



Gardens of Oceania



Annie Walter | Vincent Lebot



Australian Government
Australian Centre for
International Agricultural Research



GARDENS OF OCEANIA

Annie Walter and Vincent Lebot
with collaboration from Chanel Sam

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English translation by Paul Ferrar

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Preface

by Stephen Kalsakau
Minister of Agriculture
Vanuatu

The ni-Vanuatu people have a real passion for plants. Their relationship with the plant world is that of gardeners, aware of the rich but fragile biodiversity of their own islands, and inquiring as to what may be introduced and exploited from the modern world outside. They never stop experimenting with new species of food plants and ornamental species. Even though the genetic diversity of the indigenous species tends to become narrower, the number of different cultivated plants found within the traditional garden is at the same time increasing with the introduction of exotic species into the archipelago and their exploitation.

The population of Vanuatu is thought to have been close to a million people before the first contact with Europeans. Although little information is available, it is probable that the richness and the productivity of the soils allowed the inhabitants to meet their nutritional needs without much risk of malnutrition, despite the numerous and frequent climatic hazards. But this type of subsistence, though still possible, is not found any longer. The population of Vanuatu, decimated by introduced diseases and forced migration, was only about 110,000 inhabitants in 1980 at the time of Independence. A very high population growth rate has meant that

today there are about 200,000 inhabitants, but this is a matter of some concern: the urban population is expected to double in the next ten years, and the total population of the country will double in the next 23 years and will reach one million in 2070. Provision of the necessities of life will then become quite difficult.

In these circumstances two approaches may be taken to satisfy the food needs of the population: the amount of local food production must expand rapidly, and farmers must increase their incomes through export of produce in order to be able to buy from overseas whatever cannot be produced locally.

It is this last strategy that has been favoured since Independence, with modest success. The geographical isolation of the country, far from the main trade routes, and the physical layout of the country – an archipelago – cause major problems for the trade in food products, which are often perishable. The constraints that agricultural exports must overcome are enormous. The distance of the major consumer markets make the staple food products uncompetitive. Conversely, the agriculture of this tiny country, suffering from the absence of any protective measures, is exposed to the full measure of global competition. The importers of agricultural commodities benefit from this



and are able to place on the local market impressive quantities of exotic, imported foods, which are even cheaper than the local products. The difficulties of exporting combined with the great ease of importation make for a serious imbalance in the balance of trade.

Since Independence the agricultural balance sheet of Vanuatu has been in deficit every year. The value of imported food commodities is regularly higher than the value of those exported. Worse still, food styles and preferences change very quickly. Per capita consumption of canned meat and fish, rice, flour and other processed foods is increasing continually. Nowadays young people prefer bread and rice to the local root crops, because they acquired the taste for them during their years of education, and because these foods are quicker to prepare and cheaper for a salaried population that buys its food and is short on time. These young people thus represent a potential consumer market for overseas cereal growers, and local producers suffer a steady decline in customers even though the local production of food crops remains high.

Aware of the dangers that this situation presents, the Government of the Republic of Vanuatu decided to declare the first year of the new century – 2001 – “the year of local produce”, or “Yia blong Aelan Kakai” in Bislama. Through this simple slogan, this national campaign aims to remind citizens of the need to preserve

the local in order to face the global. The ni-Vanuatu can be proud of their biological products, which are produced without pesticides or other chemical products. The diversity of these local products deserves to be valued, but being poorly known they are also poorly utilised.

In this context, this book is an important resource: it summarises available knowledge about numerous food plants that could and should be exploited commercially in the future, in order to assure the development of an agriculture that can produce sufficient to cope with the formidable population growth while at the same time preserving the island environment. It is thus intended for a very large public: producers, to be sure, but also the teachers who have the heavy responsibility of educating the younger generations, professionals in agriculture and related sectors, those with assorted roles in public life, and finally the decision makers. All these people may quickly find source information on the history of the food plants found nowadays in Vanuatu, their botanical descriptions, the variability found within the species, the general details of their cultivation, and finally complementary information on their main uses. This is a comprehensive guide that will allow everyone, whatever their interests or character, to have systematic access to important information, from the most basic to the most particular. The book thus covers the major plants, illustrated by numerous

photographs. It provides for each plant a list of references and a repeat of specific information that is developed further in the CD-ROM: the synonyms of the plant species, the herbarium reference specimens and the studies of intraspecific variability. The reader, having consulted the book for the main information on a particular plant species, may then refer to the CD-ROM to obtain complementary information if wished from the cited references for easy access to more detailed information.

The authors, Annie Walter and Vincent Lebot, have thus provided us with a work that

comprehensively depicts our modern-day agriculture, with its ancestral plants and those that have come in additionally, giving information for all on the origin, the modes of cultivation, the variability and the practical usage of each species, and allowing specialists easy access to technical information that they may need. This is a difficult, not to say hazardous, task when one considers the remarkable diversity of plants in Oceania, but even if there may be a few errors and omissions, a thorough reading of this comprehensive and easy to access work can be recommended to all.



Acknowledgments

French edition

This book is the result of many long days spent in the gardens and the villages of Vanuatu. The list of people who have made direct contributions to this work, by letting us visit their garden plots or by giving us valuable information, is clearly too long for each to be recognised individually here. They are, nevertheless, the sources of the basic information that made up this book. It is with great admiration for their knowledge and sincere recognition of the time that they devoted to us that we convey our warm thanks to them all.

We wish to thank our collaborators in Vanuatu, in the government services, in the cultural centre of the National Museum of Arts, and in the Department of Agriculture and Forests for the discussions that we have had in the field during numerous trips undertaken around the archipelago, and for all the help that they gave us. The vendors in the markets of Luganville and Port Vila were never sparing with their time, nor ever lost their good humour, in answering our many questions whose naivety often caused great mirth among them. This book is thus naturally dedicated to the women and the men of agriculture in Vanuatu, whose knowledge through this work is translated into scientific terminology.

Also very numerous are the friends and colleagues who have helped in the realisation of this work. Chanel Sam, curator of the Port Vila Herbarium, identified the majority of the species and frequently accompanied us into the field. Alfred Mabonlala helped us throughout the production of this book. Delphine Greindl, of Luganville Market, and Fabienne Tzerikiantz, on the west coast of Santo, gathered valuable information on the methods of cultivation and preparation of the food plants. The former also provided us with numerous photographs. Elisabeth Pelegrin and her collaborators, in the Information Centre of IRD in Montpellier, helped to get for us many related publications that would otherwise have been hard for us to find. Deta Alimeck was most helpful in collating and sorting the relevant references. Pierre Cabalion, botanist at IRD, provided us with much complementary information gathered during his own studies in Vanuatu. Patricia Siméoni was kind enough to provide us with some of her own photographs. Laure Empeaire checked the section on cassava and Jean-Marie Bompard that on mango. To all of them we give our sincerest thanks, for their help, their support and their friendly comments.



Finally, we would like also to thank Jacques Florence and Francis Hallé who went through our manuscript with a fine tooth-comb, and whose comments, corrections and suggestions have greatly improved the initial draft of this text. It is of course understood that if any errors or misinformation remain, they are our responsibility.

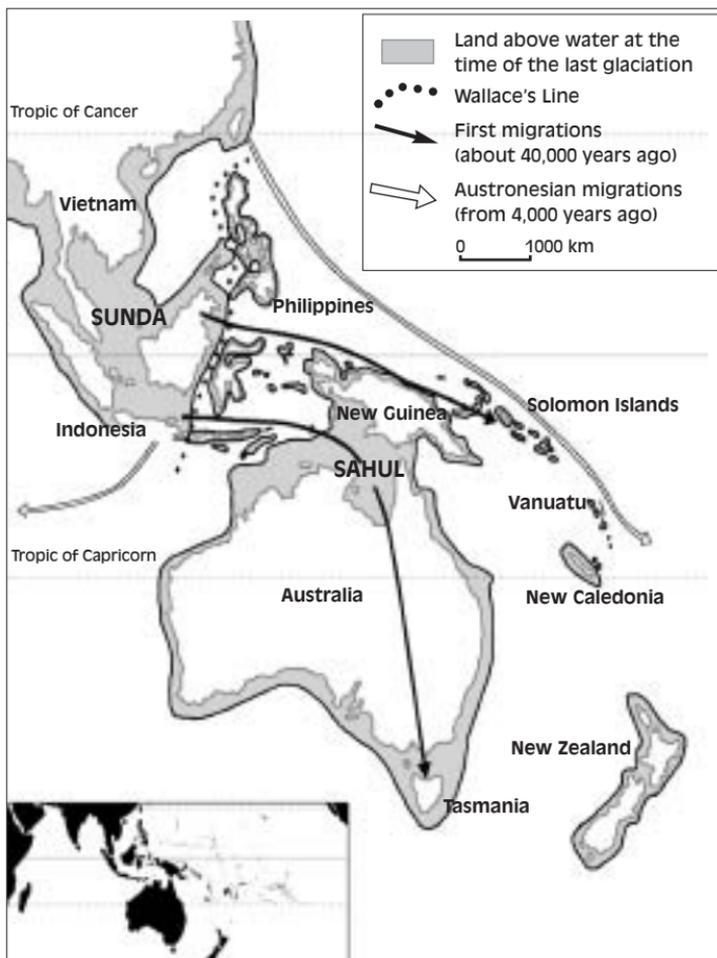
Note on English edition by translator

As translator of the fascinating earlier volume *Fruits d'Océanie*, I was excited to hear that a companion volume, *Jardins d'Océanie*, was to complete this study of the food plants of Vanuatu, and I offered my services again to translate the new work.

I was assisted with some particular French terms by my friend and former colleague Christine Moore, and also by one of the authors, Vincent Lebot, whose knowledge of English is far better than mine of French. I am most grateful to both of them, while acknowledging that any errors that remain are my responsibility.

IRD and CIRAD kindly made available a full electronic copy of the French text and all the illustrations, and permitted ACIAR to publish the English translation. I am also most grateful to my former colleague Robin Taylor (Publications Manager of ACIAR) for her encouragement and assistance with technical production of the work.

Paul Ferrar
Canberra



Migrations towards the Sahul continental plate before the last glaciation



Introduction

It is estimated that about 500,000 species of plants occur throughout the world, but only a small proportion of these have been identified, described and stored in herbaria, and many are disappearing before they have been classified.

Among these, about 30,000 species are edible and 7,000 have been cultivated or gathered by humans at one time or another in history. Several thousand species have thus been considered to be of use to human nutrition globally. Nowadays only thirty species feed the world and their cultivation provides 95% of the requirements of calories and proteins, with wheat, maize and rice alone supplying about half the energy obtained from plants. It is thus primarily on these three species, and then on the other 27 species, that the main efforts are made for improvement and conservation of genetic diversity. This shows the extent to which the nutrition of the planet is in the process of homogenisation, all the more because every time local food habits change, some species disappear – since they are no longer being used, they are no longer cultivated.

However, paradoxically in certain regions the diversity of food plants has never been all that great. The major explorations of the 16th to the 18th centuries, conversion to Christianity of the worlds discovered by Western

nations, colonisation, the increase in tourist travel and the growth of international trade have contributed to the spread of local food species on a huge scale, and to the change of tastes in food materials. Nowadays, thanks to trade in seeds, to the development of supermarkets and the growth of shops selling exotic foods, and to increasing immigrant populations, in any given country one may find practically any ingredient for preparing a meal. It seems, therefore, that if one particular economic trend tends to reduce the number of food plants to a few species, another trend is tending to increase our choice of available foods. The world, finally, is seeing an era of great gastronomic exploration. Western countries are discovering, and will discover still more, unknown food plants for which they know neither the name nor the usage. Tropical countries have seen, and will see yet more, the arrival of food products of whose origin and utilisation they are often ignorant. The former countries purchase and taste; the latter countries often start to grow and sell. For each of these groups we have conceived this guide, to present to Western nations the food plants used in Oceania, and to show to the Oceanians the origin and utilisation of the plants that have been introduced to their region.



The work has as its setting Vanuatu – a small island nation in the South Pacific situated between the 14th and 16th parallels – and as its focus the food plants that are found there at the present time. The islands of Vanuatu are young islands, formed for the most part from the seismic convulsions that shake this part of the world where the Australo-Indian tectonic plate moves under the Pacific plate. These pieces of land have been colonised since their formation by plant species that have come from elsewhere, carried by winds, ocean currents or birds. When humans first arrived on these islands they certainly found edible species there, but at the same time they also brought with them their own familiar plants. The story of the food plants of Vanuatu is thus also the story of the human migrations that have populated these islands.

Before the last Ice Age, about 10,000 years ago, Papua New Guinea, mainland Australia and Tasmania were joined into a single large continent, the Sahul. Further east, what is now the archipelago of Solomon Islands was a single long strip of land, stretching from Buka (situated north of the island of Bougainville) to Guadalcanal. Between Sunda, the continental plate of Southeast Asia, and Sahul were various islands grouped under the name of Wallacea (see map p.12) because they were situated on the biogeographical line (named after Wallace) that separates these two major regions.

The climatic upheavals occurring during the Quaternary era encouraged the movement of populations from Sunda to Sahul. The first human of Sahul was probably a *Homo sapiens* as is shown by dating carried out in Australia. Before the last rise in sea levels, the continental islands were much larger landmasses. Java, Sumatra and Kalimantan, the great islands of Indonesia, were joined to the Indochinese peninsula, just as the Philippines were connected to Sunda by some tongues of land. Between Sunda and Sahul there were some chains of tall islands, visible from far away. By calculating the angles of inter-visibility between these islands, one can work out two possible routes that would allow people to pass from one continent to the other without ever losing sight of land. One route goes via Sulawesi and Halmahera, and the other – further south – via Flores and Timor. Once on Sahul, the first Australian people would have been able to reach Tasmania on foot. Humans would likewise have been able to go to the Solomon Islands while always having an island in sight to guide them. Thus in New Ireland the presence of humans is traced back for over 33,000 years from datings made at the sites of Matenkupkum and Buang Mebarak.

The origin of the cultivated plants of Oceania has been the subject of numerous studies, and it has for a long time been accepted that these plants were introduced from Asia with the first migrations. These conclusions are

based on archaeological digs that have found traces (grains or nutshells) of plant consumption at sites that can be accurately dated by carbon-14 or other objective measures. But while this approach is generally relevant for cereals and plants with seeds or fruits, it cannot be used for plants that multiply vegetatively, where the usable plant parts rapidly decompose into organic matter in humid tropical regions. This is why, although some ethnobotanists have for a long time been convinced that root and tuber crops and bananas are among the oldest plants domesticated and eaten, it has been necessary to wait for progress in molecular biology and dating techniques to understand that the domestication of endemic species spread very early in Sahul as the hunter-gatherers, originally from Sunda, crossed Wallacea. Nowadays there are sound findings from taxonomy, biogeography, molecular biology and archaeology that show that the first inhabitants of Sahul arrived without planting materials, but then domesticated the plants found locally to fulfil their needs. Over the subsequent millennia many domesticated tropical crops were spread more widely, towards the west as much as into the Pacific. Among the best known are certainly sugar cane, bananas and breadfruit, but it is also true of various Dioscoreaceae and Araceae as well as kava and many other food plants.

Although it is difficult to obtain accurate dates, numerous works agree in showing earlier dates

for domestication of root crops than of cereals. The endemic yams of Australia, *Dioscorea hastifolia* and *D. transversa*, were domesticated by aborigines, and provided a regular food supply in a harsh region. In some wetter regions of northern Australia, taro (*Colocasia esculenta*) is endemic and was domesticated locally. It is known to have been eaten 28,000 years ago in Solomon Islands, because it has been possible to obtain accurate dating of starch grains found on grinding stones. Evidence has been found of cultivated gardens, dated as older than 9,000 years, at about 2,000 m altitude in the highlands of New Guinea. In comparison, the consumption of root and tuber crops in the New World appears to date back 5,000 to 7,000 years.

It thus follows that, although agriculture was first developed in the fertile crescent of the Middle East about 10,000 years ago, the use of vegetatively propagated plants saw the light of day on the continental platform of Sahul probably more than 20,000 years ago – at least that is what all the evidence shows.

For the peoples of Asia the use of vegetative plants is secondary in importance to the omnipresent cultivation of rice, although it does predominate among certain ethnic minorities of South and Southeast Asia (for example, the Indonesians of the Mentawai Islands off Sumatra, for whom taro is the staple food). In contrast, in Sahul only vegetative plants have been used.

The Austronesians, a mongoloid people who later colonised the rest of Oceania, introduced the use of vegetative plants to all of Polynesia, as far as the islands of Hawaii and Easter Island. According to linguists, certain groups of Austronesians from Southeast Kalimantan set off in the opposite direction over 3,000 years ago and colonised the large island of Madagascar. Their plants, loaded on catamarans and kept alive throughout the voyage, were spread in clonal form to places thousands of kilometres away. Bananas, taro and the yam *Dioscorea alata* thus reached Africa via Madagascar. Recent work has shown that banana was already grown in Central Africa more than 2,500 years ago.

The question of the introduction of sweet potato (*Ipomoea batatas*) to Papua New Guinea has used up a huge amount of ink, since it was already the staple food crop in the highlands before their “discovery” by European explorers, and was likewise already cultivated in the Hawaiian Islands before the arrival of Captain Cook. Melanesia is nowadays considered to be a second centre of diversification of this species. The diversity found in *I. batatas* in this region is greater than that found in the Peru-Ecuador region, which was not the origin of the Melanesian germplasm, and recent molecular studies suggest rather a Central American origin.

Contrary to commonly held theories which presume no Indo-Malayan centre of origin

extending from the Indian Peninsula to Papua New Guinea, the Oceanian centre is clearly differentiated on the basis of factors that are as much biogeographical as human. The existence of a centre of domestication and diversification in the Sahul then raises some interesting questions on the originality of the forms that are cultivated there and their genetic distances with regard to other forms of the same species, or to related species, originating from Sunda. In certain cases, the intraspecific differentiation of pantropical species – *Dioscorea bulbifera*, for example – is very significant. In other cases, for example sugar cane, the hybridisation of distinct species originating from the two large landmasses of Sunda and Sahul has allowed remarkable genetic gains to be made.

Melanesia has a diversity of plants with vegetative propagation and with roots and tubers, that is unequalled anywhere else on Earth in numbers of genera, of species and of varieties cultivated within each species. The cultural diversity of this region, unique in the world (a tiny country like Vanuatu has 113 languages and Papua New Guinea has over 600), combined with island environments that favour differentiation, have produced spectacular variability. Populations coming from the Asian region, from New Guinea and from Solomon Islands, and later returning from Polynesia, stayed in the Oceanian region, continental or island, and worked on the plants endemic to the region, spreading them

from island to island, selecting them and improving them. To this base of local plants were also added American plants introduced by the great explorers of the 17th and 18th centuries, and then Asian and European plants. Leaving aside some omnipresent ones like cassava, sweet potato, tannia (cocoyam or macabo) and papaya, these plants are mainly cultivated in peri-urban villages for sale in markets, and the people of Melanesian origin use these imported crop plants less than they do their own indigenous species.

Like many islands of the Pacific, Vanuatu is a fertile country, traditional and agricultural, whose economy and nutrition are evolving in a dangerous direction. Importation of food products is increasing continually, nutrition is becoming worse in the towns; the local food plants, little known and poorly studied, are progressively giving way to foreign plants considered to be of more worth. But this is only one step in evolution, and we would wager that the country will soon realise that it must adapt its choices to the realities of daily life and economic circumstances, and that it will be able amongst other things to stabilise its own food species and itself grow the fresh products that are currently purchased in processed form.

This work (the book and the CD-ROM) is devoted to cultivated food plants, and we have presented in this book studies of the 84 species that are the most important for food and nutrition.

Local species with fruits and nuts that are currently used have already been covered in a preceding work¹ and will not be repeated here. However, in order to give the reader a complete study of all the alimentary species of Vanuatu we have put in the CD-ROM a chapter on the local fruits and nuts and another on minor cultivated plants. Some readers may be surprised to see coffee and cocoa, grown commercially in Vanuatu, listed as minor species! But the ni-Vanuatu use them scarcely or not at all in their diet. The CD-ROM likewise contains a long list of foraged species whose leaves, fruits or leaves are eaten occasionally. This particular list is not exhaustive, and it is likely that other species are used for food by one community or another as the opportunity arises.

The 218 species cited or treated in this book and the accompanying CD-ROM represent the very great majority of food plants of Vanuatu. Not all have the same status, and while some are staple food plants, such as the yam (*Dioscorea* spp.), others are much rarer such as the carambola (*Averrhoa carambola*). We have chosen to present the alimentary species grouped according to their plant type – roots and tubers, trees, climbing plants and herbaceous crop plants. Within one genus the different species may belong to different plant types. For ease of reference and access to information, at each entry we have noted all species of the genus that are present

¹ A. Walter, C. Sam, 1999 – *Fruits d'Océanie*. Paris, IRD Éditions, 310 pp. English version: *Fruits of Oceania*, IRD Éditions, ACIAR.

in Vanuatu, giving the page on which each is treated. The index at the end of the work will also permit the reader to find any desired information.

This classification does not indicate the place that each species occupies within the system of cultivation and its spatial disposition among the gardens, the footpaths, the villages and the market stalls. To remedy this, the first part of the book indicates the different places where the plants are cultivated or found. Here too are covered the main aspects of the agriculture of Vanuatu, which remains based on the growing of root and tuber crops in the gardens, and trees in the villages or along pathways.

The second part of the book presents all the plant species that are cultivated for their edible roots or tubers, which is essentially the group of food plants that provides the main source of energy in the diet in Vanuatu.

The third part covers all woody species that are above 4 m in height. Among these are found trees and shrubs that provide for the most part fruits or edible seeds. Some, like *Ficus*, are also cultivated for their young leaves which are edible; others like the sago palm for the pith of their trunk. They are generally cultivated around the margins of villages or along roads and tracks. Shrubby trees, like the island cabbage (*Abelmoschus*

manihot) or kava (*Piper methysticum*) are also covered in this section.

The fourth part includes all the climbing species, with stems that sprawl or cling. They provide for the most part leaves, fruits or edible pods that are eaten cooked as accompaniments to a meal. They are almost entirely grown in gardens, sometimes close to the houses.

Finally, part five encompasses all the herbaceous plants, whatever their size, from sugar cane to mint via maize and many others.

This type of work is not totally new, and there are available reference works and encyclopaedias that have comprehensively covered the main food plants grown and used throughout the world. But, because of the huge size of this subject, the local species of Oceania are scarcely or not at all represented in these works, and their size and degree of detail makes access difficult. In the present book we have attempted to present the products of a contemporary agriculture, with its local staple plants and the exotic plants introduced over the last two centuries or more, some fully adopted, some still marginal. With the practical aim of keeping the book concise and manageable, each plant is treated by way of a short dossier covering the important points – genus, family, species present, common names, description, morphological variability, culture and production, food

uses and other uses. Each dossier is accompanied by a list of the main bibliographic references that will allow the reader to obtain even more detailed information on the plant in question. We would like the book to be accessible to the greatest number of people, so we have kept technical terms to a minimum. Those that have been used are defined in a Glossary, located at the start of the work.

The CD-ROM that accompanies the book provides information in greater detail. First of all, as we have noted, it presents the entire range of alimentary plants of Vanuatu, including minor and foraged species. It then contains technical information essential for the specialist: a list of herbarium specimens, a list of synonyms, complete bibliographical references, etc. Finally, it provides a wealth of illustrations showing the variability of the species.

The combination of book and CD-ROM, together with the preceding work *Fruits d'Océanie* (published in English as *Fruits of Oceania*), thus provides amateur and specialist alike with full information on the alimentary plants of Vanuatu. We hope that for students of this country it will also be a reference work and a tool, through which they may in their turn increase the knowledge of these plants, and protect them and develop them.

References²

Barrau (1962, 1965), Bellwood (1978), Bretting (1990), Golson (1990), Gosden and Robertson (1991), Harlan (1970), Haudricourt and Hédin (1987), Jones (1990), Loy *et al.* (1992), Matthews (1990), Mbida Mindzie *et al.* (2001), Piperno and Pearsall (2000), Roach (1987), Rossel *et al.* (2001), Telford (1986), Terauchi *et al.* (1991), Tryon (1996), White and O'Connell (1982), Whitmore *et al.* (1981), Yen (1985, 1995).

² The full list of references is given in the Bibliography in the CD-ROM.



Glossary of terms

The glossary for the French text is taken mainly from Florence (1997)³ and Boullard (1988)⁴. The glossary for the English translation has also drawn extensively on Willis (1904)⁵. Some terms, already defined in the text, are repeated below for the sake of completeness. Words in **bold type** in the text are defined in the Glossary below.



Acumen – a narrow or tapering point, variable in shape, at the tip of a leaf.

Acuminate – ending in an **acumen**, tapering progressively to a long, fine point.

Acute – pointed (for example of a leaf tip).

Adventitious roots – root-like structures on a plant that perform the functions of roots but are derived from stem or leaf tissue, i.e. are not true roots.

Aerial roots – roots or root-like structures arising above ground.

Allogamous – reproducing by cross-pollination, i.e. within one species, the flowers of an individual plant are fertilised by pollen from another plant (the alternative condition is **autogamous**).

Alternate – where leaves or organs are attached alternately

along a stem, not opposite each other (the alternative condition to this is **opposite**).

Amylaceous – containing starch.

Anthocyanin – a pigment that colours plant cells (in fruits, flowers, stems or other parts). The colour varies from red to blue according to the medium in which the plant is growing, whether it is alkaline or acid.

Apex – the tip of a leaf, flower or fruit, away from the stalk or point of insertion.

Apical – relating to the **apex** or tip of an organ.

Aril – an exterior covering or appendage of a seed as an outgrowth that envelops the seed to a greater or lesser extent.

Autogamous – reproducing by self-pollination, i.e. within one species, the flowers of an individual plant are fertilised by pollen from the anthers of the same plant (the alternative condition is **allogamous**).

Axil – the interior angle between a leaf and the branch from which it arises.

Axillary – situated in, or growing from, the **axil** of a leaf or bract.



Bifurcating – dividing into two.

Bipinnate – see under **tripinnate**.

³ Florence, J., 1997. Flore de la Polynésie française, Vol. 1. Paris, IRD Éditions, coll. Faune et flore tropicales 34, 394 pp.

⁴ Boullard, B., 1988. Dictionnaire de botanique. Paris, Ellipses, 398pp.

⁵ Willis, J.C., 1904. A Manual and Dictionary of the Flowering Plants and Ferns. Cambridge, University Press, 2nd Edition, 670 pp.



Blade – a broad, flattened part of any organ. Here, more specifically, it is the flat, green part of a leaf that is responsible for photosynthesis.

Bract – a leaf in whose **axil** an inflorescence arises. It is different in size and shape from the true leaves of the plant (see also **bracteole**).

Bracteole – a small leaf in whose axil is found each flower of an inflorescence (see also **bract**).

Bulblet – a small bulb rich in reserves that assures the vegetative propagation of certain plants by natural cloning.

Buttresses – broadened, basal expansions of a tree trunk, standing out as thickened supports.



Calyx – the outer envelope of the flower, comprising all the **sepals** either separate or joined.

Capitulum (plural **capitula**) – a group of **sessile** flowers clustered together into a single, tight head.

Carpel – the **gynoecium** (female component) of a flower, made up of a basal ovary containing the ovules, surmounted by a **style** and a **stigma**. Carpels may be separate, or fused into a **syncarp**.

Cauliflorous – (of flowers and fruits) – growing directly from the trunks or older branches of

a tree (as opposed to growing out of leaf axils).

Compound – leaf in which the single leaf-stalk bears more than one separate leaflet (the opposite condition is **simple**).

Cordate – scalloped in the form of a heart or being heart-shaped.

Coriaceous – leathery.

Corm – the swollen base of a stem.

Corolla – the inner envelope of the flower, comprising all the **petals** either separate or joined.

Cortex – bark.

Cotyledons – the “seed leaves” which become the first leaf or leaves arising when an embryo germinates. Angiosperm seed plants are divided into the Dicotyledones (with two cotyledons per seed) and Monocotyledones (with one cotyledon per seed).

Crenate – (of leaf margin) – with rounded teeth and sharp notches between the teeth.

Crown – the head of foliage of a tree or shrub.

Cultivar – a cultivated plant obtained by human selection.

Cupule – part of a plant formed into a small cup, either as a single piece or made up of small scales.

Cyme – an inflorescence whose main axis terminates in the oldest, first-opening flower, and on which subsequent flowers develop later on one side or two sides of the main axis.



Daughter bulb – (also known as an offset bulb) – a small bulb produced at the base of a bulb that is fully developed and planted in the soil. Produces, as a consequence, segmentation of the bulb. An example is garlic.

Deciduous – of a plant where all the leaves fall from the plant at a particular time of year (e.g. in the dry season or in winter).

Decurrent – where a leaf expansion is continued as a wing down the stem.

Decussate – of leaves that are arranged in pairs, each at right angles to the pair above or below.

Dehiscent – (of a seed pod or container) – splitting open when ripe.

Dentate – (e.g. of leaf) with small teeth pointing outwards.

Dioecious – where male and female flowers are borne on separate plants (the opposite state is **monoecious**).

Drupe – a fleshy fruit containing one seed, the **endocarp** of which is hard (i.e. a nut).



Ellipsoidal – a solid object (e.g. a fruit) which is oval in cross-section when cut across any plane.

Elliptical – (of leaf) – tapering equally to base and tip, and somewhat narrow.

Emarginate – apex of leaf with a deep and marked notch.

Embossed – (of a surface) – having a raised design.

Endocarp – hard shell or stone inside a fruit and surrounding the seed, which is the innermost part of the **pericarp**.

Entire – (of leaf or leaflet) – without notches in the margin.

Epicarp – (also sometimes called **exocarp**) – the outer skin of a fruit that surrounds the seed and is the outermost part of the **pericarp**.

Epidermis – the outer layer of cells or skin (e.g. of a fruit).

Epiphytic – growing on other plants rather than directly in soil, but not parasitic on those plants.

Ethnobotany – study of the complex relationships between humans and their plants. Classifications, usages and modes of cultivation are always studied from the point of view of those who utilise the plants and according to the particular cultural contexts.

Exocarp – see **epicarp**.



Fluted – (of a tree trunk) – having a series of vertical furrows or grooves.

Follicle – a dry, dehiscent fruit consisting of one **carpel** and dehiscing along the ventral side only.

Frond – the assimilatory organ of a fern, equivalent to the leaf of a higher plant.

Fusiform – spindle-shaped.



Genotype – the totality of genes possessed by an individual plant.

Glabrous – without hairs.

Globular – roughly spherical, having the shape of a globe or ball.

Gynoecium – the female part of a flower comprising ovary, **style** and **stigma** (see also **carpel** and **pistil**).



Hermaphrodite – (of flowers) – having both male and female structures within the same flower.

Heterophyllous – having leaves of more than one form on the same plant.

Hilum – the scar-like point of attachment of the seed to the inside of the seed case.

Hypocotyl – the portion of the stem below the **cotyledons**. When it elongates it lifts the cotyledons out of the soil.



Imbricated – (of scales or bracts) – arranged in rows that partially overlap each other (e.g. like roof tiles).

Indehiscent – (of a seed pod or container) – having no natural splitting lines along which to open when ripe.

Inflorescence – a grouping of flowers on a plant.

Infrutescence – a grouping of fruits on a plant, deriving from an **inflorescence**.



Kava – a sedative, slightly intoxicating drink, obtained from the root of *Piper methysticum* and drunk by men at nightfall throughout the Pacific.



Lanceolate – (of leaf) – lance-shaped, i.e. narrowly oval, with the widest part of the leaf at the base.

Lap-lap – a type of thick cake made by cooking a puree of grated yam, taro, cassava, banana or breadfruit in leaves.

Latex – a milky, usually white and often sticky fluid that exudes from cut or damaged stems of leaves of a plant.

Leaf sheath – a sheath enclosing the young leaf during its development, before it expands.

Leaflets – the individual leaf-like structures of a **compound** leaf.

Lenticels – small respiratory pores in the stems of woody plants, appearing as a series of dots on the bark surface.

Lobate – see under **Lobe**.

Lobe – the rounded portion of a leaf between two shallow indentations on the leaf edge. The leaf is then described as **lobate**.

Luau – coconut milk salted with seawater and cooked in young taro leaves.



Marcotting – a procedure for vegetative multiplication of plants in which part of a branch of the plant (usually a tree) is put into contact with soil (often the soil is bound to the branch surface with plastic), and the branch roots into the soil before being detached from the parent plant.

Mesocarp – the central fleshy tissue of a fruit, between the outer skin (**epicarp**) and the hard shell or stone around the seed (**endocarp**) (see also under **pericarp**).

Monoecious – where male and female flowers are borne on the same plant (the opposite state is **dioecious**).

Morphotype – refers to the external shape or appearance of a particular plant.

Mucilage – a viscous plant material that swells on contact with water.



Nakamal – Bislama term indicating a building (clan hut) for men.

Nalots – small balls of breadfruit paste cooked in coconut milk.

Naturalised – when a plant is introduced to a new ecosystem and reproduces there without any further human intervention.



Ob- (applied to an adjective, it reverses the direction of tapering – see definitions below).

Oblanceolate – (of leaf) – about three times as long as broad, tapering gradually towards the base (in contrast to **lanceolate**, where the gradual tapering is towards the tip).

Oblong – (of leaf shape) – with sides parallel for some distance, the ends tapering rapidly.

Oboval – (of leaf) – egg-shaped, with the broader portion at the apex of the leaf (opposite condition is **oval**, where the broader part is at the base).

Obtuse – blunt, when applied to the shape of a leaf **apex**.

Opposite – where two leaves are attached opposite each other on a stem (the alternative condition to this is **alternate**).

Orbicular – (of leaf shape) – circular in outline.

Organoleptic – something that makes an impression on or has an effect on human sense organs, of taste, touch or smell.

Orthotropic – see under **plagiotropic**.

Ostiole – a small aperture found on the fruit (fig) in the family Moraceae.

Oval – (of leaf) – egg-shaped, with the broader portion at the base of the leaf (opposite condition is **oboval**).

Ovoid – (of a fruit) – egg-shaped.



Palmate – a **compound** leaf in which all the **leaflets** arise from a single point of insertion like the fingers of a hand (the opposite condition is **pinnate**).

Palmatilobate – a **palmate** leaf on which the indentations separating the lobes do not reach to the middle of the leaf blade.

Panicle – an **inflorescence** composed of clusters of flowers, themselves arranged in clusters on a central axis.

Paripinnate – a **pinnate** leaf with an equal number of **leaflets** on either side and without a single extra leaflet at the end.

Parthenocarpic – (of a fruit) – developing without needing to be fertilized.

Pedicel – a flower stalk.

Pedicellate – having a **pedicel**.

Peduncle – a fruit stalk.

Pedunculate – having a **peduncle** (opposite: **sessile**).

Peltate – a leaf in which the **petiole** is inserted in the middle of the leaf blade.

Pendulous – of an inflorescence that is sufficiently long to hang downwards from the branch on which it is situated.

Pericarp – the part of a fruit that covers the seed. May consist of an **epicarp** (outer skin), **mesocarp** (a fleshy mass of tissue under the outer skin) and an **endocarp** (a hard shell or stone around a seed).

Persistent – (of flowers or flower parts) – remaining unwithered on or around the fruit (as opposed to deciduous, where it shrivels and falls as the fruit develops).

Petals – the components of the **corolla**, or inner envelope of the flower; the petals may be either separate or joined.

Petiolate – having a petiole (opposite: **sessile**).

Petiole – a leaf stalk.

Petiolule – the stalk of a **leaflet**.

Photoperiodicity – when the relative lengths of day and night change and this change has an effect on the development of a plant.

Pinna – a **compound** leaf of very large size.

Pinnate – describing a **compound** leaf in which the **leaflets** arise from the sides of the central **rachis** (as in the leaf of a pea plant). The opposite condition is **palmate**.

Pistil – the female part of a flower comprising ovary, **style** and **stigma** (see also **carpel** and **gynoecium**).

Plagiotropic – describes branches that grow horizontally, perpendicular to a vertical axis which is described as **orthotropic**.

Polyembryonic – production of several individuals by division of a single egg.

Polygamous – a plant in which certain flowers are **hermaphrodite** (male and female) while others are either male alone or female alone.

Polymorphic – occurring in several distinct forms or shapes.

Pubescent – with fine, soft hairs.



Quadrangular – four-sided.



Raceme – **inflorescence** made up of **pedicellate** flowers on an unbranched axis.

Rachis – the elongated axis of an **inflorescence**, or the main axis of a **composite** leaf that bears the **leaflets**.

Ret – to leave something to macerate in water.

Rhizome – an underground stem or branch of a plant, often thickened and sometimes serving as a storage organ; looking like a root but distinguished from a true root by the presence of buds, nodes and often scale-like leaves.

Root rot – infection of the root system by a bacterial or fungal pathogen which leads to rotting of the roots and death of the plant.

Rosette – the shape in which a number of elements radiate symmetrically from a central point, particularly of leaves where all are inserted close to one another at the end of the stalk.

Rugose – ridged or wrinkled.



Sagittate – arrow-shaped (leaf).

Sepals – the components of the **calyx**, or outer envelope of the flower; the sepals may be either separate or joined.

Sessile – without a stalk, attached directly at base (of leaf or fruit; opposite conditions are **petiolate** or **pedunculate**).

Simple – a leaf with only one leaf on the leaf stalk (opposite condition is **compound**, where there are several **leaflets** on each leaf stalk).

Somatic – relating to the body (in this case the vegetative organs) of a plant, as opposed to the reproductive cells and genes.

Spadix – an inflorescence that is a fleshy or succulent spike, bearing flowers that are unisexual and **sessile**.

Spathe – a sheath that envelops a **spadix**.

Spherical – shaped like a sphere or ball.

Spike – an inflorescence where the **sessile** flowers (or groups of flowers known as **spikelets**) are spread along the length of a **rachis**.

Spikelet – one of a group of flowers making up a **spike**.

Stamen – the male part of a flower that produces the pollen.

Stigma – the part of the **pistil** of a flower that receives the pollen at fertilization.

Stipules – the pair of small leaflike appendages arising at the base of the leaf in many plants.

Stolon – a long, creeping stem differentiated from the roots and leaves, usually formed as an axillary branch on the main stem near the base, growing along the soil (or just beneath it) and rooting at the nodes.

Style – the part of the female flower connecting the **stigma** to the ovary. Generally tapering in the shape of a filament.

Sub- (as a prefix to any adjective) – nearly, e.g. **subsessile** = nearly sessile.

Subglobular – almost globular.

Sub-opposed – almost opposed.

Subsessile – nearly sessile (e.g. with a very short leaf or fruit stalk).

Sucker – a vigorous stem arising from the root of a tree, or more generally the underground stock of a plant.

Syncarp – a fruit arising from a **gynoecium** made up of fused **carpels** or a fruit made up of elements that are totally united into one.



Tapa – cloth made from tree bark beaten flat.

Tarodièrè – a taro garden, usually irrigated and comprising a series of small pits inside which flows water coming from a single source.

Tepal – name given to the pieces of a flower when the petals and sepals are completely identical.

Terminal – at the furthest point away from the point of attachment of anything. In the case of the crown of a tree, the uppermost part of the tree.

Trilobate – having three lobes.

Tripinnate – a leaf or frond composed of three **leaflets** or **pinnae** (called **bipinnate** when there are two leaflets or pinnae).

Tuber – a subterranean stem or part of a stem that is thickened and contains stored reserves of nutrient material.

Tuberised – describes thickened roots or stems that look like tubers.

Tubular – (e.g. of a corolla) – with the separate petals joined together to form a tube-like structure.



Umbel – an **inflorescence** composed of a number of flowers whose small **pedicels** (flower stalks) all arise from a single point and are the same length, giving the inflorescence a rounded shape.

Undulate – (of leaf margins) – wavy.



Vegeculture – cultivation and groups of plants multiplied entirely by vegetative propagation, using holes dug for planting and without tillage. [Note: Vegeculture is the French term but is not usually used in English. There is no specific English term other than 'vegetatively propagated plants'.]

Vegetative propagation – reproduction that does not involve any sexual process. Produces clones.

Vesicant – a plant that produces small blisters on the skin when touched.



Whorl – a number of leaves or flowers arranged in a circle around the same point on a stem or axis.

Wing – flattened, somewhat leaf-like expansions on certain organs (stem, fruit).

