently as 1985, the following reptile species were found in the Toloa Rainforest Reserve:

Gehyra oceanica, *Gehyra mutilata*, *Lepidodactylus lugubris*, *Hemidactylus garnotii*, *Nactus pelagicus*, *Emoia cyanura sensu lato* and *Lipinia noctua* (Ineich & Zug, 1996).

Fōkai

Banded Iguana
(*Brachylopus fasciatus*)

An extraordinary creature, the male is banded in shades of bright green, its long tail and toes resemble twigs. It eats leaves and flowers and occasionally large insects and geckos. They live in trees and bushes, especially the chestnut tree (*ifi*). The female lays four eggs into rotting wood or a hole in the ground. They hatch after six to eight months, the longest incubation time for any vertebrate.

Related to iguana species in the Caribbean, the *fōkai* is thought to have somehow migrated to Polynesia from Central America a million years ago, possibly on natural rafts of driftwood or floating mangroves. It is the only iguana to have survived in Tonga. Archaeological studies show that the *fōkai* was eaten regularly by early Tongans. This predation and the destruction of its habitat posed a great threat to the *fōkai* and contributed to the extinction of other species of iguana in Tonga (Pregill & Dye, 1989). Today, the *fōkai* is often feared – and killed – as dangerous, yet it is completely

Fo'ui

(*Grewia crenata*)

This tree has a very small fruit in four segments. The fruit is black when ripe and its skin is sweet and edible. The timber of the *fo'ui* is used to make housing posts. The *fo'ui* tree is the subject of a Tongan legend:

On the island of 'Euakafa in Vava'u, the Tu'i Tonga Tele'a and his wife, Talafaiva, lived in a home that was securely fenced, but there was a *fo'ui* tree growing beside the fence with one branch crossing over into the compound. Talafaiva often asked her husband to cut the tree down, but he always put it off. Eventually, a handsome young man named Lolomanaia climbed over into the property on this branch and successfully paid his addresses to the lady of the house. When the husband lost his temper on finding out, she replied, "It was your *fo'ui* tree that did it."

From this legend, we have the Tongan proverb, *Fo'ui ne fai* ('The *fo'ui* tree did it') and the name of the *fo'ui* has entered the Tongan language meaning 'fate' (E.

Tu'inukuafe, *Simplified Dictionary of Modern Tongan*, 1997).

Ifi

Tahitian chestnut
(*Inocarpus fagifer*)

A tree probably brought to Tonga in ancient times, it is now common in the Toloa Rainforest Reserve and found in three varieties. The *ifi* is a large tree, up to 15m high, with a fluted trunk and white flowers. Its large peanut-like fruit (up to 10cm across) vary from yellow to dark-green, depending on the variety, and from oval to round in shape. The fallen seeds are collected and roasted whole on a fire, or shelled and boiled (Whistler, 1992a).

Treating burns (*vela*) with *ifi* bark prevents scarring. The bark can also be used to treat diarrhoea (*pihipihi*) in infants. The tree is also used in the treatment of eye injury. A necklace of *ifi* leaves symbolises surrender in war, or sometimes it is used to show submission to a chief or to seek his or her mercy.

an ifi leaf

high-canopy trees

Koka

Red cedar
(*Bischofia javanica*)

A widespread Pacific tree, probably introduced to Tonga in ancient times. The *koka* is a large, spreading tree of up to 20m or more in height. It has small, inconspicuous flowers and small brown berries. The leaves and bark are used to treat mouth infections in infants (Whistler 1992a).

The *koka* tree is sometimes cultivated for its uses in making dye. Sap squeezed from the bark is used to make a natural dye for staining the Polynesian bark cloth known in Tonga as *ngatu* (a *k a* *tapa*). The word *koka* also means to rub a pattern onto *ngatu*. The dye made from *koka* provides the background 'waihi' while another darker dye made from a mangrove tree (*tonga*) is used to paint the patterns and designs on the cloth. *Ngatu* is traditionally made in large pieces by groups of women. Each piece represents an enormous amount of work in several stages. The more dye used and the darker the *ngatu*, the more valuable it is.

Kotone

Wild nutmeg
(*Myristica hypargyrea*)

A forest tree, often domesticated, used for timber and *peka* – the red seeds are threaded together to decorate dancers' costumes at the neckline and waist. The tree grows to a height of 10m or more and is a favourite of the *ape* (Pacific pigeon).

a kotone leaf

Kumā

Tongan or Polynesian rat

A big grey rat, native to Tonga and living in the Toloa Rainforest, though active only at night.

Long ago, Tongan rats were reared by children as pets and also formed part of the human diet. When they were roasted on embers, effort was made not to burn the tail, so that they would appear in totality. The expression *Kumā si'i vela hono ika* ('Little rat, his tail burnt'), has become an admonition against the unwise use of scarce resources (Tu'inukuafe, *A Simplified Dictionary of Modern Tongan*, 1997).

Today the native rat is rarely eaten, though there is one famed instance in 1799 when a chief named Vaea bit the head off a *kumā* and smeared its blood on his face in a frightening declaration of war, earning him the nickname *kai kūmā* ('rat eater'). A descendant of that chief, Baron Vaea, a former Premier of Tonga, still bears that nickname, and sometimes the people of his village, Houma, are also teased as being 'rat eaters'.

There is a Tongan legend and a song about the *kumā* and the *peka*, which are thought to look alike. The story tells of how the *kumā* once asked to borrow the *peka*'s wings. When granted the favour, the *kumā* flew off and never came back. Thus the *kumā* became the *peka* and the *peka* became the *kumā*.

NB. The **black rat** (*Rattus rattus*) and **Norway rat** (*Rattus norvegicus*) are common pests introduced to Tonga by Dutch navigator Abel Tasman in 1643 and again by the English explorer James Cook (1770s) and other Europeans. They are aggressive, omnivorous and adaptable. Their highly developed senses and superior agility give them survival advantages over their native cousin. These rats can give birth to up to 150 young per year and potentially transmit up to twenty different diseases.

Tonga has only two native mammal species, due perhaps to the difficulty of mammals finding their way to these remote Pacific islands in ancient times. It is not surprising then, that one of the species that managed the trip is able to fly.

Peka

Flying fox

A fruit bat named for its fox-like face. It has large, well-developed eyes and, unlike most smaller bats, uses vision rather than echolocation to navigate in flight.

The Toloa Reserve is a favourite haunt of the *peka*, where they can be seen silhouetted in flight or hanging upside-down in trees. They eat *niu* (coconuts), *lesi* (pawpaws), *ifi* and *fo'ui* fruit.

The *peka* contributes to forest ecology by pollinating native flowers and spreading seeds.

They assist in the survival of many crops valued by humans (e.g., bananas, mangoes, avocados and breadfruit) and are generally not a threat to fruit crops that are harvested while they are still too green to attract *peka*.

However, they also compete with native fruit-eating birds and can damage mature canopy trees when they congregate in large numbers (known as 'camps') and strip the leaves and bark with their claws. Our forest ranger encourages them to move from tree to tree on a regular basis, to try to prevent them from killing the trees.

Peka are themselves threatened by deforestation and hunting (as pests or for food). They are typically hunted in Tonga with a sling-shot or *sengai* (from the English 'shanghai'), or trapped in a prickly plant called *talatala'amo*, and can be roasted over a fire. In ancient times, the chiefs of Kolovai at the western end of the island forbade hunting of the *peka*, on pain of death. Today the *peka* is not a protected species and is declining in Kolovai.

Lopa

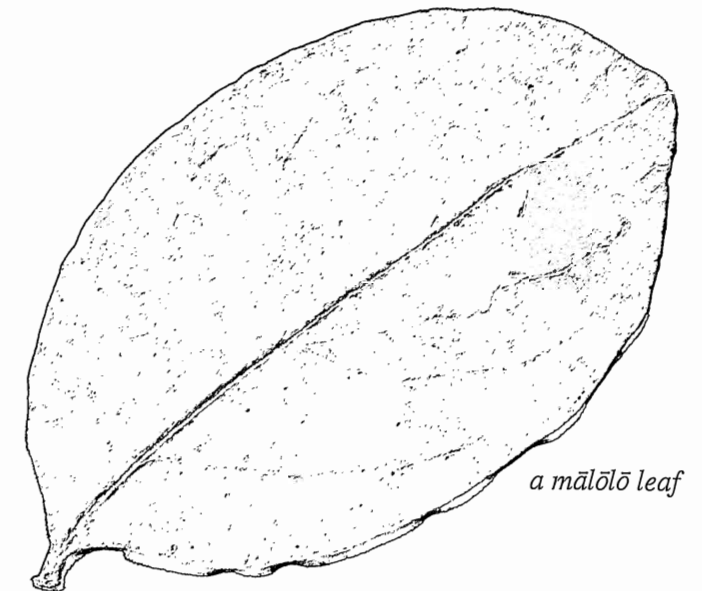
Red sandalwood
(*Adenanthera pavonina*)

The branches and wide trunk of the *lopa* are used as firewood and for the construction of Tongan houses (*ngaahi fale*). Its dark-red seeds are edible and are strung together to make necklaces and curtains. It is not common in the Toloa Rainforest Reserve, where there are only three mature specimens.

high-canopy trees

Mālōlō ('rest'; 'retire'; 'pause'),
Masi koka or *Mahame* (see *masi*)
of the spurge family * **rare**
(*Glochidion ramiflorum*)

A medium-sized coastal tree of about 10m in height that occurs in two varieties: *Mālōlō kula* (red) and *Mālōlō hina* (white). Their leaves and bark are both valued in Tongan medicine for the treatment of mouth, skin and stomach ailments, especially in young children.



Mango

Mango
(*Mangifera indica*)

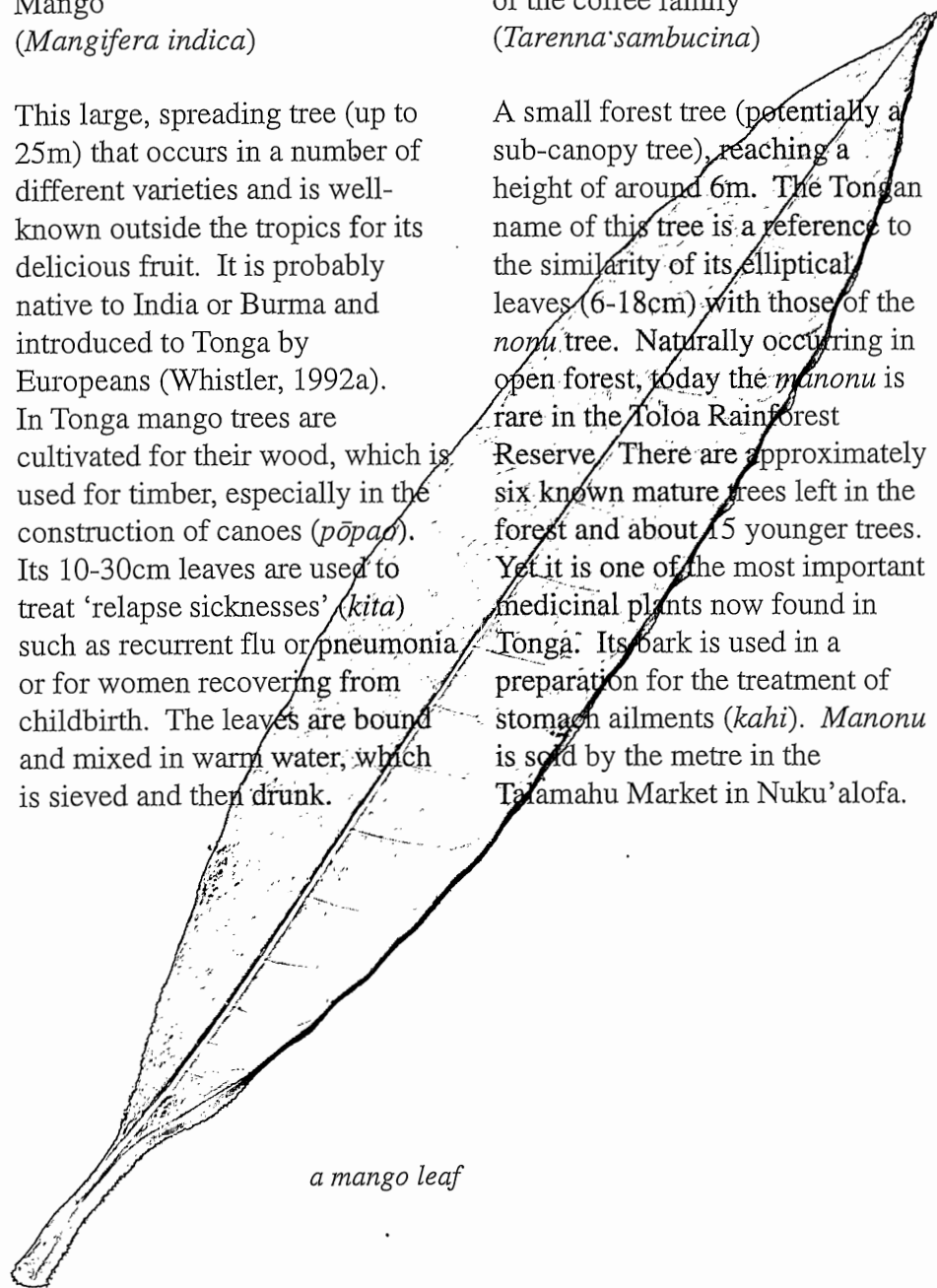
This large, spreading tree (up to 25m) that occurs in a number of different varieties and is well-known outside the tropics for its delicious fruit. It is probably native to India or Burma and introduced to Tonga by Europeans (Whistler, 1992a). In Tonga mango trees are cultivated for their wood, which is used for timber, especially in the construction of canoes (*pōpao*). Its 10-30cm leaves are used to treat 'relapse sicknesses' (*kita*) such as recurrent flu or pneumonia or for women recovering from childbirth. The leaves are bound and mixed in warm water, which is sieved and then drunk.

Manonu

of the coffee family
(*Tarenna sambucina*)

* rare

A small forest tree (potentially a sub-canopy tree), reaching a height of around 6m. The Tongan name of this tree is a reference to the similarity of its elliptical leaves (6-18cm) with those of the *nomu* tree. Naturally occurring in open forest, today the *manonu* is rare in the Toloa Rainforest Reserve. There are approximately six known mature trees left in the forest and about 15 younger trees. Yet it is one of the most important medicinal plants now found in Tonga. Its bark is used in a preparation for the treatment of stomach ailments (*kahi*). *Manonu* is sold by the metre in the Talamahu Market in Nuku'alofa.



a mango leaf

Tala ('informer')

White tern or Fairy tern
(*Gygis alba rothschildi*)

A snow-white sea-bird, 25-30cm long with a 71cm wingspan, it has large, dark eyes and a black beak. It feeds on fish and some insects and perches at night in high canopy trees, laying its eggs in the branches. Thus this sea-bird can sometimes be seen inland in the Toloa Rainforest Reserve.

Tongans have named this bird an 'informer' because its quacking call alerts other birds to the whereabouts of schools of fish or the presence of humans. They will hover curiously above humans and other animals with little sign of fear. They may inform you of the presence of other people in the Toloa Rainforest Reserve.

The *tala* is the subject of a Tongan proverb and religious metaphor. The observed behaviour of the *tala* in conjunction with another species of sea-bird, the black *ngongo* (brown noddy or *Anous stolidus*), has given rise to the proverb, *Tau fengongo fai fua ki he 'ulu*. The two species co-operate when searching for fish

at sea. Flocks of *ngongo* fly low over the water, but cannot see the fish below the surface. They look upwards and the presence of a *tala* or two, flying high overhead, 'informs' them of where the fish are. Tongans see in this a spiritual significance. The *tala* is a metaphor of the omniscient God above, to whom the people should look for guidance.

Veka

Buff banded rail
(*Gallirallus philippensis*)

A large, reddish-brown bird with a grey breast (about 30cm long). The male of the species has a horizontal stripe across its eye and black and white bands on its flanks. A common ground-dwelling bird, the *veka* rarely flies but can run well. Pairs of rails often call to each other while foraging.

birds

Sikotā

White-collared kingfisher
(*Halcyon chloris*)

A handsome white bird with long, pointed bill and brilliant blue head and wings. It can live in a variety of habitats and is common in the Toloa Rainforest Reserve. It is often seen perching on power lines around Toloa. About 22cm long, it feeds on lizards and large insects and will even forage on coral reefs where it eats small marine organisms.

Sikiviu

Polynesian triller
(*Lalage maculosa*)

A small black-and-white patterned bird (about 15cm long), the third most common native Tongan songbird. It is a noisy and quarrelsome species, often seen in aerial pursuit of other songbirds. It feeds in trees and on the ground, preferring insects, caterpillars and small fruit, e.g., lantana, *polo* and *fo'ui*. The species is under threat on some islands and declining in the Toloa Rainforest Reserve.

* rare

Masi

Fig
(*Ficus tinctoria*)

Figs occur in the Toloa Rainforest Reserve in three varieties: the *masi kona*, *masi 'ata* and *masi koka*. The *masi kona*, also known as *masi 'aukava* (*Pittosporum arborescens*), has medicinal uses including the treatment of *kita* with the leaves ('relapse sickness' – see mango). Its fruit can also be used to poison fish in shallow reefs. This traditional method of fishing, known as '*aukava* (meaning 'flow of poison'), is now prohibited as it kills fish indiscriminately, including immature fish.

The *masi 'ata* has dark-green, hairy leaves somewhat like the ubiquitous *pula* vine. The *masi koka* is named for the similarity of its leaves to the *koka* (see *māleolo*). It can be used for the treatment of stomach ailments on and near

high-canopy trees

Mo'ota ('Selfish' tree) * rare

Stinkwood
(*Dysoxylum forsteri*)

A large native tree of around 15m found in open forests and on 'Eua. It has a yellow flower and brown fruit (about 2cm). The timber is used in construction and for other purposes. Its leaves (25-50cm) and bark are used to treat a *tēvolo* ('devil') sickness known as '*avanga* – something like a psychosis involving hallucinations. The stink of the leaves and bark are thought to chase the devil away. The US ethno-botanist Whistler notes that these apparently psychotic patients are traditionally treated very differently in Tonga than they might be by Western psychiatry and "with more favourable results" (1992a, p. 39).

a *masi 'ata* leaf

high-canopy trees

high-canopy trees

Motou

(*Cyrtocarya glaucescens*)

A common tree in the Toloa Rainforest Reserve and a popular perch for *moa kaivao* (wild chickens). Its timber is used for firewood and posts.

Ngatata (lit. 'rattle')

Rattle tree

(*Elattostachys falcata*)

Also found in high-island forests, the *ngatata* is a tall tree of around 15m and a popular haunt for birds. Its timber is used for firewood and posts. It was once common in the parts of the Toloa Rainforest that have now lost their canopy. It now accounts for about 5% of the Toloa Reserve (Wiser et al., 1999).

Coconut palm
(*Cocos nucifera*)

The coconut is perhaps the most famous tree of the Pacific and the most common on Tongatapu. It is shrouded in legend and revered by Islanders for its many uses, having as many as 121 cultural uses, not including its ecological functions (Thaman & Whistler, 1996). The coconut palm is frequently cultivated and can become a weed in a forest environment. Coconut trees can grow over 20m in height and live for up to 50 years.

motou leaves

birds

Pekepeka

Pacific swallow

(*Hirundo tahitica*)

Dark-grey to black with paler, faintly barred underparts and a reddish-brown throat. Best known on the island of Tofua, it is often confused with the more common *pekepekatea* (white-rumped swiftlet). About 12cm long, it is almost always seen in flight, often feeding close to the ground, although it does land occasionally.

Pekepekatea

White-rumped swiftlet

(*Aerodramus spodiopygius*)

Black upper, grey underside with distinctive white rump, about 10cm long. Its long, thin, sickle-shaped wings and darting flight are characteristic. It feeds on insects in flight and never lands on the ground. It nests in large numbers in caves where it can navigate in the darkness by echolocation. It is not generally found within the Toloa Rainforest Reserve, but is common in the surrounding areas.

birds

Misi Tonga

Polynesian starling
(*Aplonis tabuensis*)

A common native species, perhaps the most common land bird in Tonga. Like the *kokī*, the *misi Tonga* is named by science after the island of Tongatapu. *Misi* is a Tongan word describing the kissing noise made by this bird. Tongans use a similar noise to summon their dogs.

Found in all kinds of habitats, often in pairs, the *misi Tonga* is dark brown on its head and wings and grey to beige underneath and 19cm long. It eats fruit, native berries and sometimes insects. It nests in hollow trees or in the trunk of a coconut palm if the top has broken off.

Moa kaivao ('wild chicken')

Red jungle fowl
(*Gallus gallus*)

A species probably introduced from south-east Asia by the first Tongans. It is like a small domestic chicken, but with less individual variation. The 76cm male is a spectacular bird with multi-coloured iridescent plumage, a dark-green, sickle-shaped tail feathers, russet-coloured neck, body and red comb. Females are smaller (37-43cm) and either brown or black, also with a comb. They can interbreed with domestic chickens, but truly wild *moa* are shy of humans and difficult to spot in the forest. They like to roost in the *motou* tree where they can be spotted at night with a torch, perched slumbering in a row.

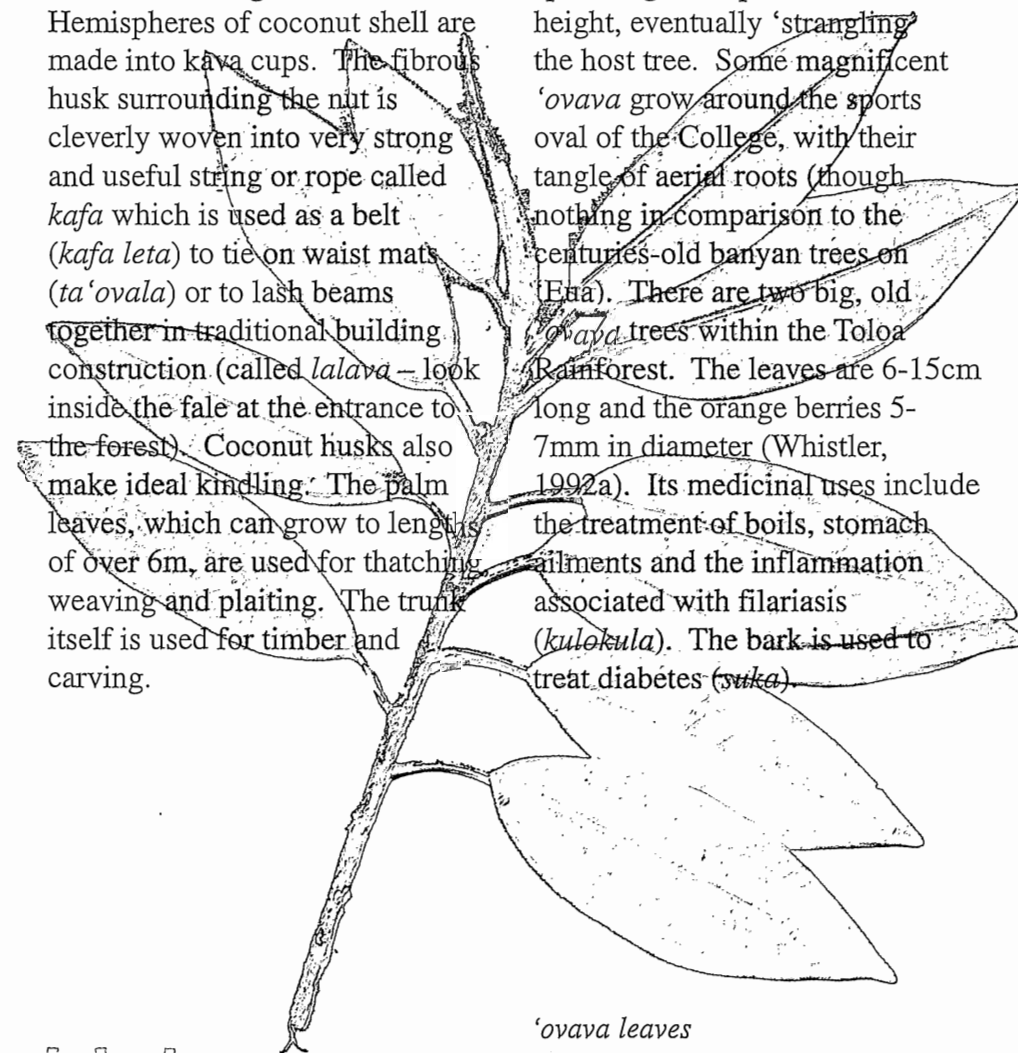
Moa kaivao have long been hunted by Tongans using a variety of ground traps (or a shot gun). Their feathers are used to decorate *ta'ovala* (waist mats) and the male bird's neck feathers are used by traditional fishermen to cover their fishing hooks on a line dragged behind the fishing boat. The trailing feathers imitate a squid and attract '*atu* (bonito fish).

'Ovava or 'Ovava Tonga

Polynesian banyan tree or
Strangler fig (*Ficus obliqua*)

Common in lowland forests, the '*ovava* begins life as an epiphyte (parasite) and grows into a large spreading tree up to 30m in height, eventually 'strangling' the host tree. Some magnificent '*ovava* grow around the sports oval of the College, with their tangle of aerial roots (though nothing in comparison to the centuries-old banyan trees on 'Eua). There are two big, old '*ovava* trees within the Toloa Rainforest. The leaves are 6-15cm long and the orange berries 5-7mm in diameter (Whistler, 1992a). Its medicinal uses include the treatment of boils, stomach ailments and the inflammation associated with filariasis (*kulokula*). The bark is used to treat diabetes (*suka*).

The flesh of the nut is used in many Tongan foods. It can be processed into coconut oil – *lolotonga* – shredded to make coconut cream or makes a ready source of pig food. The 'juice' of the nut is a handy, take-anywhere drink in a biodegradable container. Hemispheres of coconut shell are made into kava cups. The fibrous husk surrounding the nut is cleverly woven into very strong and useful string or rope called *kafa* which is used as a belt (*kafa leta*) to tie on waist mats (*ta'ovala*) or to lash beams together in traditional building construction (called *lalava* – look inside the fale at the entrance to the forest). Coconut husks also make ideal kindling. The palm leaves, which can grow to lengths of over 6m, are used for thatching, weaving and plaiting. The trunk itself is used for timber and carving.

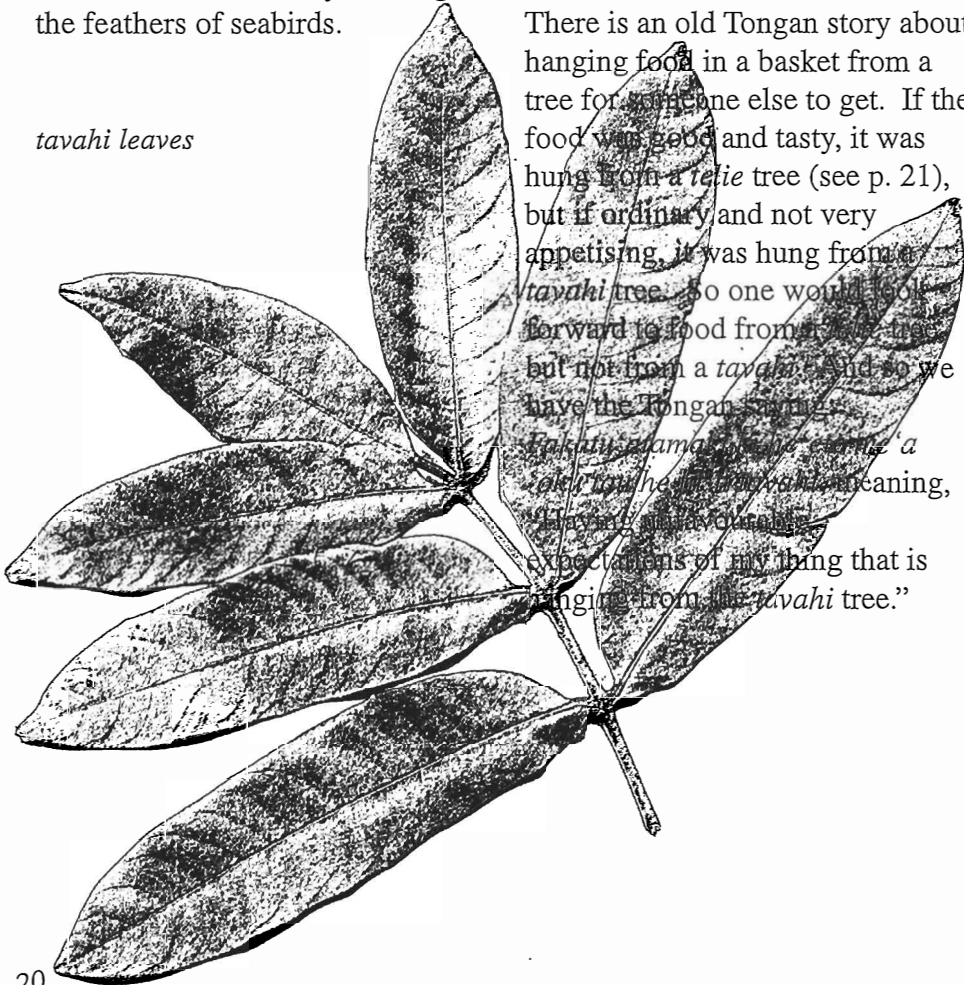


'ovava leaves

high-canopy trees

of the Four o'clock family
(*Pisonia grandis*)

tavahi leaves



Island sumac
(*Rhus taitensis*)

There is an old Tongan story about hanging food in a basket from a tree for someone else to get. If the food was good and tasty, it was hung from a *telie* tree (see p. 21), but if ordinary and not very appetising, it was hung from a *tavahi* tree. So one would look forward to food from the tree but not from a *tavahi*. And so we have the Tongan saying: *Fakatu'alamaki'ia e tala'a 'a oia' to'u he tala'ava'i* meaning, 'I have high expectations of my thing that is hanging from the *tavahi* tree.'

Pacific pigeon
(*Ducula pacifica*)

It eats many kinds of fruit, up to 4cm in size, opening its mouth wide and swallowing them whole. There is a Tongan proverb, *Hange ha lupe kai kotone* ('Like a *lupe* eating a wild nutmeg'), referring to something that is difficult or impossible to do, like the *lupe* with its small mouth swallowing the *kotone* fruit whole.

European or Common starling
(*Sturnus vulgaris*)

Introduced from Europe, as its name suggests, the *missi pālangi* is common in villages and other open areas of Tongatapu, but is not well adapted to the hotter islands to the north. A shiny black bird with white spots, about 21cm long. Its bill is yellow during mating season (summer) and dark the rest of the year.

Kulukulu

Purple-crowned (or 'crimson-crowned') fruit dove
(*Ptilinopus porphyraceus*)

A green, grey and yellow native bird with a purple crown, about 22cm long. It is named for its distinctive 'kulukulu' call. It is common in Tonga, though often difficult to spot amongst the foliage of large trees. As a fruit-eater, particularly fond of the 'ovava' berry, it is in direct competition with flying foxes and threatened by their dominance in the Toloa forest.

Lulu

Barn owl
(*Tyto alba*)

A large bird (34-50cm long) with mottled brown and cream upper parts, white underside and a mesmeric heart-shaped face with dark eyes and a pale bill. It occurs almost worldwide in a variety of habitats, nesting in tree hollows, holes in rocks, caves, old buildings, palm trees, etc. It may have been introduced to Polynesia to control rodents. Common in the Toloa Rainforest, its nocturnal habits mean you will spot it only at dusk, night-time or early in the morning when it is out hunting. In flight it appears completely white, and you may hear its raspy hiss or screech. Rats and mice are its main source of food, although it will also hunt lizards, large insects and small birds. Its taste for chicken can make it unpopular in Tonga.

Te'ete'e manu

of the dogbane family
(*Ervatamia obtusicaucula* /
Ervatamia orientalis)

Found in lowland forest, it occurs in two types – a tall variety that forms the forest canopy and a smaller shrub-like variety. It is common in the Toloa Rainforest Reserve in both varieties, growing up to 5m. The smaller variety is used by Tongans to treat excessive nasal mucus. The leaves, 6-18cm long, are bound and squeezed for the milky sap, which is used to cure mucous membrane problems in young children. Whistler (1992a) reports that the leaves are also used to treat infections of the mouth, teeth and gums.

Telie

Tropical almond or Indian almond
(*Terminalia catappa*)

A large canopy tree (25m or more), possibly introduced. The *telie* has small white flowers growing on spikes 8-23cm long and oval-shaped fruit, 3-8cm long, that turn red when ripe. The fruit is difficult to extract from its fibrous husk, but edible. The wood is highly prized for making traditional wooden gongs (*lali*), canoes (*pōpao*), utensils and houses (*ngaahi fale*). An infusion made from the bark or leaves is used to treat mouth infections (*pala ngutu*).

From the same story told about the *tavahi* tree (see p. 20) we have the Tongan saying: *Fakatu'amelie ki he'ete me'a'oku tau he fu'u telie*, meaning, "Looking forward hopefully to my thing that is hanging from the *telie* tree" (E. Tu'inukuafe, *A Simplified Dictionary of Modern Tongan*, 1997).

a te'ete'e manu leaf

high-canopy trees

Toi*** rare***(Alphitonia ziziphoides)*

A large native hardwood tree reaching up to 15m or more and also found in the forests of 'Eua and Tafahi. It has dark-green leaves 5-15cm long, which are grey underneath. Its small black fruit are 6-9mm in diameter (Whistler, 1992a).

The culturally important timber of the *toi* tree is used as the logs on which *ngatu* (*tapa*) is pounded and for construction. *Toi* bark is also valued for the treatment of abdominal ailments. One of the last remaining old-growth specimens in the Toloa Rainforest Reserve was killed by unco-ordinated attempts to strip its bark for medicinal remedies. You will see this dead tree in the forest wrapped in cyclone wire with which the College attempted to prevent its destruction. Bark can safely be removed from trees for cultural purposes if the bark is taken from one side only and not from around the entire trunk, which constitutes a fatal wound to the tree, known as 'ring-barking.'

Ahi*** rare**

Sandalwood
(Santalum yasi)

Now very rare in the Toloa Rainforest Reserve, it is valued as a perfume. Tongans scrape the branches, grind it into a powder and fry it with coconut oil to make scented Tongan oil (*lolotonga*). William Mariner also records a remarkable use of the tree, mixed with *toa* (*Casuarina equisetifolia*) in the preservation of the bodies of deceased chiefs for more than twenty days before burial.

a *toi* leaf**Kalae**

Purple swamphen
(Porphyrio porphyrio)

A large (37-48cm), glossy, purple-blue bird with long red legs, a bright red bill and white undertail. Partly nocturnal, they are most active at dawn and dusk. A common Pacific bird partial to wetlands, it is not unknown in forest habitat. Its migratory habits means it is not always present in the Toloa Rainforest Reserve. It is fairly elusive by nature and doesn't often fly, preferring to walk or run. Fond as it is of bananas, you are most likely to spot the *kalae* – alone or in pairs – when the bananas growing in the forest are ripe.

Kókī or kakā*** rare**

Red Shining Parrot
(Prosopis tabuensis)

The *kokī* is originally from Fiji and was brought east long ago by Tongans returning from long sea voyages to their Polynesian neighbours. With no other red birds in Tonga, the *kokī*'s red plumage was highly prized. Handicrafts decorated with *kokī* feathers had increased value.

Over time, however, the *kokī* evolved in Tonga to have darker red feathers than its Fijian cousins. It also has striking green and blue plumage, orange eyes, black feet and a round, black bill. About 46cm long, the Tongan *kokī* is now considered a sub-species and its scientific name *tabuensis* is derived from the name of the island of Tongatapu.

Escaped parrots managed to establish the species on the island of 'Eua, south-east of Tongatapu, although they are still preyed upon by cats and rats and are under serious threat from hunting and deforestation. 'Eua's famous parrot once thrived in the Toloa forest as well, although there may be as few as one or two left. The presence of at least one individual is evident from its noisy birdcall, though as a shy creature it's rarely seen at Toloa. The Tongan Wildlife Centre in Veitongo has a captive breeding programme and releases family groups of the *kokī* on uninhabited islands in the hope of averting their extinction.

birds

Fuiva or
Manufo'ou (lit. 'new animal')
Red-vented bulbul
(*Pycnonotus cafer*)

Introduced from south-east Asia in the 1930s, the *fuiva* is now common on Tongatapu and often a pest to fruit farmers. It has adapted to various habitats, including forest, and can easily be spotted at Toloa and in urban areas. The *fuiva* is 20-22cm long, predominantly black with a white-tipped tail and a black crest on its head, which it raises when alarmed. Look out for the bright red feathers under its wings. A noisy and gregarious bird, its melodious song can be heard at dawn.

Tonga has 25 native land birds and some introduced species. Introduced birds pose a threat to native species by competing with them for food and other resources and by introducing diseases and parasites. Listen carefully for different bird calls in the forest and, if you are quiet and patient, you may see some of these birds.

Fuleheu
Wattled honeyeater
(*Foulehaio carunculata*)

An olive-green songbird about 19cm, with a long, black beak. It has some yellow on its wings and tail and a distinctive yellow wattle below the eye. An aggressive bird, it is noisy in the mornings. Probably the second most common native Tongan songbird, it can be seen flying about residential areas and sucking nectar from flowers. It also eats insects and occasionally lizards. There are plenty in the Toloa Rainforest.

Ahi vao
Wild sandalwood
(*Vavaea amicornum*)

An interior forest tree. Its timber is used for posts and branches are cut to make Christmas trees, hung with balloons, sweets and toys.

*** rare**

Fā or **lou'akau**
Pandanus or screwpine
(*Pandanus tectorius*)

A striking tree of 8-10m in height, the *fā* has aerial prop roots (*hoko'i*) and prickly stems. Occurring in about nine different varieties, it's one of the most useful trees in Polynesia and is often domesticated. Its long, tough leaves up to 2m in length are woven into mats, thatching, sails, basketry, fans, hats, etc. Sometimes the dried leaves are substituted for cigarette papers. The male flowers are used to scent coconut oil (*lolotonga*) and the half-red half-green fruit are popularly used for decoration. They were once eaten, either raw or cooked. In years gone by, the fruit was boiled and dried to make a hard, edible jelly, which lasted well and could be taken as provisions on long sea journeys. The trunk of the tree is used to make traditional houses (*ngaahi fale*) and the prop roots were split to form walls. The tip of these roots can be grated and the juice thus formed used to treat skin sores and stomachache (Whistler, 1992a).

a fā leaf

sub-canopy trees

Fau

Bast tree, Giant hibiscus or Beach hibiscus (*Hibiscus tiliaceus*)

A common shrub or tree growing 10-15m tall. Its yellow flowers have a purple centre, while the leaves are green on the top and grey underneath, between 8 and 20cm long. It has a small fruit that splits into five sections, containing about 15 seeds.

The *fau* has many uses. Its light, soft wood is used for timber, firewood, tool handles and fish-net floats, amongst other things. The large round leaves are used to wrap food or as serving platters. The slimy sap is used in traditional medicine to treat eye ailments and injuries. An infusion of the bark is used to treat stomachache (Whistler, 1992a).

The inner bark is perhaps the most valued part of this tree, woven into a string or twine also known as *fau*. *Fau* string has varied uses, from fishing line to handicrafts such as lacy waist mats for men and women (*ta'ovala*) and is sometimes used to decorate women's dancing costumes. Coconut milk is traditionally

made by grating the coconut flesh, adding water and squeezing or wringing the mixture through handfuls of *fau* bark. But perhaps the most important cultural use of the *fau* is in the straining of the drink kava in a traditional ceremony.

a *fekika vao* leaf

Fekika Vao ('wild fekika')
Mountain apple
(*Syzygium clusiifolium*)

A tree bearing small, dark-purple, edible fruit, that is known as *mafua* in Niuatoputapu. Its leaves are very similar to those of the *mapa* (p. 34), only not quite as thick and with a more pointed tip. The *fekika vao* is perhaps the most common tree in the Toloa Rainforest Reserve.

Vailima

Hilo grass, Sour paspalum or T-grass (*Paspalum conjugatum*)

A creeping perennial grass with a pale green, hairy leaf 8-20cm long. A native to tropical America, it was first introduced to Tonga some time in the 19th century.

It can be used medicinally as equivalent to *mohuku laufoke*: its sap applied directly to the skin to treat scratches.

vailima leaves

fakamalu tēvolo
fungi

There are many varieties of fungi in the Toloa Rainforest Reserve, known in Tongan as *fakamalu tēvolo* (or 'devil's umbrella'). Once classified as members of the plant kingdom, fungi are now thought to be an entirely separate category of life. Fungi thrive by absorbing nutrients directly from the air or from the branch, trunk or dead log on which they grow. Most fungi reproduce by airborne spores, which can travel long distances. Together with bacteria, fungi are responsible for the decay and decomposition of all organic matter and are therefore vital to the life-cycle of the forest. They are also food for many small animals, insects and millipedes.

grasses & fungi

grasses

Mohuku laukofe

Basket grass

(*Oplismenus compositus*)

A creeping perennial grass, with broad, hairy leaves up to 25mm wide. It was probably introduced to Tonga in ancient times where it grows in shady areas.

Sap from the seed stem is applied directly to the skin to heal scratches.

mohuku laukofe leaves

There are a number of grass and sedge species in the forest known by the general Tongan term, *musie* ('grass').

They grow where there are gaps in the canopy and sunlight reaches the forest floor. They are generally undesirable as they inhibit the re-growth of native forest plants. The high grass known as *saafa* is a particular problem in this regard.

The ground inside a rainforest should be a carpet of leaf litter, not grass.

Saafa

Guinea grass

(*Panicum maximum*)

A tufted perennial grass growing in large bunches between 1-2.5m high. It has a yellow-green leaf 5-25mm wide. Native to Africa, it is thought to have been introduced to Polynesia as cattle feed in the late 19th century where it can become dominant. You can see it all over Tongatapu, often growing by the side of the road up to shoulder height. It thrives in the Toloa Rainforest Reserve where the canopy is down, especially since Cyclone Cora in 1998. It inhibits the re-growth of canopy trees.

saafa grass

sub-canopy trees

Filimoto

(*Xylosma simulans*)

Found in indigenous forest, its timber is used as *tutua* – the long broad surface on which strips of mulberry bark are laid and pounded with an *ike* (mallet) in the manufacture of *ngatu* (tapa).

Kanume

of the ebony family

(*Diospyros elliptica* /

Diospyros ferrea)

* rare

A native tree common in littoral (coastal) forest, *kanume* seeds may have been brought to Toloa by birds. They can grow to 10m in height, although there are no mature specimens in the Toloa Rainforest Reserve. Both its small leaves (4-10cm) and yellow-red seeds (1-1.3cm) are edible and are often eaten raw with coconut. The bark is often used in conjunction with other plants to treat stomachache or other abdominal complaints.

kanume leaves

sub-canopy trees

sub-canopy trees

Lesi

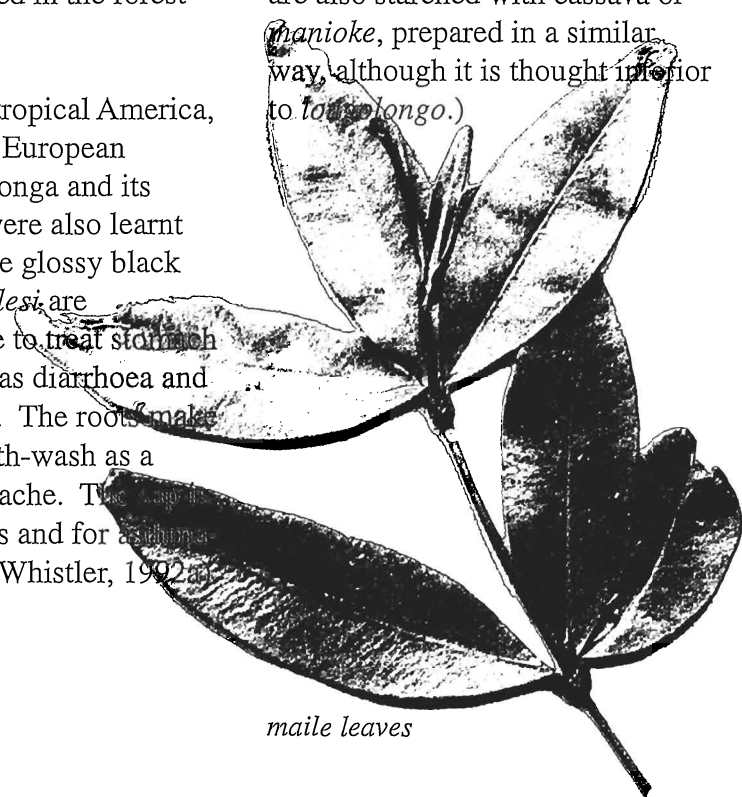
Papaya or pawpaw
(*Carica papaya*)

A common, domesticated fruit tree with a soft-wooded, un-branched trunk up to 10m in height. The female of the species is easily distinguished for its large orange fruit and the male for its cream-coloured flowers. *Lesi* grows readily unassisted, but is not a native forest plant. It springs up in the Toloa Rainforest Reserve wherever the canopy is broken and is therefore a weed in the forest context.

Originally from tropical America, *lesi* was an early European introduction to Tonga and its medicinal uses were also learnt from abroad. The glossy black seeds of a green *lesi* are swallowed whole to treat stomach complaints such as diarrhoea and intestinal worms. The roots make an effective mouth-wash as a remedy for toothache. The sap is used to treat boils and for asthma-like complaints (Whistler, 1992a).

Longolongo

A cycad-like coastal plant, not native to Toloa but introduced to the entrance area where three specimens are evident. A starch made by grating and squeezing the fruit of the *longolongo* is used with coconut and sugar to make a traditional dessert called *topai* (though nowadays flour is often substituted). The starch can also be used to stiffen fabric. (Clothes are also starched with cassava or *manioke*, prepared in a similar way, although it is thought inferior to *longolongo*.)



maile leaves

Vālai (female) or *Sipi* (male)

St Thomas bean, Water vine or Drinking vine
(*Entada phaseoloides*)

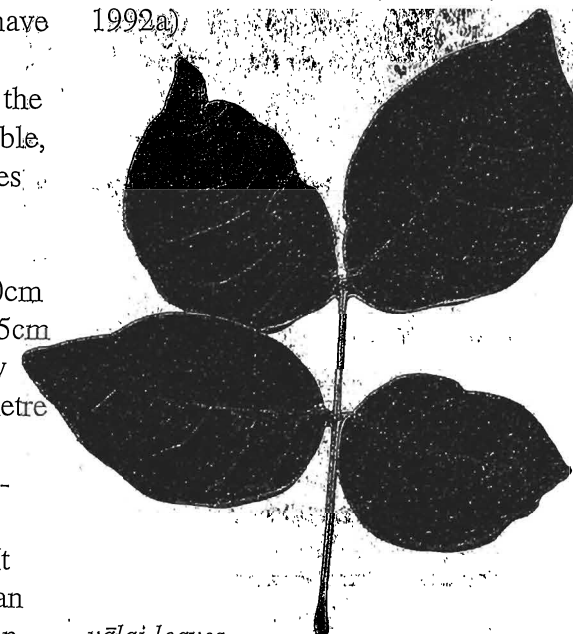
A large, high-climbing forest liana native to Tonga, the *vālai* can have a trunk as thick as a tree (up to 26cm in diameter). When cut, the soft woody stem exudes a potable, watery sap that is drunk in times of need, hence its name.

The *sipi* has glossy leaves 4-10cm long and white flowers up to 25cm long. Its fruit is a large, woody pod, which can grow up to a metre or more in length and contains several hard, shiny brown, disc-shaped seeds up to 5cm in diameter, known as *pa'anga*. It is their resemblance to European coins which gives us the Tongan word for money. These seeds are cut in half to making rattling instruments strung around dancers' ankles or to adorn their costumes. Once upon a time they were also used as throwing pieces in a Tongan children's game called *pa'anga lafo*. (A similar game for adults called *paenga lafo* has playing pieces fashioned from coconut shell.)

vines

vines

The *vālai* vine is also used to make Tongan twine, swings or skipping ropes. The bark of the vine is used to treat mental illnesses ('devil sickness') as well as stomacheache (Whistler, 1992a).



vālai leaves

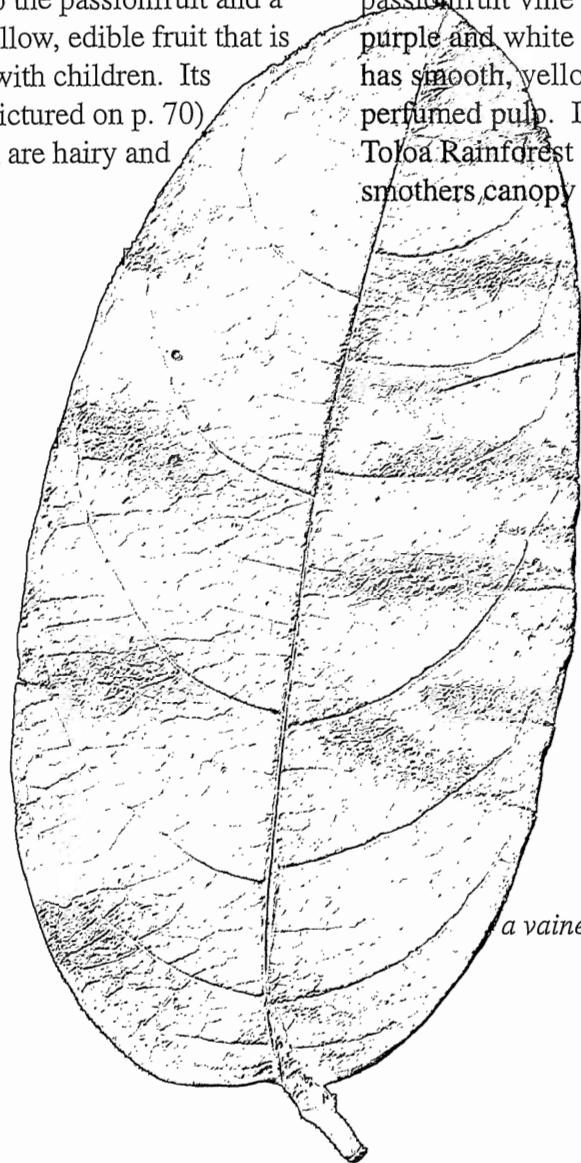
Vanila

Vanilla
(*Vanilla planifolia*)

An introduced species cultivated near by as a cash crop, but now rare within the Toloa Rainforest Reserve.

Vaine 'ae kumā ('rat vine')*(Passiflora triloba)*

A vine common in the Toloa Rainforest Reserve, with a flower similar to the passionfruit and a small, yellow, edible fruit that is popular with children. Its leaves (pictured on p. 70) and stem are hairy and oily.



a vaine kai leaf

Vaine kai ('eating vine') or
Vaine Tonga ('Tongan vine')

Passionfruit

(Passiflora maliformis)

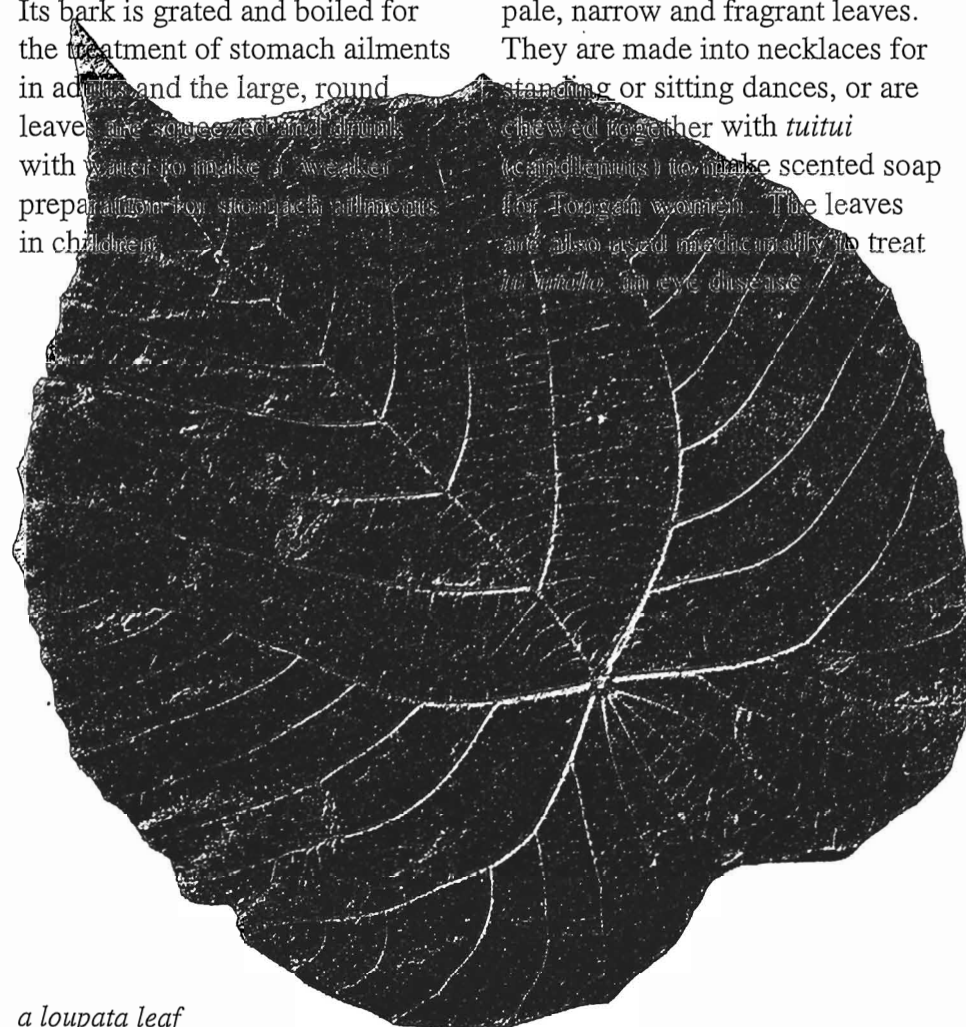
An introduced variety of passionfruit vine with an exquisite purple and white flower. Its fruit has smooth, yellow skin and pale, perfumed pulp. It is a pest in the Toloa Rainforest Reserve where it smothers canopy trees.

Loupata

Macaranga

(Macaranga harveyana)

A small native tree (3-8m) common to forests and wasteland, the *loupata* has a small, thorny fruit that turns yellow when ripe. Its bark is grated and boiled for the treatment of stomach ailments in adults and the large, round leaves are squeezed and drunk with water to make a weaker preparation for stomach ailments in children.



a loupata leaf

*Maile**(Alyxia stellata)*

This small tree with creeping tendencies has a small oval fruit that are black when ripe. The *maile* is particularly valued for its pale, narrow and fragrant leaves. They are made into necklaces for standing or sitting dances, or are chewed together with *tuitui* (candlebush) to make scented soap for Tongan women. The leaves are also used medicinally to treat *tu'itutu*, an eye disease.

sub-canopy trees

sub-canopy trees

Moli peli

Mandarin

(*Citrus reticulata*)

There are three of these trees growing in the Toloa forest. Their edible fruit are yellow when ripe and orange on the inside.

Nonu

Beach mulberry or Indian mulberry (*Morinda citrifolia*)

A small, south-east Asian tree (up to 8m) introduced to Tonga in ancient times. The *nonu* is found in open and coastal areas and accounts for about 1% of the Toloa Rainforest Reserve. It has an edible though unpleasant fruit that is eaten in times of scarcity, but more often fed to pigs. It has a white flower and leaves 15-35cm long.

The *nonu* is popular in traditional medicine throughout Polynesia, used to treat stomach ailments, *tēvolo* ('devil') sickness (perhaps mental illness) as well as mouth, eye and skin infections, such as boils. The juice of its fermented fruit is also mixed with garlic and honey and drunk for high blood-pressure. The *nonu* tree is now a valuable export crop, cultivated for its leaves, which are used in the West in skin lotions, dietary supplements and are thought to have anti-cancer properties.

The *nonu* bark is also used in Tongan handicrafts, principally to make red dye for pandanus *ta'ovala* (waist mats). The pandanus is naturally white, but when buried for up to a month in a mixture of *nonu* bark, water and ashes from a fire, the matting turns dark red, suitable for waist mats worn to funerals and as mourning attire. A yellow dye can also be made from the roots of the *nonu*.

Pula vaine

Balloon vine

(*Stictocardia tiliaefolia*)

A large perennial vine of the morning-glory family. Stems grow up to 10m long and have clear sap. The underside of its 8-24cm heart-shaped leaves are covered with fine black dots. Its funnel-shaped, 5-lobed flower is 7-10cm and reddish-purple with a dark centre and five radiating lines. The fruit is a smooth, papery capsule 2.5-3.5cm in diameter, each containing four seeds.

The *pula vaine* is native in tropical America and Asia and probably arrived in Tonga in the late 19th century. Its ability to climb over other vegetation makes it the worst vine in the Toloa Rainforest Reserve. It can kill canopy trees and prevent their re-growth. There are two varieties at Toloa: the 'red' *pula*, named for its red stem, has a dark-purple flower and the 'white' *pula* has a pale green stem and a paler purple flower.

vines

Tutu'uli

Wild jasmine (*Jasminum betchei* / *Jasminum simplicifolium*)

A high-climbing woody forest vine with white flowers, black fruit and dark green leaves 4-10cm long. The *tutu'uli* is a Tongan native but can be a problem in the Toloa Rainforest Reserve when it strangles tall trees.

The relatively thin stem is used in traditional medicines to treat cancer and diabetes. It is also used to produce ink. Whistler (1992a) also reports use of the bark and leaves to treat 'swollen liver' ('*ate pupula*).

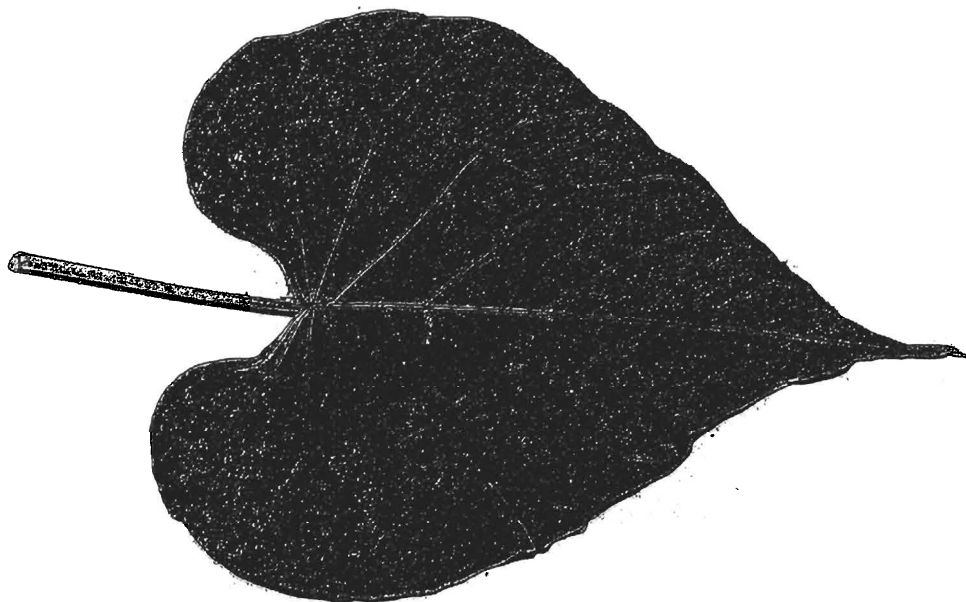
vines

vines

Laumatolu

Wax plant
(*Hoya australis*)

Laumatolu is a semi-woody vine more common in coastal areas. It has thick, heart-shaped leaves with rounded ends and white sap. These leaves are traditionally used in the treatment of skin diseases.



a white pula vaine leaf

Lautolu 'uta

of the pea family
(*Vigna adenantha*)

The *lautolu 'uta* is a herbaceous vine with stems up to a metre or more in length. It is probably native to Tonga, though found elsewhere. Its dark-green, hairy leaves are used to treat *tēvolo* ('devil') sickness. A related variety, known in Tongan as *lautolu tahi* ('sea *lautolu*') is found in coastal areas and has thicker, paler, rounded leaves without hairs.

Ponga

A tree fern that can grow over 2m high. It is common in 'Eua and introduced to Toloa. When the tree is dead, its hollow trunk is cut up and used for potting orchids.

sub-canopy trees

Siale mohemohe ('sleeping Charlie')

Wild tamarind
(*Leucaena leucocephala*)

A woody, leguminous shrub or small tree 1.5-5m in height, it has fluffy white flowers, feather-like leaves and clusters of flat, dark-brown seed pods about 2cm long, each containing 15 to 25 shiny brown seeds, which are often used to make necklaces and curtains. Its timber is used for fence posts and traditional housing construction. It is native to tropical America and was probably introduced to Polynesia in the 19th century. Like all leguminous plants, it enriches the nitrogen in the soil.

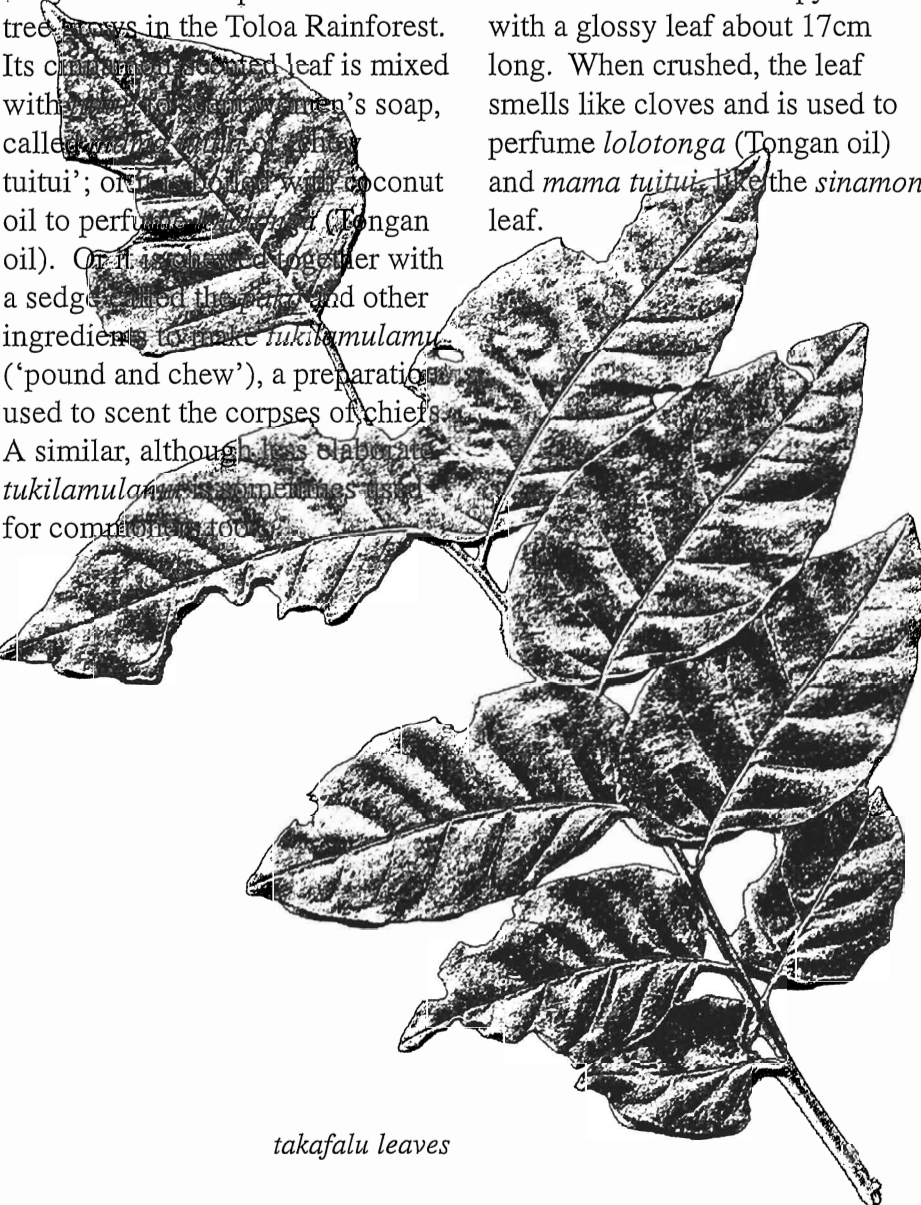


a nonu leaf

sub-canopy trees

Sinamoni ('cinnamon')

Only one known specimen of this tree grows in the Toloa Rainforest. Its cinnamon-scented leaf is mixed with *mama tuitui* (Tongan oil) to perfume *lolotonga* (Tongan oil). Or it is chewed together with a sedge called *the tui* and other ingredients to make *tukilamulamu* ('pound and chew'), a preparation used to scent the corpses of chiefs. A similar, although less elaborate *tukilamulamu* is sometimes used for commoners too.



takafalu leaves

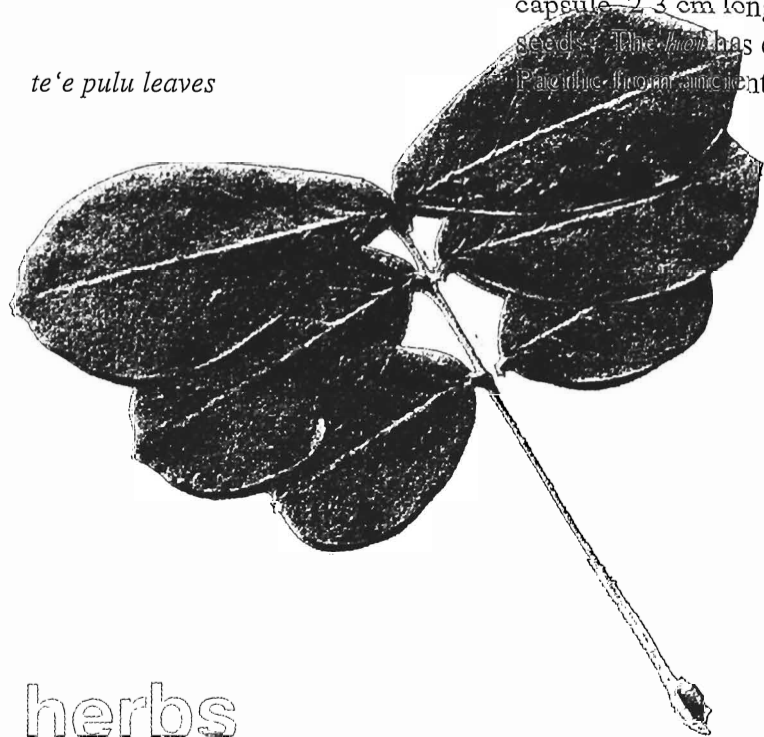
Sipaia ('spice')

An introduced sub-canopy tree with a glossy leaf about 17cm long. When crushed, the leaf smells like cloves and is used to perfume *lolotonga* (Tongan oil) and *mama tuitui*, like the *sinamoni* leaf.

Te'e pulu ('cow dung')
Peanut weed
(*Cassia toro*)

This shrub has smooth leaves similar to those of a peanut plant and slender beans. It often grows where cows graze, hence its colloquial name. It can be a pest in pasture and native forest. It occurs in the Toloa Rainforest Reserve where the canopy is damaged.

te'e pulu leaves



Hoi
Aerial yam or bitter yam
(*Dioscorea bulbifera*)

A high-climbing, non-woody vine with a large underground tuber as well as aerial tubers up to 8cm long. They are bitter, but edible if washed and cooked correctly. The grooved stem of the *hoi* twists in a clockwise direction (when viewed from the tip) and can grow up to 30m long. Its heart-shaped leaves grow 6-22cm long. Tiny white flowers grow along a pliable spike 5-15cm long. Its oblong seed pod is a brown, papery, 3-winged capsule, 2-3 cm long, with winged seeds. The *hoi* has existed in the Pacific from ancient times.

Te'e hoosi ('horse dung')

False mallow

(*Malvastrum coromandelianum*
or *Sida parvifolia*)

A widely branching shrub growing up to 1m in height. The tooth-edged leaves are 1-3.5cm long. It has a pale-orange flower, each with five heart-shaped petals. It is said you can tell the time by the *te'e hoosi* flowers as they are thought to close promptly at noon. The spiny seed pod is 4-7mm in diameter and breaks into 10 to 15 segments.

The *te'e hoosi* was probably introduced from tropical America in the 19th century. It is also called 'broom weed' in Tonga, where it is dried and bunched together for use as a broom.

Te'e kosi ('goat dung') * rare

A shrub with a dark-red stem, square in cross-section. Its small, veined leaf has a serrated edge. Black mourning clothes are often washed with this plant to make them darker and pleasantly scented, rather like mint.



te'e kosi leaves

Takafalu

(*Micromelum minutum*)

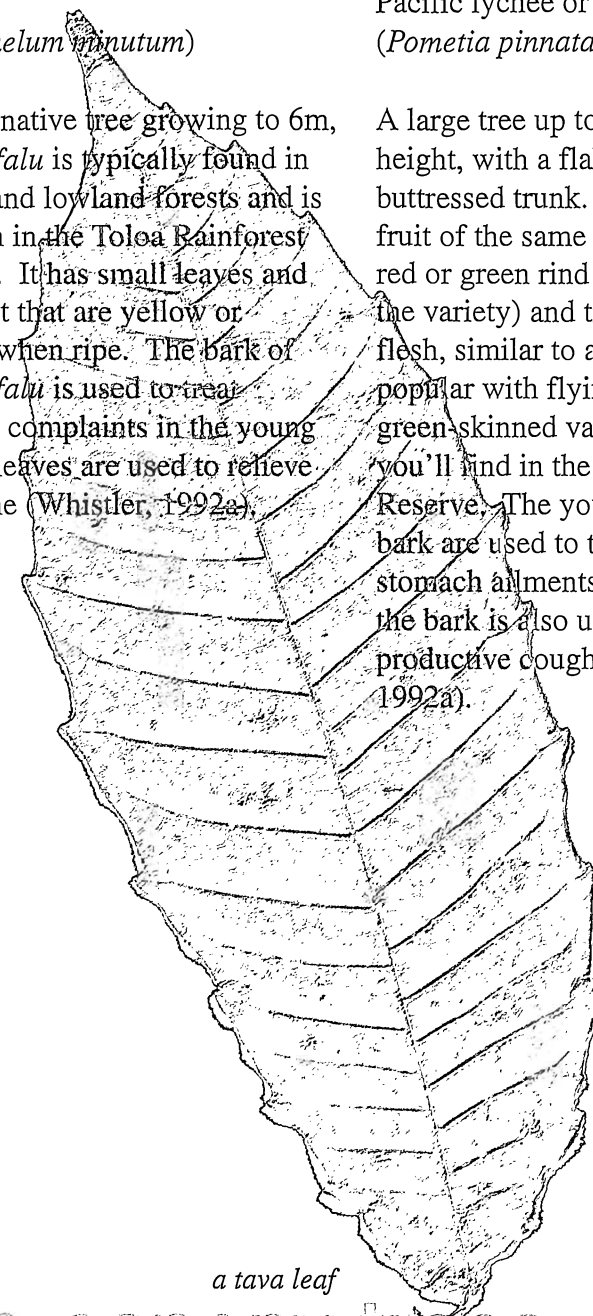
A small native tree growing to 6m, the *takafalu* is typically found in coastal and lowland forests and is common in the Toloa Rainforest Reserve. It has small leaves and oval fruit that are yellow or reddish when ripe. The bark of the *takafalu* is used to treat stomach complaints in the young and the leaves are used to relieve toothache (Whistler, 1992a).

Tava

Pacific lychee or tava

(*Pometia pinnata*)

A large tree up to 30m or more in height, with a flaky bark and buttressed trunk. It has a delicious fruit of the same name with a thin red or green rind (depending on the variety) and translucent white flesh, similar to a lychee, and very popular with flying foxes. The green-skinned variety is the one you'll find in the Toloa Rainforest Reserve. The young leaves and bark are used to treat mouth and stomach ailments. An infusion of the bark is also used to treat productive coughs (Whistler, 1992a).

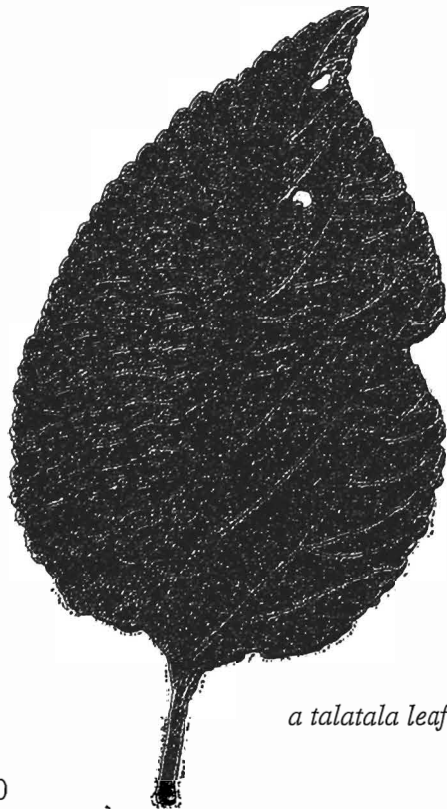


a tava leaf

herbs

Mate loi ('fake death')
Giant sensitive plant
(*Mimosa invisa*)

A spreading shrub forming tangled masses up to 1.5m in height, with prickly stems and leaves somewhat sensitive to the touch. Seed pods and flowers very similar in appearance to the lower-growing *Mimosa pudica*. Native to tropical America, the giant sensitive plant was introduced to Polynesia in the mid-20th century where it is now widespread and often a weed.



a talatala leaf

Mo'osipo

(*Triumfetta procumbens*)

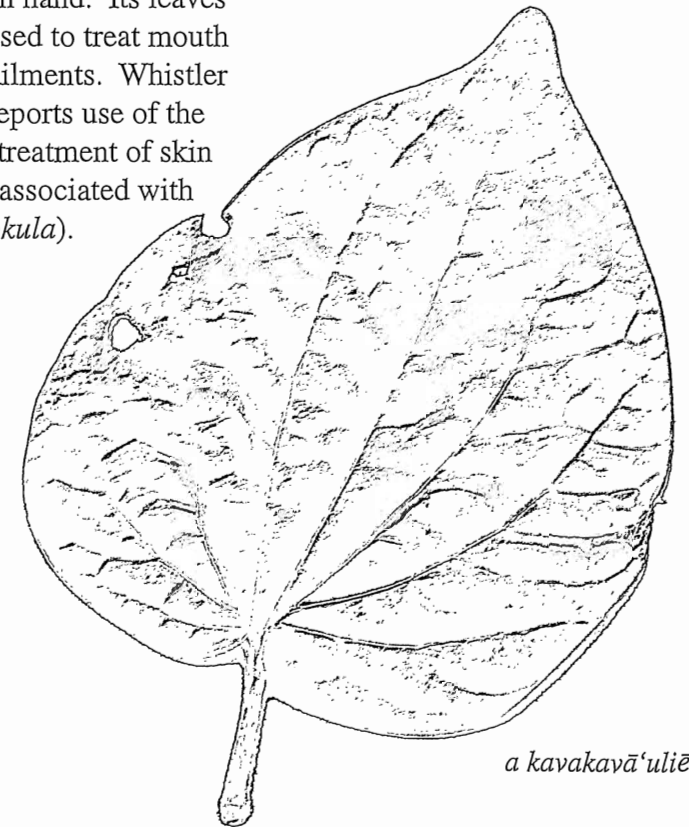
A low shrub with trailing stems up to 3m long. It has broad, oval-shaped leaves, velvety to the touch. It has small, yellow flowers and spiky green fruit. This shrub occurs in the Toloa Rainforest Reserve in two varieties, the so-called *mo'osipo pālangi* and the *mo'osipo Tonga* (that is, European and Tongan *mo'osipo*). The Tongan variety is the smaller of the two and is used to treat skin diseases.

There is a Tongan proverb concerning the hardiness of this plant and its ability to grow back even if crushed. In fact, being trodden underfoot can help it flourish. The proverb is, *Malakia a mo'osipo* ('step on the *mo'osipo*') and is used to refer to something that is difficult to destroy.

sub-canopy trees

Volovalo
Verbena
(*Premna serratifolia*)

The *volovalo* is a small native tree (3m or more), usually found by the sea. It has tiny white flowers and leaves up to 20cm long. Only one specimen of this tree survives in the Toloa Rainforest Reserve. The tree is about 30 years old and although its location is kept secret, recently some bark was removed by an unknown hand. Its leaves and bark are used to treat mouth and stomach ailments. Whistler (1992a) also reports use of the leaves for the treatment of skin inflammation associated with filariasis (*kulokula*).



a kavakavā'uliē leaf

shrubs

* rare *Kavakavā'uliē* * rare
(*Micropiper puberulum*)

A native Tongan shrub, up to 2m high, named for its similarity to kava. The two species are related, but *kavakavā'uliē* is not used in a beverage. Its leaves are used to treat mouth diseases, stomachache and skin complaints such as boils (*hangatāmaki*).

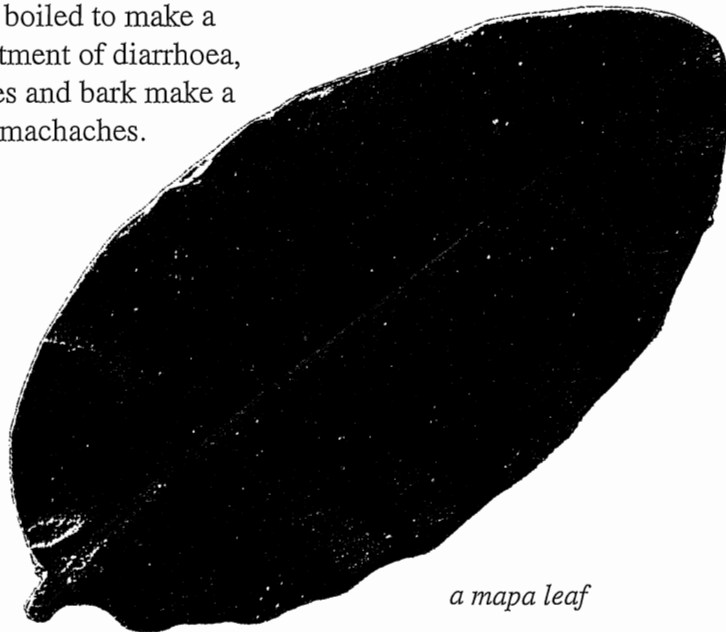
sub-canopy trees

Kuava

Guava
(*Psidium guajava*)

A popular fruit with yellow rind, pink flesh and many seeds, the kuava grows up to 10m in height. Its oblong leaves are 3-7cm long with strong veins underneath. It has a small, very pretty white flower. It is native to tropical America and appears to have been introduced to Polynesia in the 19th century, where it can become a weed.

The bark and leaves of the *kuava* contain tannin, making them useful in astringent preparations. The leaves are boiled to make a tea for the treatment of diarrhoea, while the leaves and bark make a remedy for stomachaches.



a kuava leaf

Mapa

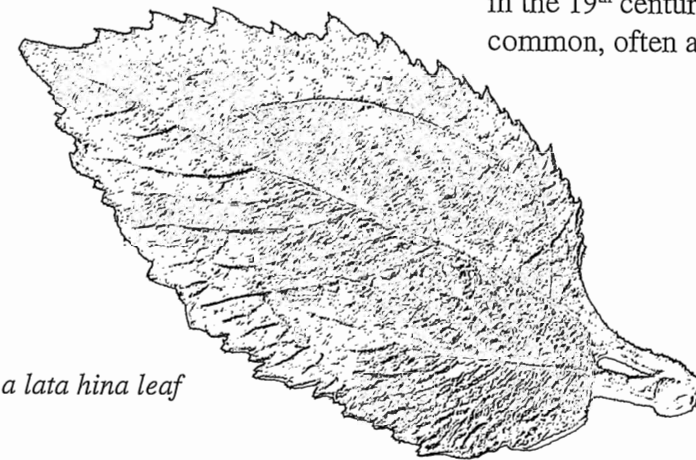
* rare

A large shrub with dark-green, smooth-edged leaves and a small round red fruit that is used to make women's necklaces. It is rare, with only five examples in the Toloa Rainforest Reserve. Nearby Pelehake village is nicknamed *vao mapa* or 'garden of *mapa*', where it grows more abundantly.

Lata hina

Tobacco weed or Elephant's foot
(*Elephantopus mollis*)

An American native introduced to Polynesia in the 20th century and now common throughout the tropics. Its bristly seeds spread by sticking to clothing and fur. It grows up to 1.5m in height in sunny areas. It has hairy leaves 2-7cm long.



a lata hina leaf

Mate loi ('fake death')

Sensitive plant.
(*Mimosa pudica*)

A low plant up to 40cm in height, the *mate loi* has remarkable, feather-shaped leaves that close up when touched. Its stems are reddish, with tiny curved prickles. It has a small fluffy round flower in a lilac-pink and a flat, oblong seed pod 8-15mm long with bristly margins. It is native to tropical America and thought to have been introduced to Polynesia in the 19th century, where it is now common, often a pest.

herbs

Hulufe ('fern')

Ground fern

(*Dennstaedtia parksii*)

A common fern in the Toloa Rainforest Reserve. The leaves of the *hulufe* are used to wrap jellyfish for transport. The leaves act as a sieve, allowing the seawater to drain away.

Kihikihi

Wood sorrel

(*Oxalis corniculata*)

A widely branching, creeping perennial herb, thought to have been introduced unintentionally in ancient times. Today it is found in open areas and can be a weed. It has clover-like leaves and small yellow flowers, each with five petals. Its green, cylindrical seed pod is 1-2cm long and explodes with many tiny seeds. *Kihikihi* is used in Polynesian medicines to treat infants and children, e.g., mouth infections and navel ailments (Whistler, 1992a).



hulufe

shrubs

Pula ('balloon' or 'bubble')

(*Solanum mauritianum*)

Two different species of plant bear the Tongan name *pula*: this sub-canopy tree or bush is related to the *tisaipale* (p. 36) and an invasive introduced vine, *pula vaine* (p. 45). This tree has a velvety leaf, slightly paler underneath than on top. It has a small, purple flower with a yellow centre and a small, round fruit that turns yellow when ripe.

Sĩ

Ti or Ti plant (*Cordyline terminalis* / *Cordyline fruticosa*)

The *sĩ* plant (up to 5m) is probably native to tropical Asia, but was introduced to Tonga in ancient times where it served as the first form of sugar before European contact. The long, tuberous roots were dug up and baked in an earth oven ('*umu*'). They can then be eaten as is, or bound and the sap squeezed out to sweeten other Tongan foods such as *po'opo'oi*. Related varieties in red and green are commonly used ornamentally. The leaves, 30-70cm long, have a number of uses, including skirts and dancers' costumes. They are also used to treat eye problems attributed to supernatural origin, or toothache (Whistler, 1992a).

Tanetanevao

* rare

(Polyscias mulijuga)

The domesticated variety of this bush, called *tanetane*, has variegated leaves and is popularly used in hedges. The wild, or *vao*, variety found, if rarely, in the Toloa Rainforest is not variegated.

*tanetanevao leaves**Tisaipale* ('disciple')

Prickly solanum

(Solanum torvum)

An erect, branching perennial shrub growing up to 4m in height. Its stems have scattered prickles between 2-9mm long. It has small, white 5-sided flowers with yellow stamens and small, green-to-yellow berries with many seeds. The *tisaipale* is native to the Caribbean and was not introduced to Tonga until the 20th century. It was once found in the Toloa Rainforest but has been deliberately eradicated here and elsewhere in Tonga.

'*Akau veli*' ('itchy plant')

Wild indigo

(Indigofera sufruticosa)

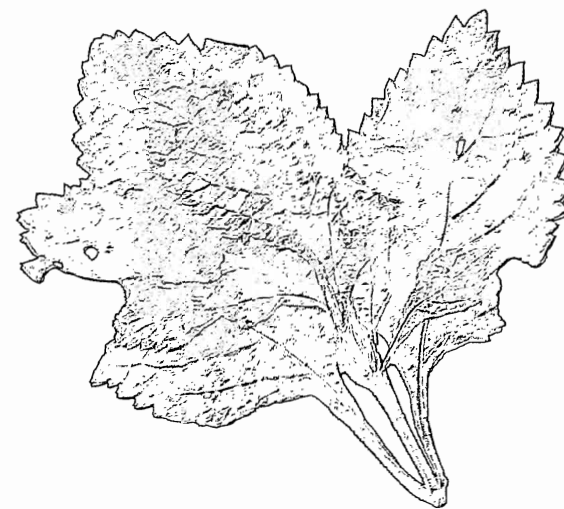
Belonging to the pea family, this shrub grows to 60cm-2.5m in height. It has grey, ridged stems and small, elliptical, green-grey leaves. It has small, salmon pink, pea-like flowers and short, curved, cylindrical seed pods, each with 4 to 6 dark brown seeds. The '*akau veli*' is native to tropical America and was probably introduced to Tonga in the 19th century. Its leaves are widely used to treat bee stings (Whistler, 1992a).

Hiku'i kumā ('rat's tail')

Blue rat's tail

(Stachytarpheta urticifolia)

A widely branching sub-shrub with stems woody at their base. It has tapering, tooth-edged leaves up to 2cm long. Its purple or dark-blue flower grows at the base of a pliable green 'spike' up to 5cm long, reminiscent of a rat's tail. It produces a small, black nut 3-5mm long that splits into two segments. The *hiku'i kumā* is native to tropical America and was probably brought to Tonga early in the 20th century.

*hiku'i kumā leaves*