



Gardens of Oceania



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Australian Government
Australian Centre for
International Agricultural Research



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with collaboration from Chanel Sam

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English translation by Paul Ferrar

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Contents

Book

Preface	7
Acknowledgments	10
Introduction	13
Glossary of terms	21
Agriculture and cultivated places	31
Root and tuber crops	57
Trees, shrubs and bushes	109
Climbing plants	179
Herbaceous plants	221
Index of generic names	299
Index of common names	305
Table of contents of book	323

CD-ROM

Full text of book

The Fruits of Oceania

Minor species

Photos of morphological variability

Bibliography

Annex 1: Plants that are foraged

Annex 2: Synopsis of species covered in book and CD-ROM

Annex 3: Species names and main synonyms

Annex 4: Herbarium specimens





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

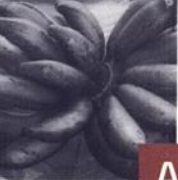
the local in order to face the global. The ni-Vanuatu can be proud of their biological products, which are produced without pesticides or other chemical products. The diversity of these local products deserves to be valued, but being poorly known they are also poorly utilised.

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.

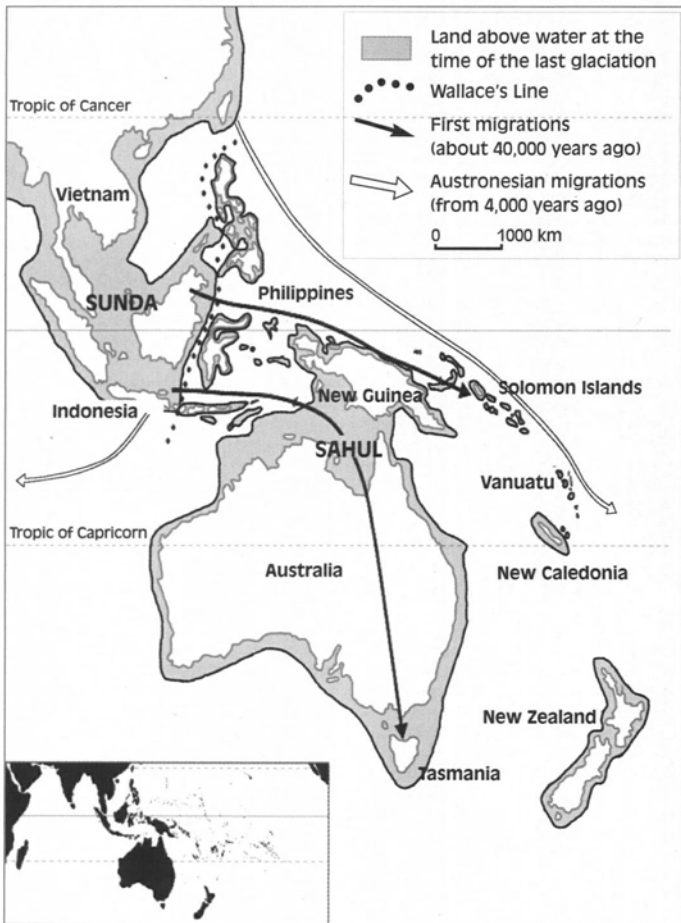
Note on English edition by translator

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