TECHNICAL PAPER No. 195

KAVAS OF VANUATU

CULTIVARS OF PIPER METHYSTICUM FORST.

SOUTH PACIFIC COMMISSION
NOUMEA, NEW CALEDONIA

SOUTH PACIFIC COMMISSION

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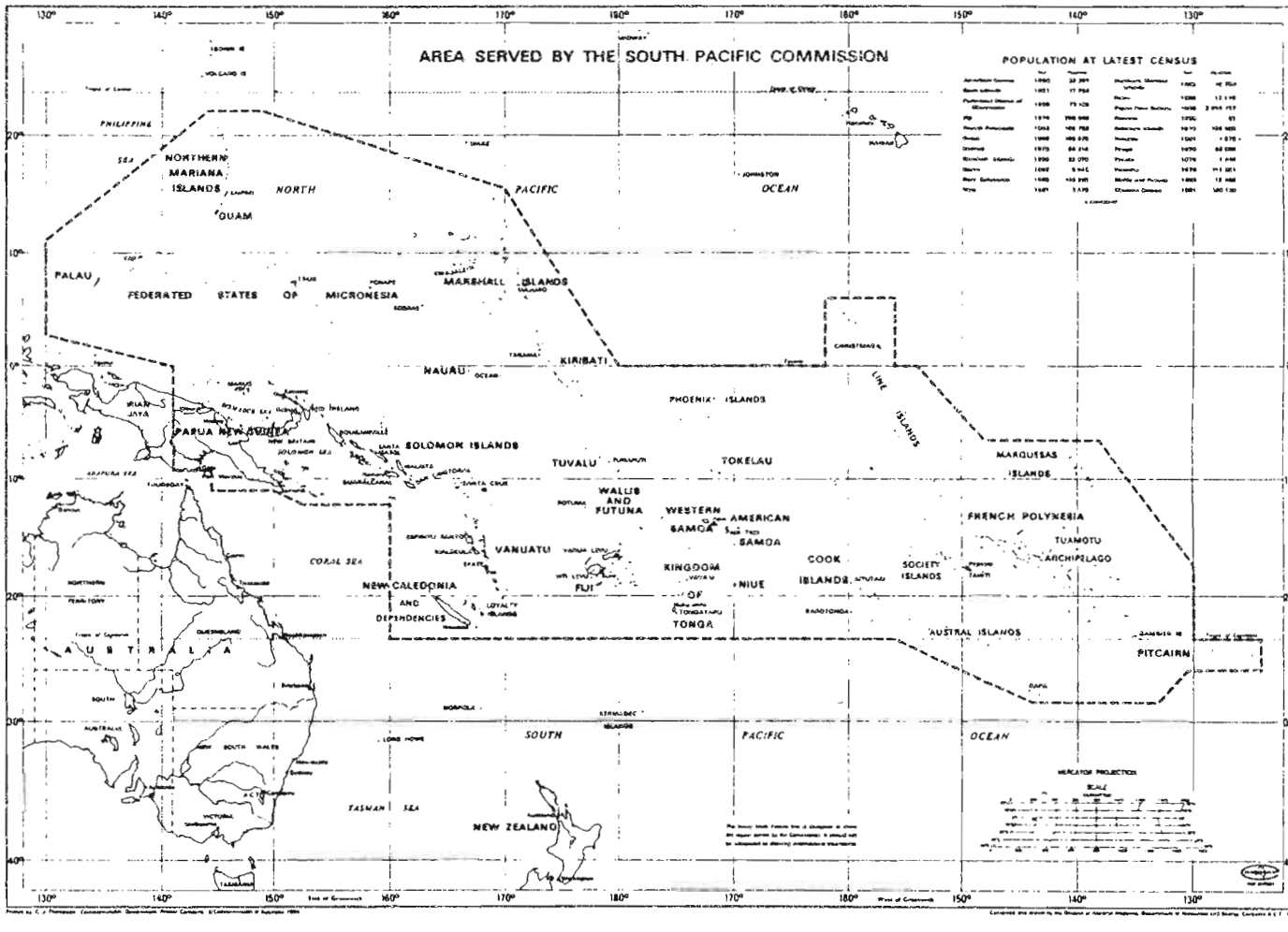

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KAVAS OF VANUATU

Cultivars of *Piper methysticum* Forst.

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INTRODUCTION

In terms of the cultural role it performs, kava is to Vanuatu, and indeed to a large part of the Pacific, what wine is to southern Europe. Today, *Piper methysticum* is enjoying a fresh surge of popularity. As a prized traditional beverage and a pharmaceutical raw material, kava is becoming an increasingly common commodity while continuing to occupy its position in traditional life and the customary exchange system.

The main purpose of this study is to consider the various aspects of kava-growing in Vanuatu, by means of ethnobotanical fieldwork, station trials at Tagabe (Port Vila) and a statistical survey covering most islands of the group. The authors also appraise the sum of current knowledge about this species in various spheres including botany, chemistry and pharmacology. This leads inevitably to a certain amount of repetition, to avoid excessive cross-referencing, for which the reader's indulgence is requested.

One of the aims of the Vanuatu Government's first five-year development plan was the diversification of agriculture and cash crops, most of which (coffee, cocoa, copra (1)) are of European introduction. Some difficulty often accompanies the initiation of a new commercial crop which is not always successfully fitted in to the Melanesian way of life and horticultural practices. Even if the development of new crops is a laudable objective, however, the value and potential of traditional plants have in the past often been neglected. For this reason the development plan recommends the development of kava, which term refers to the root of the *Piper methysticum* Forster (2) plant species as well as to the drink or the ceremony surrounding its consumption. Kava is not merely the traditional beverage of Oceania but is also a medicinal plant possessing extraordinary properties.

One of the best ways of developing a crop is to ensure that a market, at least a potential one, exists and that the producer is motivated, i.e. already in the cash economy. For Vanuatu, there are two contrasting markets for kava : one is the 'drinking' kava market, located solely in the South Pacific, which is apparently expanding apace, while the other is sales to the European pharmaceutical industry, which are proving stable. In addition, the Pacific Basin countries, those of Asia in particular, seem to offer good prospects as a growth market.

Although synthetic substitutes have now taken the place of tropical flora as the raw material for many drugs, certain plants are still used in preparing medicines ; this is the case with the dry rhizome of *Piper methysticum* Forster, which is in demand for laboratory processing in Europe. These processes can produce a ten-fold appreciation in the value of the original product, which explains the thinking, which has understandably quickly gained wide ground, whereby developing countries such as Vanuatu should process their own medicinal plants domestically. Such reasoning requires a survey of those species of the country's flora with the relevant potential to be carried out ; a thorough knowledge of such flora is also needed (3). Care should be taken to avoid futile schemes, since some synthetic products are equally efficacious and cheaper than the corresponding vegetable extract.

Where kava is concerned, crop development will enable growers with little in the way of resources in the smallest, most over-populated islands to secure an income per unit area higher than that yielded by most other plants cultivated for commercial purposes.

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(1) Coconuts were a food crop well before the Europeans' arrival. Today, they are grown to produce copra for export and this sector is primarily a Melanesian activity.

(2) J.G. Forster, 1786, Pl.Esc.Ins.Oc.Austr.76.

(3) Part of ORSTOM's research programme (P.C.) on Vanuatu's medicinal plants.

The significant part played by this plant in Melanesian society is a factor in favour of its development as a crop without too much government interference. In December 1981, the Department of Agriculture recommended that production should be boosted and the planted area increased. An agronomic research programme was accordingly initiated to consider kava's potential and characteristics for the purpose of assisting farmers.

As kava's agronomy had previously been neglected, this study was a vehicle for collating the bibliography, carrying out the ethnobotanical research needed to appraise the polymorphism of the species and setting down the cultural techniques. This publication contains the results of that work (1).

May those who made this study possible or helped in the research find sincere thanks here :

- Mr. Douglas Malosu, Director of Agriculture and Mr. Barry L. Weightman, adviser to the Minister, for their unconditional support.

- Mr. David Marshall, Principal Statistician and supervisor of the Agricultural Census, who agreed to set up the statistical survey and gave his permission for the results to be published.

- Mr. Meto Nganga and Mr. Owen Drew of the Vanuatu Commodities Marketing Board.

- The Tagabe School of Agriculture students who helped in the agronomic trials and the statistical survey.

- Mr. Siri Seoule of ORSTOM's Port Vila centre who drew the illustrations.

- Mr. Joel Bonnemaison, geographer/ethnologist, and Mr. Maurice Schmid, botanist/ethnologist with ORSTOM, who willingly read and revised the manuscript.

- Ms. Dora Obed and Ms. Tourifenua Kalfau who patiently typed and retyped the English translation.

- Ms Yvana Routier who typeset the English text for publication.

(1) The authors' intention was to evolve a method of investigating unused species which could easily be applied to other plants. Such an approach overlaps the area where ethnobotany and agronomy meet and is an as-yet innovatory field of study, but it is believed to offer promise for locating new sources of income for third-world farmers, in island countries especially.

PART ONE

KAVA, AN OCEANIAN PLANT WITH A CULTURAL DIMENSION

The bibliography relating to *Piper methysticum* Forst. is abundant, covering the fundamental fields of study of a cultivated medicinal plant, namely its taxonomy, cultural importance, pharmacological properties and commercial prospects. The first part of this study reviews the published material on cultivated kavas and related species of the *Piper* genus, the genus' taxonomy and the distribution of the species. A summary is offered of ethnologists' and anthropologists' observations about kava consumption as a social ritual, as practised in Vanuatu particularly. This paper then addresses the results of the many chemical and pharmacological analyses carried out on this plant. In conclusion, it is stressed that the agronomic research work which would allow more rational development of kava is being neglected.

1.1 BOTANICAL ASPECTS

1.1.1 Taxonomy

Study of the flora of the Pacific started with the first voyages of exploration and discovery undertaken by the Europeans in the XVIIIth Century. Captain James Cook himself showed particular interest in kava, its associated ceremonies and methods of preparation and its importance within social structures. Daniel Carl Solander (1) and Sydney Parkinson (2) sailed with Cook on his first voyage aboard the Endeavour in 1768-1771. They were certainly the first scientists to take an interest in kava, which they observed for the first time in Tahiti (S. Parkinson, 1773).

On his second voyage from 1771-1775, Cook was accompanied on the 'Resolution' by two German botanists engaged by the British Admiralty: Johann Reinhold Forster and his son, Johann Georg Adam Forster. To these two men is owed a major contribution to the botanical knowledge of the islands explored by Cook during that period.

The first description of kava is thus to the credit of J.G.A. Forster, who named it *Piper methysticum* (Forster, 1781) or intoxicating pepper, *methysticum* being the Latin transcription of the Greek *methustikos*, derived from *methu* which means 'intoxicating drink' according to Steinmetz (1960). This description is not recognised as botanically valid. The samples gathered by the Forsters in fact belonged to two species, kava, *P. methysticum* and 'wild kava', *Macropiper latifolium*. For reasons of nomenclature explained by A.C. Smith (1981), the earliest reliable description of kava is that of Forster (1786), which can be found in *De plantis esculentis insularum oceani Australis* (Forster, 1786).

The botanical synomyms are: *Macropiper methysticum* Miquel, *Piper decumanum* Opitz, *Piper inebrians* Solander ex. Parkinson and Bertero, from the Latin *inebriare* (to intoxicate), and *Piper spurium* Forst. Amongst related species occur a species from New Guinea, the *P. torricellense* Lauterb. (Sterly, 1970 and Burkill, 1935), the so-called 'Honolulu kava', *P. puberulum* Benth., and *Piper excelsum* Forster, endemic to New Zealand, known as **kava** or **kava-kava** to the Maoris, which does not have the properties of *P. methysticum*, but whose leaves are used in an infusion against headaches (Steinmetz, 1960), *Piper plantagineum* Schlechter, native to Mexico and used there in the same manner and *Piper latifolium*, synonymous with *Macropiper*

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(1) Swedish botanist, disciple of Linnaeus

(2) Botanical artist.

latifolium Forster (Forster, 1791) endemic to Oceania (1), used in the traditional pharmacopoeia of Vanuatu (Vienne 1981), from which the *P. methysticum* species may derive as a result of natural mutation, natural hybridization, or these two factors combined. These theories are discussed later. The same remark is valid for *P. wichmannii* C.DC., known in New Guinea and the Solomon Islands.

1.1.2 Description of Piper methysticum

The genus Piper belongs to the Dicotyledon class, the Piperales order and the Piperaceae family. It comprises several hundred species of which some ten render products used to varying degrees as spices or medicinal drugs, for example : *Piper nigrum* L., one of the oldest known spices, *P. guineense* Schum. and Thonn. or Ashanti pepper, betel or *P. betle*, matico or *P. angustifolium*, cubeb, (also Java pepper), *Piper cubeba* L. or 'tailed pepper' native to Indonesia, formerly used as a medicine and today as a spice, and the long peppers : *P. officinarum* DC. and *P. longum* L., both species native to the Indian sub-continent.

P. methysticum is an elegant plant, like a bush or shrub in shape and, depending upon the variety, measuring from 1 metre to over 4 metres in height. Growth, although slow, is often compared by Vanuatu farmers to that of bamboo. The shrub is a hardy perennial, adopting an erect posture and with upright, ramifying stems. Stems and branches are glabrous and fleshy. The stems are usually between 2 and 4 cm in diameter at the internode and develop from a crown which is 10 to 40 cm wide at the neck. The internodes are cylindrical and flexible. Side branches are produced from the young parts of the stem, and as they age they die and fall away leaving characteristic scars on the nodes. Branches may sprout from the stem in either a levogyrate or dextrogyrate arrangement, depending on variety. When it reaches maturity, the plant's appearance is that of a bouquet of ligneous stems clustered together at the base. The plant does not have many leaves. Those it has are thin, single, whole, heart-shaped, alternate, petiolate and quite large (8 to 25 centimetres long and sometimes wider than they are long). They are deciduous and rot quickly, being carried on petioles 2 to 6 centimetres in length. Although generally smooth, some varieties show a very fine pubescence on the underside and occasionally the upper surface of the lamina or the veins, of which the three main ones extend to the tip of the leaf (Figures 1a, 1b, 2 and 3). The base of the petioles and the stipules is enclosed in a caducous amplexicaul sheath.

The inflorescence, axillary to or opposite the leaves (Fig. 4), is a spadix typical of the Piperaceae. The flowers are small and unisexual, closely bunched around a rigid axis. They are notable for possessing neither calyx nor corolla and are sessile, i.e. they have no peduncle. The species is dioecious (2) ; the male flowers with their stamens are therefore found on one plant and the female flowers with pistils on another. Cuzent (1857) mentioned in passing that 'the fruits are monospermal', while Barrau stated in 1957 that : ' The male flowers have two short stamens. The floral bracts are rounded, peltate and have a pubescent pedicle. The female flowers have a unilocular ovary with a bottleneck-shaped style. The fruit is a berry with a single seed'.

These comments on the fruit are surprising because the authors, despite extensive field investigation, have never observed a single fruit. No farmer can remember ever seeing one in Vanuatu.

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(1) From the Marquesas Islands to Vanuatu, through Tahiti and Rarotonga, excluding Fiji and Samoa (A.C. Smith, 1943).

(2) However, we did once in 1983 in Port Vila observe a bisexual kava inflorescence, whose overies were apparently immature while the few brownish stamens seemed already dead. Was this sample an error or nature or an individual example of this species' sexuality?

In 1937 Benjamin Delessert (1) depicted male inflorescences without fruit as did Degener in 1940. The latter stated that he had not seen one in any of the plantations he had visited and pointed out that Hillebrand, an indefatigable collector, had been unable to illustrate one in his flora several years earlier because none could be found. In 1960, Hansell confirmed this information. All these authors state that they have never seen any female flowers.

Whatever the case may be, the cross-pollination obligatory in dioecious plants could be responsible for the wide variability observed in the progeny : it is postulated that the great number of combinations which would have resulted from this mode of reproduction would have been responsible for creating the present genetic stock (see 3.1).

1.1.3 Biology

Piper methysticum in its present state would seem incapable of reproducing itself sexually ; its vegetative propagation is solely due to man.

Degeneration is therefore likely to be a danger for kava if it is not constantly cloned, but excessively intensive propagation could also weaken the species over time.

Cultivars grow from a stem bud. The point of growth is situated at the axil of a branch scar. An orthotropic shoot develops and then axillary buds and plagiotropic axes appear. In the same way, a root system develops from an underground bud and directly feeds the portion of the stem corresponding to the original cutting, which grows rapidly in volume and forms the heart of a rhizome around which new growth points extend the aerial and underground parts of the plant. In Vanuatu, the average fresh weight of the root system is 1 kg at the age of 10 months. The average number of stems is 11 and the number of nodes on the longest stem 10. The first inflorescences appear at age 2 to 3 years in the form of spadices very irregular in size. Senescence does not set in until the age of 15 to 30 years, depending on variety.

1.1.4 Distribution and origin

Kava is a cultivated species comprising many different varieties whose cultivation is widespread thoughout the Pacific region. Each cultivar has its own well-defined requirements and a much more restricted distribution than the species. Substantial differences exist between the genotypes and this remarkable variability in characters is due to the climatic diversity and the many different ecosystems of the islands and archipelagos. A clear relationship can, therefore, be observed between phenotypical variance and geographical distance.

This plant seems to have followed the main migratory trends of the Oceanian era, but its geographical origin remains uncertain. Its area of cultivation was much wider before the arrival of the Europeans when the religious tabus of certain Christian missions limited its use to only a few islands. Today, however, its popularity is on the increase again (Fig. 5).

The origin of kava is one of the classic riddles of Oceanian ethnobotany, which has attempted to solve the problem by studying the vernacular names of the plant.

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(1) Icones selectae plantarum, vol. III, tab. 89, 1937.

The most well-known name, **kava**, most certainly derives from the Polynesian word **ava**, meaning inebriating drink (1). Certain authors, such as Thomson (1859-193), Seeman (1868-261) and Steinmetz (1960), think that **kava** is a deformation of the Sanskrit word **kashya** which is also thought to mean 'intoxicating' drink (1). It is generally accepted that the species was distributed by man in Polynesia (2), and this is how Degener (1940) explains its introduction to Hawaii.

1.1.4.1 Vernacular generic names

P. methysticum, whose area of distribution is strictly limited to Oceania (it is not to be found in either the Philippines or Central America) (3), is known under a variety of vernacular generic name, (names of varieties : see 2.2).

In Micronesia, kava is drunk in Ponape where it is called **sakau** (it also used to be consumed at Kosrae; Riesenberg, 1968).

In Polynesia, all the mountainous islands (4), except for New Zealand, Easter Island and Rapa, have apparently recorded the consumption and cultivation of kava, at one time or another in their history (Marshall, 1976 ; Gatty, 1956).

On Wallis and Futuna, it is known as **kava**, in Samoa: **ava ava**; in Tonga: **kava**; in Hawaii, where it has almost completely disappeared: **awa**; in the Marquesas: **kava-kava**; in Niue: **kavainu**; in Tubuai: **ava**; and in Tahiti: **ava, ava-ava** or **evava** (Cuzent, 1857).

In Melanesia, it is known as **yaqona** (5) in Fiji, but was never cultivated in New Caledonia where it seems not to flourish.

In Vanuatu, the stories and observations vary considerably from island to island. Paton (1973) reported that the kava known as 'wild kava' in Bislama (6), which corresponds to *Macropiper latifolium* Forster (Fig. 6) as opposed to cultivated kava, was used for magic rituals, but that kava was never drunk (7). MacDonald (1889) wrote that kava was known as **meruh** on the east coast of Malakula. Consumption was common almost everywhere. Only a few small tribes of Santo and Ambrym and the inhabitants of the central and southern parts of Malakula were reported as not knowing it (Speiser 1923-162) according to Sterly (1970). Although Harrison

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(1) Refer to Part 1.1.1, para. 3. Incidentally, 'ava, arva' seems clearly to mean nothing more than 'bitter, sour' in Tahiti and elsewhere in Polynesia according to Sterly (1970) and the 'Davies' (1851) : 'A Tahitian and English dictionary, with introductory remarks on the Polynesian language and a short grammar of the Tahitian dialect with an appendix'. Tahiti, London Missionary Society Press. Reprinted with appendices, 1984, Ed. Haere po no Tahiti, Box 1958, Papeete.
However, Cuzent (1857) noted that 'in earlier times, in Tahiti, all liquids that were capable of producing a state of drunkeness were called 'ava' and stated in 1860 that after alcohol was introduced a distinction was made between two sorts of intoxicaing drinks, ava maohi (native) and ava-popaa (introduced).

(2) There is however nothing to prove beyond doubt that kava was domesticated in Polynesia and this study prefers to postulate a Melanesian origin - see further on.

(3) Sterly (1970) states that all attempts to cultivate P. methysticum in the Singapore Botanical Garden were unsuccessful. After a short period of time, the plants withered and died (Burkill, 1935).

(4) James Morrison (reprinted 1966) relates its presence on Tubuai, the main island of the Austral group . Kava reportedly grew there abundantly 'without being cultivated'.

(5) Pronounced yangona.

(6) Lingua franca in Vanuatu, see :
Charpentier, J.M. Pidgin/Bislama(r) and multilingualism in the New Hebrides. 1979. Langues et civilisations a tradition orale No.35, Selaf, PARIS.

(7) Paton's study concerned Ambrym.

(1936) recorded that it was drunk by most tribes on Santo, Riesenfeld (1950) stated that the be 'pigmy' tribe who lived in the ranges of the western region had never known its use. A survey carried out recently in west Santo has revealed that the inhabitants of Nokovoula village, now deserted, at 1132m altitude, had always been familiar with kava, and called it **malohu**.

Despite the isolation of the region due to its relief, the presence of kava would not therefore be due to introduction, if local oral tradition is to be given credence. Nevertheless, a striking affinity exists between the name **malohu** and other vernacular names in the island group. It is surprising to learn that, according to Lester (1941), the people of Paama island did not drink kava, whereas farmers remember it as always being known as **malou** (1). Codrington (1891) is much more credible when he writes that there was none on Gaua (Banks group), whereas Rivers (1914) felt that the local people had simply given up using it. Today it is still hardly grown on that island and its introduction or its reintroduction is evidently very recent.

In the Solomon Islands, again according to Rivers, kava was drunk on Vanikoro and Utupua, whereas Codrington (1891) and Thompson (1908) thought it to be unknown in the Santa Cruz islands. Fox (1924) states that he saw some on San Cristobal . A little further along on Anuta, Firth (1954) noted that kava was not cultivated and had never been identified on that island, although some traditions do seem to imply that it was drunk there (Firth, 1970) . In San Cristobal, it is related that the men drank kava at burial ceremonies (Fox, 1925 - 216), according to Sterly (1970), but apparently not regularly (2).

Sterly (1970) was certainly the first author to record in the bibliography the different vernacular generic names for kava in Papua New Guinea. These are as follows :

Lou, Admiralty Islands, Bismarck Archipelago, **ka** (Parkinson,1907-373); Jacob Island, Astrolabe Bay, North-east New Guinea, **ayuw** (Aufinger in Anthr. 1939-279); Bogadjim, Astrolabe Bay, North-east New Guinea, **kial** (Hagen, 1899-266); Bongu gorendu, Astrolabe Bay, North-east New Guinea, **keu, kau** (Micklucho-Maclay, 1875/76-328; 1886 a); Gende, Bismark Range, Central New Guinea, **karangimi** (?) (Aufenanger and Holtker, 1940-401); Lake Kutubu, Central New Guinea, **tokarabu, sagainya (waki, kewato)** (Williams, 1940-41, XII, 58); Gogodara, Golf of Papua, South-east New Guinea, **sika** (Wirz in Nova Guinea, 1934-453; Nevermann, 1938-180) ; Kiwai, Fly delta, South-east New Guinea, **gamada, gamoda, wariki, gumada** (Riley, 1925-89 ; Landtman, 1927-106,350); Mowata, Transfly region, Southern New Guinea, **komata, gamoda** (Haddon, 1916-147) ; Oriomo, Daudai hinterland, Transfly region, Southern New Guinea, **irka** (H.P. Beach in Haddon, 1916-149); Keraki, Transfly region, Southern New Guinea, **kurar** (Williams, 1936-427; cf. Haddon 1901/08, V, 100); N'gowugar, Torassi river source area, Southern New Guinea, **koriar** (Nevermann, 1938-182) ; Kanum-irebe, between the lower Torassi and the Maro, Southern New Guinea, **ten, tta, ka** (Nevermann, 1938-184 ; 1939-8) ; Je-nan (Jei-anim), upper Maro, Southern New Guinea, **bikwe** (Nevermann, 1938-182 ; cf. Nevermann 1942); Marind-anim, Southern New Guinea, **uati, wati** (Wirz, 1922/25,
III, 192; Nevermann, 1938-184) ; Maklenga and Jilmak, West of the Marind-anim, Southern New Guinea, **j{liki** (Nevermann, 1938-188); Jabga, West of the Marind-anim, Southern New Guinea, **dikoi, jeliki** (Nevermann, 1938-188; Serpenti, 1965-49); Komolom Island, Southern New Guinea, **toe, tue, tui,** (Nevermann, 1938-188); Frederick-Henry Island, Southern New Guinea, **toe, towe, toa tigwa,** (Nevermann, 1938-190; Serpenti, 1965-49); Mapi River, South-west

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(1) Lester must have been misinformed. There was pressure to ban this habit at that time, due particularly to the John Frum movement on Tanna.

(2) According to Whitmore, T.C., 1966, Guide to the forests of British Solomon Islands, 208 p, Oxford University Press, no sample of Piper methysticum had been found in the Solomon Islands at the date of this publication. It cannot be concluded that kava does not exist there but this is at least an indication of its rarity in that island group.

New Guinea, **waghi**, **bari** (Nevermann, 1938-188); Binandele region, **pimgi** (Chinnery, 1922-24).(1)

Later, Brunton (2) used linguistic affinities to explain the distribution of kava both within Papua New Guinea and between Melanesia and Polynesia. According to this author the situation is not very clear in Papua New Guinea, but the affinities are so striking between the forty or so recorded names that there can be no doubt about contacts or exchanges having taken place in the interior of the main island.

On the Maclay coast, in the north-east, it is called **koi** or **keu**; in the south, around the Fly River estuary: **komata** or **gamoda** (Landtman, 1927), the Marind-amin in the western province call it **wati**; a little further to the north the Samo refer to it as **oyo** (Shaw, 1981), whereas in Irian Jaya, the western part of Papua, it is called **waghi**, **bari**, **tigwa**, **ikawati**, **dikoi** and **wati** (2).

It is relatively easy to draw up a map of the present and former zones where the plant was cultivated, but more difficult to explain it. Various research avenues can be followed to try and cast light on the issue.

1.1.4.2 First research method to locate kava's area of origin: linguistic affinities

Most authors, especially the enthnologists and anthropologists, give kava a Polynesian origin (3). This theory is considered unlikely for several reasons. As has been explained, dispersion of kava always results from the intervention of man who concurrently transports the name. Throughout that part of the Pacific where the present occurrence of kava seems to be linked with an introduction from Polynesian islands, the plant is known by various terms of Polynesian affinity, but in New Guinea, where it is traditionally drunk by certain mountain tribes who still today have very little contact with the coast, kava has very different names.

The same phenomenon may be observed in Vanuatu, to the north of the bio-geographical boundary marked by Efate (4). In the southern islands where there was a strong Polynesian influence the vernacular generic name of kava is apparently an introduced one, whereas in the north the names vary greatly and seem to be typically Melanesian. The names found in the southern islands of the group were probably introduced through inter-island contacts (5) and their geographical distribution corresponds to the areas where kava is traditionally masticated.

A far more intricate and dispersed distribution of cultivars and their names seems to have occurred in Melanesia, where the consumption of this plant and its cultivation are very localised,than in Polynesia. This state of affairs can be explained partly by the ready availability of land for cultivation and also by the much more pronounced cultural and political partitioning in Melanesia. It could also be due to the use of kava dying out in certain regions and subsequently being revived after new contacts.

Insofar as the presence of kava seems always to result from man's involvement, the linguistic approach makes it possible to define two main zones, one where the plant is called 'kava', in

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(1) The phonetic transcriptions in this paragraph have been simplified.

(2) Brunton, R., 1984, Kava drinking: The problem of its distribution (personal communication).

(3) Seeman stated (1868-261-262) in Flora Vitiensis that 'kava was not cultivated in the islands which were inhabited only by the Papuans' which implies 'by Melanesians'.

(4) Schmid, M., 1975. The flora and vegetation of the southern part of the archipelago of the New Hebrides. Phil. Trans. R. Soc. Lond. B., 272: 329-342.

(5) Out of the 179 languages and dialects recorded by Tryon (1976), five are of Polynesian origin: Aniwa, Futuna, Mele, Fila, Makatea, and are all located in the south or the centre of the archipelago. These migrations generally took place some seven centuries ago, not long before the coming of the kingdom of Roimata (see Garanger, 1972).

Polynesia and southern Vanuatu and another where it has Melanesian generic names, in the north of Vanuatu and in New Guinea, but other factors should also be taken into consideration.

1.1.4.3 Second method of research to situate kava's area of origin: population migrations in the Pacific

Kava can be classified as a food crop as root crops can. It must therefore have followed the same patterns of introduction and distribution as all food crops in Oceania during the pre-European era, showing a west-to-east trend which has been extensively debated by many authors.

Some historians (Rivers (1914), believe that kava was one of the first cultivated plants introduced by the Melanesians. Betel (1), it is argued, took its place in some cases, such as the Solomon Islands for example. Chinnery (1922, according to Sterly, 1970) shows furthermore that, in certain parts of New Guinea, kava and betel are consumed together. This can be interpreted as being an intermediate stage, if the substitution of the latter for the former did effectively take place. If such an assumption is made, kava would have to be considered as originating in Papua New Guinea.

1.1.4.4 Third method of research to identity kava's place of origin: the main domestication centres

Ecologically, kava is a shade-loving species which likes altitude. Its natural environment is sub-tropical rain forest. This being so it is doubtful that it originated in the mountainous islands of Polynesia (2), and kava's history is more likely to have its roots in Papua New Guinea. The closer an island is to one of the main centres of domestication and biological evolution, such as South-east Asia or the Indo-Malay archipelago, the more likely it is that the species found in that island originated there (3). Kava seems to be highly hybridogenous and occurs in very variable forms. It produces many clones, but seminiferous varieties may still exist at its place of origin.

In Vanuatu, the age of this crop is demonstrated by the large number of varieties occurring, of which, to our knowledge, there are more than there are cultivars found elsewhere. Vanuatu was probably for a long time an improvement and propagation centre for the best varieties, which were later distributed eastwards by the Polynesians who travelled far and wide across the Pacific during the pre-European era.

The authors share the view held by Rivers (1914, Vol.2, p. 255) that kava-drinking was a typically Melanesian custom, but that certain ceremonies or custom rituals were of Polynesian inspiration.

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(1) The 'betel nut' or areca nut, fruit of the betel nut palm - Areca catechu - should not be confused with the 'betel leaf', i.e. Piper betle. In fact, the masticant which is used in certain parts of Papua New Guinea and the Solomon Islands consists of a betel palm nut wrapped in a Piper betle leaf, the two together being called 'betel'.

(2) According to a compilation made by Dahl (1980 - Regional ecosystems survey of the South Pacific area, Noumea, Technical Paper No. 179), this ecosystem is relatively rare in Polynesia as compared to Melanesia, where it is relatively common and more widespread.

(3) The Piper genus is represented by many species in India and South-east Asia. The problem raised by the determination of the exact centre of origin of this genus is complicated by its presence in other Vavilovian places of origin (African or American). But as a cultivated species which resulted either from natural hybridisation or a selected mutation, it is logical that it should originate in a geographical zone rich in related species of the same genus. In this case, the probability that kava originated in Polynesia becomes very low.

Piper methysticum Forst., like most cultivated plants, is a derived form of a fertile wild species. It bears a great resemblance to the *Macropipe latifolium* Forst./*Piper wichmannii* C.DC. species. This 'wild kava' has a very similar morphology and grows wild in many areas of Vanuatu. The number of varieties of kava in Vanuatu and the abundance of this wild form, which can be found at various heights in most of the islands of the group, is a persuasive argument for seeking a relationship between these two species and proposing this country as the centre or one of the centres of domestication of *Piper methysticum*. This theory remains to be demonstrated (1). See also 1.1.1.

In addition, in the places where kava has a mythical origin, it is likely that the plant or its use was introduced or invented at some time of other. Explanations abound in these legends attributing the origin of kava to gods, spirits of the dead or even to animals, such as the pig in New Guinea and the rat in Fiji (Riesenfeld, 1950-370; Sterly, 1967-111) and Vanuatu.

According to the Marind-anim of New Guinea, kava came from a devil-stork whose legs are thought to resemble the knotty stems of the plant (Nevermann, 1938-186), according to Sterly (1970). In the centre of the same island, near Lake Kutubu, kava is said to have come out of the ground, where Waki the 'underground man' lived. According to other versions, it is the 'big-man' or 'big-man Sagainya' or Tokorabu himself who reappeared from beneath the ground in the form of kava (Williams 1940/41, XII, 58-609), according to Sterly (1970).

In Fiji, on the island of Vanua Levu, legend has it that kava appeared on the grave of prince 'Ranggona' who had died a short time previously, perpetuating his memory with the name 'yanggona' (Hocart, 1952-127), according to Sterly (1970).

In Vanuatu, one of the authors, (Cabalion), recorded a myth of identical origin for *Solanum aviculare* (2), a clearly introduced Australian Solanaceae on Tanna, near Eniou. A father had lost his son Iaukes and is said to have seen the fruit of the plant in his dead son's bed in a dream. On waking, he found the seed, planted it and named it **Ningh-ah-iaukes**, 'Iaukes' tree', the story goes.

Kava's mythical origins on Tanna and Pentecost are of particular interest because they refer to this plant as being the descendant of a 'wild kava', which could be *Piper wichmannii* C.DC., and as the raw material used for the preparation of a drink.

Whatever the case may be, if these myths do not provide a reliable explanation, they fall in line with the idea of a Melanesian origin of kava, which is also shared by A.C.Smith (1981-59): who felt that the origins of *Piper methysticum* were uncertain, but that it was probably indigenous to eastern Malesia or possibly in the New Hebrides; he considered that it was certainly one of the first plants that aboriginal voyagers would have taken with them.

1.2 THE PREPARATION AND EFFECTS OF KAVA

1.2.1 History

Piper methysticum has always had a special part to play in the history of Pacific societies and is today enjoying a resurgence of popularity with the Oceanian peoples, who are anxious to assert their cultural identity.

The Pacific Ocean and its countless islands very quickly attracted the attention of anthropologists, more so than the continents perhaps. Starting from their very first observations, scientists have

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(1) It is now certain that Piper wichmannii C.D.C., not Macropiper latifolium Forst., is the ancestor of kava.

(2) P.C. 1601 (Flowers, Port Vila and Noumea).

wanted to know how indigenous populations found the key to 'artificial paradises'. Schultes (1979) explains how Hoffman, using Lewin's first drugs classification as his basis, determined a number of categories and classified kava as a narcotic and hypnotic. It is neither an hallucinogenic nor a stupefacient. This clarification is significant because it helps to better understand the spirit of sociability which is felt when drinking kava. This atmosphere could not be created if kava was classified as a drug, as defined according to prevailing pharmacological standards, which causes addiction and dependence when taken.

Of all the scientists who showed interest in the effects felt by kava drinkers, Lewin (*Phantastica*, 1927-237) has certainly provided the most eloquent description:

> When the mixture is not too strong, the subject attains a state of happy unconcern, well-being and contentment, free of physical or psychological excitement. At the beginning conversation comes in a gentle, easy flow and hearing and sight are honed, becoming able to perceive subtle shades of sound and vision. Kava soothes temperaments. The drinker never becomes angry, unpleasant, quarrelsome or noisy, as happens with alcohol. Both natives and whites consider kava as a means of easing moral discomfort. The drinker remains master of his conscience and his reason. When consumption is excessive, however, the limbs become tired, the muscles seem no longer to respond to the orders and control of the mind, walking becomes slow and unsteady and the drinker looks partly inebriated. He feels the need to lie down. The eyes see the objects present, but cannot or do not want to identify them accurately. The ears also perceive sounds without being able or wanting to realize what they hear. Little by little, objects become vaguer and vaguer. The drinker is prey to exhaustion and feels the need to sleep more than any other sensation. He is overcome by somnolence and finally drifts off to sleep. His sleep is similar to that induced by alcoholic inebriation and the subject comes out of it grudgingly. When the mixture is of moderate strength the effect is felt twenty to thirty minutes following its absorption. The effect lasts for about two hours, sometimes longer and up to eight hours. How long the effect lasts depends on the drinker's level of inurement. When the mixture is concentrated, i.e : when it contains a lot of resinous elements, the effect is felt much more quickly. Drinkers can be found prostrate at the place where they have drunk their kava. Before falling asleep, they could have suffered slight nervous trembling. During their sleep, sensitivity is reduced. No excitement precedes these symptoms.

Observations on the state of drinkers were made during the very earliest explorers' voyages. Cook noticed that his crew members showed the same narcotic symptoms as produced by opium after absorbing heavy doses of kava. J.G. Forster (1777), who was very interested in the behaviour of drinkers, described kava as either whitish and tasteless or similar in taste to a weak peppery infusion.

Although Lewin (1886) claims to be the first person to have studied kava, it is in fact to the French navy pharmacist Cuzent (1856) that we owe the first detailed study of the use and symbolism of kava, amongst the inhabitants of the Marquesas Islands (1). He later reproduced part of this study in several other publications (1857, 1858, 1860, 1861, 1873) in which he made detailed descriptions of the methods of preparation and their social significance. Nevertheless, Lewin is still the first scientist to have written a monograph on kava (1886). He stated that no distinction could be made between the main ethnic groups of the Pacific (Micronesians, Melanesians and Polynesians), regarding the consumption of kava. The effect sought does however differ from one group of islands to another. Gaillot (1962) noted that in Futuna (2), where kava was probably introduced from Tonga, traditional consumption followed a highly hierarchical and strict ceremonial form, whereas in Melanesia, Papua New Guinea and Vanuatu, the purpose of almost daily consumption of fresh kava is to attain a state of intoxica-

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(1) There was a lengthy controversy over the first chemistry performed on kava. It is discussed in 1.3.2.

(2) Wallis and Futuna islands or Wallis and Horne or Uvea and Futuna.

tion(1). Van Veen (1938) also mentions that certain tribes of Papua New Guinea drink a kind of tea made from kava leaves, when normally only the roots are consumed.

The most frequent use of kava is in the form of an essentially ritual and social drink for its soporific and anxiety-relieving properties. In Hawaii, every social class drank kava to relax. Handy (1940) agrees with Pukui (undated article) and in contradiction with some views, that kava was not forbidden to the lower classes but that the nobility drank it as a mark of hospitality, the priests for ritual and esoteric purposes and the under-privileged class for the relaxation it afforded. It seems that kava production was very high at that time and that certain varieties were set aside for specific functions, the darkest kavas in colour being used for ceremonies. On Tanna, for example, there is a kava which is drunk only on the eve of hostilities called 'war kava' (Bonnemaison, personal communication). The reader is also referred to the name of the **tabal** variety, which brings to mind **ta-balan**, 'to make war' (Annie Walter, personal communication).

As a ritual oblation on the family altar, kava was offered to the spirits of the ancestors or to the gods, such as the 'shark patron' (Handy, 1940). In some cases, the gift was made through a medium who imbibed in the name of the spirit called upon. Kava was occasionally given to the 'seers' who contemplated it and drank it 'to induce the desired passivity or trance' (Handy, 1940). In such events it was used as a hypnotic, which is still the case on Tanna with the 'kleva' or healers (Bonnemaison, 1985-717). Kava was also used in central Polynesia to produce a serene state of mind (Fraser, 1954). On the island of Uea, whose culture is similar to that of Samoa, kava was deliberately drunk to stimulate inspiration (Handy, 1927). Thompson (1902) reported the same use on Niue. In Hawaii, the high priests drank kava to 'fortify the spirits' during their invocations and Gattyr (1956) noted the same use in the Marquesas Islands. On Tanna, it is drunk to help the people find inspiration for custom chants and dances (Bonnemaison, 1985). The same is true in the north of Vanuatu; a 'notable writer of songs, George Boe of Maewo ... prepared himself the previous evening ... with kava and invocation' (Crowe, 1985). The Tongans of Pangai village considered this drink as beneficial for healthy people but not advisable for the sick . They usually drank it in moderation, claiming that a man addicted to kava became weak, lazy and encountered family problems through neglect of his responsibilities (2) (Beaglehole, 1941) (3).

Whichever island, ceremony or method of preparation is referred to, kava was always drunk at dusk and before the meal, never after, probably because of its properties. It is odd to note that Cook reported often seeing Samoans take several bowls of kava during the morning (Lewin, 1886). Today such a habit would seem illogical if not unthinkable, except on feast days.

Kava is a social phenomenon specific to Oceania, which European influence often disrupted considerably. According to Lewin (1927, reprinted 1970), the cultivation of kava had declined steeply in 1830 in Tahiti where 'it was no longer possible to find a single specimen of the plant and (where) many Tahitians no longer even knew it by name. At that time, it could still be found in Raiatea, Moorea, the Tuamotus and the Marquesas'. Nevertheless, Cuzent had managed to find 12 different cultivars, between November 1854 and May 1857, on the island of Tahiti (Cuzent 1857), probably with the help of a few old healers. Lewin's peremptory statement may be false, but the fact remains that the decline of kava coincided with the rapidly increasing consumption of alcohol and that the two phenomena are linked. The restrictions imposed on

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(1) This argument favours a Melanesian origin of kava. When supply can easily meet demand, there is no need to ritualise consumption excessively. If kava does not grow so well in Polynesia, or if, upon the arrival of the Polynesians at their islands, kava production was low, consumption may have had to be restricted to important occasions. The fact that, in Melanesia, kava is a social drink rather than a ritual one is probably due to its abundance, but Melanesian kava does nevertheless have a religious significance. It is a medium for contact with the realm of the dead and the supernatural.

(2) This being a gentlemanly way of putting it.

(3) On some islands, kava is reputed to cause impotence, but this has never been proved. See chapter 1.3.1, ethnobotany.

kava by some churches have sometimes had unexpected effects, such as swelling the sales of spirits.

In Vanuatu, such hostility towards kava was particularly marked in the Presbyterian, Pentecostal and Adventist missions (1) (Guiart 1956; Gadjdusek, 1957; Brunton, 1979; Gregory, 1981). Newly-established in Vanuatu, the Holiness Fellowship Church has in its turn outlawed not only the consumption of kava, but also tobacco and alcohol. The Catholics on the contrary 'supported' kava. The Marist fathers always drank it with their neighbours and still do. The Anglicans seem to have adopted the same attitude.

A number of authors, such as Rivers (1914), devoted a large part of their studies on the history of Oceania to kava. During the pre-European era, the methods of preparation and in particular the drinking rites varied between islands, and sometimes within the same island.

Differences in culture, dialect and ethnic group have a direct bearing on the content and nature of these ceremonies. Whereas in certain regions the traditions and rituals connected with kava have been preserved, in others the European influence and the bulldozer action of that civilisation have left nothing but vague longing to drink kava.

1.2.2 The drug (2)

A plant is rarely uprooted before it is 2 or 3 years old. The most important organ at this stage is the rhizome (Fig. 7), which is knotty, thick, sometimes tuberous, with roots up to two metres long and filiform at the end. In some countries it is consumed fresh, as in Papua New Guinea, Vanuatu and in the Wallis and Futuna Islands, and in others after drying, as in Fiji, Samoa and Tonga. Its fresh weight varies from 5 to 50 kg (3) depending on maturity and variety. After hot-air drying to a constant weight, the final product only scales 2 per cent of its initial weight (45 per cent according to Cuzent, 1860).

The scraped and dried pieces of root, which in Fiji are called **waka**, can weigh between 800 g and 5 kg. They are cut into pieces 3 to 10 cm in length and 1 to 5 cm in diameter. The rhizome and the bottom of the stems are also a commercial item (known as **lewena** in Fiji). The dry product, longer than it is broad, is wrinkled and shows the root scars. Greyish-yellow on the outside, it varies in colour at the point of separation from white to dark yellow depending on its active principle content, which is contained in a lemon-yellow resin.

The central part is spongy and pithy (fig. 7) ; old rhizomes are easily recognised by the many holes and cracks they show, due to the partial destruction of their parenchyma. The rhizomes and roots comprise a multitude of ligneous fibres as well as over 60 per cent starch. Around the centre of the pith, made up of starch cells, are layers of vascular and ligneous tissue which alternate with small cells also filled with starch. The drug cannot be consumed in this state.

1.2.3 The methods of preparation

There are two different methods of preparation depending on whether fresh or dried roots are used. The principle applied is very simple and remarkably efficient in allowing easy extraction of the chemical constituents, by either chewing or grinding followed by maceration.

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(1) The term 'Pentecostalists' refers to the Apostolic Church and the Assemblies of God. 'Adventists' refers to the Seventh Day Adventists (SDA).

(2) Drug in the pharmaceutical sense of raw material and not the pharmacological meaning of substance provoking addiction and dependence.

(3) A four-year old kava, grown in very sandy soil in Port Vila, had a rhizone which weighed 132 kilos fresh (plant pulled up by V.L.).

Today, mastication of the fresh roots is still practised only in the southern and central parts of Vanuatu and by certain tribes of Papua New Guinea. This method was very widespread in Polynesia and Fiji at the beginning of the pre-European era, but was abandoned under the influence of the missions who considered the practice unhygienic. Nowadays, kava is prepared in these countries by grinding followed by maceration of the fresh or dry root. A distinction will therefore be made between the methods of preparation used in the Pacific in general and in Vanuatu in particular.

1.2.3.1 The methods of preparation of kava in the Pacific

In Tonga at the beginning of the last century, the old and young roots, once pared, were cut into pieces which could be held in the mouth (Beaglehole, 1941). In Fiji, they were ground on a stone into small pieces which were then masticated by the men or the women, but especially by young boys and girls with strong jaws. They chewed until they were exhausted and the drinkers were vigilant that none was swallowed.

In the Admiralty Islands of New Guinea, on Lou particularly, kava was cultivated and the drink prepared from the masticated roots (Parkinson, 1907-373) according to Sterly (1970).

Nowadays, in Fiji, Wallis and Futuna, Samoa and Tonga, kava is prepared in a much more hygienic way, mainly by scraping the rhizome then grinding it between two stones, one of which is a small pebble with a concave top. Water is added and the mixture is then strained through the fibre of the stipule of coconut leaves (1) acting as a filter which is called **fau** in Samoa (A. Kramer, 1902). This task must be performed by a young girl, preferably a virgin, who has been 'purified' for the ceremony by washing of the hands and wrists (Steinmetz, 1960). According to Kramer, the ceremony, which was very strict in Samoa, required that the girl should sit cross-legged on a mat, bare-breasted, with flowers carefully arranged in her hair and her hips swathed in a grass skirt, this representing an image of beauty which was supposed to attenuate the impression left by the preparation of the beverage.

In most Pacific Islands, the ceremony in which young boys and girls were obliged to chew kava rhizomes has been outlawed. In Hawaii in the 1850's a law was passed to forbid the consumption of kava without medical control or advice, but it was not very strictly enforced. Spencer (1943-1932) stated that in Fiji, although the Government had forbidden the mastication of kava roots for health reasons, the practice continued at ordinary gatherings, because it was thought that such a method produced a better drink. He was told that in local custom it had always been forbidden to prepare ceremonial kava by mastication. In Fiji, once the chewing was complete, the young girl deposited her mouthfuls of kava pulp in a big wooden dish called a **tanoa** where she finished the mixing and where the mixture macerated before being filtered and distributed in individual bowls called **bilo** (Steinmetz, 1960).

The ceremony begins as soon as water is poured on the chewed or ground kava and usually consists of incantations to the gods or the dead, but differs greatly from island to island (Steinmetz, 1960). When the water has been left long enough and permeated the masticated kava, the plant residue is extracted from the mixture. Each guest at the ceremony drinks from his own recipient consisting of half a coconut shell and performs other individual rituals.

Gaillot (1962) described in detail a royal kava ceremony on Futuna (2). In Futunese society, kava is a symbol of forgiveness. Custom requires that the person offended or injured be offered a kava root, to obtain his pardon. The method of preparation by mastication has also disappeared on Futuna, after a missionary in 1930 introduced the grinding technique. The Futunese

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(1) A kind of sheath at the base of the leaf petioles.

(2) Wallis and Futuna Islands.

ceremony was always performed with the presence of a master of ceremonies who directed the different stages of the preparation and finally decided whether the kava was 'good or too strong'. As in Fiji, Samoa and Tonga, the drink, which was in the past prepared by mastication, was drunk only by adult men and formed a rite which was an integral part of religious and social life.

Drinking kava is important during feasts; it is a sign of hospitality whose ritual varies enormously from one culture to another. To drink kava is therefore more a rite than an act of 'debauchery'.

1.2.3.2 The methods of preparation of kava in Vanuatu

In Vanuatu, kava is always consumed fresh, sometimes after mastication, whereas in Ponape, Wallis and Futuna, Samoa, Tonga and Fiji, kava is first dried then ground. However, according to Barrau (1957), 'on the island of Aoba (Ambae) and in certain villages of Malakula, the dried roots are also used'.

Kava is cultivated and consumed on almost every island in Vanuatu, but the rituals and methods of preparation vary. On the islands of Anatom, Tanna, Futuna (1), Aniwa, Erromango, Nguna, Emae, Tongoa, Tongariki, Epi and Paama, it is drunk after mastication and maceration. In the north, Pentecost, Maewo, Ambae, Santo (2), Banks and Torres, it is prepared by grinding, using a coral grinding stone on a wooden dish.

It is also reportedly chewed in the south-western part of Santo, on Malakula and on Efate (Codrington, 1891, Speiser, 1923, Guiart, 1958) according to Sterly (1970).

On Tanna, kava is prepared and drunk communally as soon as the sun has set. The preparations and ceremonials have been extensively described by Gray (1892), Guiart (1956) and Bonnemaison (1975 and 1985). There is a very strict hierarchy and division of tasks between the men present in the **Nakamal** (3).

This activity is an exclusively male domain. Young men who have been circumcised, i.e. recognised as full members of the male community, chew for older men, whereas the host prepares his guest's kava. If two persons are of the same social rank or status, each prepares the other's kava (Bonnemaison, 1975). 'To masticate one's own kava would be considered bad manners for a stranger, but for a 'man ples' (4) it is a way of showing on that occasion a temporary indifference towards social relationships' (Guiart, 1956). Accordingly, one never drinks kava alone because it is a social and religious activity, which enables the drinker to feel closer to his ancestors. 'Thus through the roots of kava do the men of ashes and shadow leave the world each night to return to the deepest ages' (Durand, 1973).

First of all the rhizome is cut into pieces with a bush knife, then scraped with a small knife to remove the worst dirt and finally rubbed with coconut husks to complete the cleaning. The pieces are then carefully masticated and each mouthful deposited onto a leaf of the bourao tree, *Hibiscus tiliaceus*, laid flat on the ground. The pulp thus obtained is then placed in the

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(1) Futuna in Vanuatu.

(2) It is very surprising to note that the former inhabitants of the village of Nokovoula (alt. 1132 m) in the island's mountain range prepare their kava by mastication (August 1985 Expedition).

(3) In Bislama, the place where kava is drunk. It is called yimwayim on Tanna in the Nvhaal language, according to Guiart, 1959 (language also called Imreang, No. 173, by Tryon, D.T., 1976).

(4) In Bislama: a person from the area.

stipule of a coconut leaf and soaked in fresh water. The first filtrate called **bodi blong kava** (1) is strained into half a coconut shell, containing 100 ml. The residue, vigorously compressed, is called **makas** (2) and is used for another serving whose physiological effect is weaker. The taste depends on the age of the plant used and especially the variety chosen.

Kava has a strong, characteristic but not unpleasant smell. Most islanders appreciate kava more for its bouquet than its taste, which is acrid and astringent. Every drinker, even the most devoted, grimaces and shakes his head when he takes the potion, which is quaffed at one go and in silence. The 'man Tanna' is expected to expectorate loudly once he has swallowed the contents of his shell. This is the **tamafa**, a kind of traditional and public prayer to the ancestors, where the drinker often makes a personal wish. He then sits down beside the fire to 'listen to the song of the kava' (3). At this stage, one of two different responses may be oberved - either silence, as is usually the case on Tanna, or, on the contrary, conversation, as in the northern part of Vanuatu. Bonnemaison (pers. comm.) says that 'on Tanna each person moves away from the others and sits beside some glowing embers smoking his pipe. Silence reigns over the dancing ground crossed only by young boys bringing drinkers their bowl. Too much noise or light could 'kill the kava' (4) and each person concentrates on the effect felt'. In the north, on the other hand, according to Crowe (1985), 'it is the time for serious conversations, to tell stories and myths and to talk politics and discuss matters of deep interest to the men. It may seem unlikely, but under the influence of kava, one feels a sensation of immense peace and has such a wide range of thoughts, that there seems to be an answer to even the most inextricable problems'.

These statements have been verified by the authors, as they could be by anyone in Vanuatu, at the nakamal.

On Tanna, kava has become a symbol of social reaction against the intransigence of the Presbyterian missions who tried hard to forbid its consumption (5). This is why the followers of the John Frum movement and also all the custom groups drink kava every day. In 1956, when there were about 15,000 inhabitants on Tanna, Guiart counted 233 **nakamals**, or **yimwayim**, or dancing grounds, where each night the men gathered to drink kava. The number of such dancing grounds seems to have increased considerably today, probably to over 500 (6).

Quite surprisingly, in the south of Tanna and in Aneityum, the women can drink kava, which they prepare for each other, but it is difficult to say how far back this practice goes, unique as it is in Vanuatu. It would appear to be a very ancient practice.

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(1) 'The body of the kava' in Bislama, or the first extraction which contains the essential active ingredients.

(2) 'Residue, dregs', in Bislama.

(3) 'To feel the effect', in Bislama : harem sing sing blong kava or harem kava.

(4) 'Eliminate the effect', in Bislama.

(5) The consumption of kava has been prohibited in various parts of the Pacific. Hawaii has already been cited in the previous chaper. In Irian Jaya, the Dutch administration in 1935 promulgated an order prohibiting the cultivation, possession and trading of kava. This ban was lifted in 1957 (Serpenti 1962-59) according to Sterly (1970). The case of Vanuatu is mentioned above. Other examples could also be quoted. However, if forbidding women to drink kava is not legal, it is customary. In Fiji women were only allowed to drink kava at the beginning of the century (Thomson 1908-213-346) according to Sterly (1970).

In the Marind-anim tribe, southern New Guinea, the old women occasionally drink kava (Nevermann, 1938-185) according to Sterly (1970).

This prohibition was apparently not systematic, therefore, with every kava-drinking people, but was the case in Vanuatu apart from some rare exceptions (see above text).

(6) Many dancing grounds have been 'reopened' since, following demoraphic growth, but also due to the resurgence of custom on that island (Bonnemaison, 1985). The island has 115 or 116 main 'tribal' groups called niko or 'canoes' in the local language, and each niko has 5 to 10 'dancing grounds' (yimwayim) corresponding to a small patrilineal clan organised around one such dancing ground (Bonnemaison, pers. comm.).

According to Gajdusek (1967), of all the Pacific islands where kava is consumed, Tongariki (1) is the one where kava-drinking has reached its zenith. This is thought to be a relatively new development, which can be attributed to the fact that the consumption of kava on the island has never met any strong religious objection, as no Presbyterian missionary has ever lived there. On Tongariki, kava is also chewed, but is only filtered when the meal is ready because the men prefer eating immediately after drinking their kava. This practice can also be found on Tanna. Gajdusek was interested in the effect of kava on the sexual behaviour of drinkers. According to the women questioned, the men did not seek any sexual contact after using kava. He noted that, contrary to trends he had observed in other Pacific islands, the population of Tongariki was not increasing and suggested that kava could therefore be an effective means of birth control.

Dam-Bakker, Van de groot and Luymen (1958) also suspected **wati**, as it is called in one particular region of Papua New Guinea, as being one of the probable causes of the many cases of infertility amongst the Marind-anim people. However, experiments carried out in laboratories have never been able to prove this and nothing prevents the partners from seeing each other during the day, at the garden, to repair the previous night's omission.

In Vanuatu, there are very close relations between the religious powers attributed to kava and certain acts of magic. The Big Nambas, a tribe in northern Malakula, made drink-offerings before their ancestors' skulls to improve the fertility of their women (Deacon, 1934). Their method of preparation seems very similar to that used on Tanna, to the extent that some men masticate the kava while a circumcised youth prepares the mixture (Harrison, 1937). According to Allen (1964), the people of Aoba feel that magic is more efficient when the performers are under the influence of kava. Rivers (1914) noticed that, in the Torres group, invocations were made to an ancestor's memory just before drinking, whereas Layard (1942) stated that on Vao, an island off north-east Malekula, although kava was not drunk, its roots were used in many religious rites.

From the north to the south of Vanuatu, the different methods of preparation, which in the past were very strictly regulated by custom, are tending to change and become more and more identical. Whereas on Tanna kava-drinking is a communal activity, in the Banks group kava was prepared by a single high-ranking dignitary and this is still the case on occasions (Rivers, 1914). The same is true for southern Pentecost, but the person responsible for the preparation is simply the host himself, whereas in the north the company splits into two and a person from either group prepares the kava of a drinker from the other group chosen according to his affinities. Preparation is by grinding fresh kava in a big wooden dish, with a piece of coral stone.

When the dishes are old, they are sometimes covered with a greyish-green deposit which can be very thick and which is sometimes found at the bottom of the half coconut shell used as a drinking bowl. This residue is the resinous substance which contains the active ingredients. Some drinkers occasionally scrape the deposit from the dish and mix it with fresh water to obtain a brew with very powerful effects because of its highly concentrated active principle content.

1.2.4 The effects felt by kava drinkers

The fresh roots, prepared by mastication or grinding, yield a greenish, milky potion, which is considerably stronger than the grey mixture obtained from dry roots. Before Lewin began his research on the plant, it was generally considered that the method of preparation was the only factor determining the effect felt. It was thought that, during the mastication process, the saliva converted the starch contained in the roots into sugar and that the fermentation of this sugar produced alcohol. This author has proved such a theory invalid (Lewin, 1886) : 'It is proved that this theory is incorrect in every respect'. However, it has been demonstrated that prepara-

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(1) Shepherd Island group.

tion by grinding produces a weaker drink and one with a different action from the chewing method, the main factor determining the effect of the kava being the degree of separation of the resinous active ingredients (Steinmetz, 1960). Van Veen (1938) noted that for a kava to be active, it had to be emulsified very finely in water by saliva, lecithin or oil, in order to disperse the active substances. Mastication reduces the rhizome into tiny particles and at the same time breaks up the resin to obtain the narcotic effect sought. The active substances, which are insoluble in water, become drinkable as a result of this emulsification process (Van Veen, 1938). This explains why the drink prepared by simply macerating the ground rhizome is practically without effect physiologically. However, it is very thirst-quenching and many Europeans acquire a taste for it. According to Lewin (1927-238) the strongest kava in Fiji came from Rotuma where the people enjoyed making passing sailors drunk. In Fiji, the kava break has replaced the tea break in offices (Barrau, 1956; Naidu, 1983). The scraped, ground and macerated kava is drunk in moderation and has a basically narcotic effect. The preparation is never kept for long . It is the habit to eat a little after drinking but kava reduces appetite and over-eating may make the person feel sick. On the subject of this kind of concoction, Lewin said 'that a well-prepared kava potion drunk in small quantities produces only pleasant changes in behaviour. It is therefore a slightly stimulating drink which helps relieve great fatigue. It relaxes the body after strenous efforts, clarifies the mind and sharpens the mental faculties. If a certain quantity of these active elements is absorbed they produce special narcotic effects'.

Steinmetz (1960) described these effects as a paralysis of the nervous system through reduction of spinal rather than cerebral activity, followed by muscular stimulation and then paralysis particularly affecting the lower limbs. Kava reduces the cardiac rhythm then stimulates and slows down respiration. As opposed to alcohol, it does not affect the capacity to think before the person is overcome by sleep. Some people even say that it helps the thought process. If an excessively strong dose is absorbed, it affects the sight, making the pupils dilate and only react very slowly to light. The person then suffers from photophobia (Steinmetz, 1960). Cases of diplopia, double vision, are not unknown (Bonnemaison, pers. comm. and the wife of one of the authors, P.C.), expressing temporary oculomotor paralysis.

In certain tribes of Papua New Guinea, women drink fresh masticated kava as an anaesthetic, when they are being tattooed (Steinmetz,1960). They also drink large quantities when they are pregnant, especially just before delivery, to stimulate milk production.

Kava prepared in this manner has many properties. Its active ingredients bring on sleepiness and muscular relaxation. A half coconut shell of certain varieties of kava is strong enough to put the drinker into a deep, dreamless sleep within half an hour. This is an excellent performance for a soporific. The next day, the drinker awakes in excellent shape and has fully recovered his physical and mental capacities. It has no after effects comparable to those of alcohol as long as only a reasonable quantity is absorbed. Contrary to the claims of Lewin (1886), who said that 'from the point of view of its moral influence on the individual this passion is like alcoholism, morphine-addiction and other yearnings', the addiction rate in fact seems to be very low.

Lewin also refused to accept that kava was 'responsible for the skin diseases of the Pacific islanders, especially a state of scaly exfoliation giving the skin a shrivelled appearance' ; this is nevertheless one of the unpleasant side effects brought on by chronic consumption of kava. It has now been proved that very frequent consumption of this drink causes skin lesions and drying up of the epidermis, producing an advanced exanthema whose urticarial patches produce intense itching. Such reactions are only found in heavy drinkers, and can be attributed to the properties of kava's active constituents. These are lactones, related to sesquiterpenical lactones, 'allergens capable of causing severe eczemas ... what provokes the aggressiveness of these substances is the presence of an alphamethylene-butyrolactone group which enables them to

attach themselves to the skin proteins thus easily forming complete antigens, which are responsible for the series of biological reactions, which finally lead to the stage of allergy' (1). These skin lesions, called **kani kani** in Fiji (Frater, A.S, 1958) disappear if the amounts consumed are reduced and a special diet followed . This occurrence in fact only concerns drinkers who are prone to the allergy in the first place.

In various villages in Vanuatu, habitual drinkers are recognisable by their blood-shot eyes and the ulcerous appearance of their skin. These symptoms are very often wrongly diagnosed as being those of ichthyosarcotoxism (2) which is a health problem in the South Pacific.

When the potion is prepared by grinding dry roots followed by maceration in water, these side effects are rare. Compared to the other method, this technique yields an appreciated drink, but one without a strong physiological effect, especially if it is very diluted. In spite of this often unhygienic method of preparation, there has never been any case of serious disease ascribed to it. The last side effect to mention here is the permanent state of apathy which affects large-scale drinkers, preventing them eating adequately. However, this is a consequence of the important place taken by kava in a heavy user's life rather than a side effect as such. If kava is drunk in moderation, it has no toxic action whatsoever and no side effects. Contrary to alcohol it induces sleep and relieves anxiety, keeping the drinker calm.

1.3 THE SOCIO-CULTURAL ROLE OF PIPER METHYSTICUM IN OCEANIA

1.3.1.1 Kava as a ritual offering

The Oceanian peoples who are familiar with kava hold it in esteem primarily as a ritual offering or a ritualised form of payment. From this concept stem the various uses to which the plant is put.

Many authors have commented on the role of kava and it is not intended to go back over that aspect here. However, before turning our attention to the plant's various uses, it would seem worthwhile appraising its symbolic importance in local customs, especially in the Melanesian traditions of Vanuatu and Fiji. Kava's medicinal reputation would appear, at least originally, to be a corollary of its narcotic action and its role in the exchange system between men and especially between men and the gods. Why has kava acquired such favour ? Other plants in Vanuatu also play the part of a customary gift, especially yams, but only kava has such a pre-eminent role on so many different occasions and this is believed by the authors to be due to its pharmacological properties. By offering kava to the gods or spirits, man was gaining their goodwill and by drinking it, he could move closer to the supernatural world. This evokes the very eloquent title that Schultes and Hoffman (1980) found for their book, *Plants of the Gods*. In our case, however, the plant in question is not hallucinogenic.

Vanuatu: History

Kava has been known for a long time in Polynesia, through the literature from the first scientific voyages to the Pacific (3), but this is not the case for Melanesia, especially Vanuatu (4). It was

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(1) (p.27) Benezra, C. and Dupuis, G. Sept. 1983, L'allergie du contact, La Recherche , 147 : 1062-1072.

(2) Or ciguatera (fish-poisoning).

(3) Drake del Castillo (1886) at that time listed 15 varieties of kava, 6 from Tahiti, 5 from Hawaii and one each from the Marquesas, Fiji, Wallis and Tonga. 61 years before that in 1826, Lesson had already noted that 'The most active plant is the one which provides ava'.

(4) Forster (1981) noted its presence in Vanuatu, but took a sample of Macropiper latifolium (see 1.1.1.).

only in 1985 that MacGillivray recorded its presence in Futuna in the ex- New Hebrides. Without taking any samples, he included it in a list of food crops and useful plants which he probably saw near a village: 'among the more remarkable plants not before alluded to (Cocoa-nut, Bread-fruit, reed-like grass, yam, taro, Horse-taro, kava, etc.)' (MacGillivray 1854).

The first botanical sample from Vanuatu was taken by D. Levat who collected it in Port Vila as **kava** (1), (Guillaumin, 1919).

The second herbarium sample was found in 1928 at Lenakel, Tanna, by Kajewski (2): 'The roots make the native intoxicant **n'kava**'. (Guillaumin, 1932).

At that time, Cuzent's monograph on Polynesian kava was already seventy years old.

A case of mistaken identity (3) and sample No RSNH 50 (4) show that the plant did not attract the attention of the botanists who came to Vanuatu. In fact, most of the time, botanists feel that they are wasting their time collecting cultivated or common species.

An ethnologist/anthropologist, an ethnobotanist and an agronomist collected the other specimens known from Vanuatu.

Unlike botanists, ethnologists and anthropologists are interested in plants' significance and not in the plants themselves. We owe the first description of a medicinal use of kava to Vienne (1981) who actually introduced a sample of the plant into an herbarium (5). He was followed by Chanel Sam (6) and one of the authors, (VL) (7) who collected *Piper wichmannii* C.DC., also called **wael kava** in some islands of Vanuatu, which we believe to be the possible ancestor of kava.

So far, six samples of *Piper methysticum* have been gathered in Vanuatu, which is very poor compared to the number of articles and publications referring to kava (8). It is probable that other herbarium kava samples from this archipelago are lying dormant here and there in collections of which nobody is aware.

The first reference to the use of kava in Vanuatu seems to be that of Codrington (1891): 'to control the weather'. This use in magic is related later on. Although the use of the plant for the preparation of a drink is alluded to several times subsequently, especially by Guillaumin (1932), (1954) and Barrau (1956), not until Guiart (1956) were other uses cited and not until Vienne (1981) were the first two medicinal indications of this species recorded on Motalava.

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(1) D. Levat, unnumbered, 1883, Port Vila, at the seaside, 'kava' (Museum of Paris).

(2) S.F. Kajewski, No. 119, 6-3-1928, Tanna, Lenakel (Arnold Arboretum) (Museum of Paris).

(3) I. and Z. Baker, No 15. 2-11-1983, Santo, Hog Harbour, altitude of 90 feet, wet forest, 'nevulko' (British Museum), is referred to as Piper methysticum Forst. in Guillaumin's article (1938-559). In fact it was a Macropiper latifolium (L.f) Miq. forma latifolium according to A.C. Smith's identification at the British Museum's herbarium in 1975. We would like here to thank Mr.P.S. Green, Honorary Research Associate at the Kew Botanical Garden and Herbarium for checking at the British Museum the identification made by Guillaumin, which did not match the vernacular name or the presence of fruits on the sample cited by Baker and Baker (1936-508 and 510).

(4) Chew Wee Lek, Royal Society Expedition to the New Hebrides (RSHN),No 50,19-7-1971, Aneityum, Neizouima (Kew, Noumea, in flower, Port Vila, in flower).

(5) B. Vienne, unnumbered, Banks group, 1972, 'taqevarus' (sterile: Noumea).

(6) Ch. Sam No 128, 17.11.1981, Tongoa, 'namaluk' (in flower : Port Vila, Noumea, Paris).

(7) V. Lebot, No 1, 10.4.85, Tongoa, Piper wichmannii C.DC, kindly identified by Dr Chew Wee Lek, Sydney, whom we would like to thank (in flower : Paris and Port Vila).

(8) It is the same in Fiji, where A.C. Smith could only record 8 species in 1981. See Whitmore (1966), comment p.11.

By comparing and filling in the gaps in all the information gathered by the botanists and anthropologists and by studying the agronomic and chemical data, it is possible to gain more knowledge about this cultivated plant.

. *Kava in Vanuatu custom*

In his sociological survey on the role of the plant in Vanuatu, Guiart (1956) listed the various uses to which it was put.

On Tanna, kava is present in some form or other in most of the social and magic rituals. Pigs and kava plants are the most common form of ritual payment for turtles and were also used in the past to pay for corpses wrested from enemies. Kava roots are also used as payment for the ceremonial aigrettes or **kweriya**, the preparation and performance of weather-controlling magic which is supposed to have influence over the elements, and of course also to meet the requirements of traditional medicine. Although incomplete, this list shows that kava demand is always high and that this commodity is the constant companion of the important social events. On Tanna a special technique for the cultivation of kava was even developed, which produced longer and therefore more attractive roots for customary exchanges. The kava obtained from such a method is relatively protected from nematodes and the surface of the rhizome and roots is whiter and smoother than with ordinary kava. The upper part, which is swollen along 20 to 40cm of its length, corresponds to the rhizome and the root itself can reach a length of 2m. This **nekava topunga** (Guiart,1956) or **kava tabunga** (Bonnemaison, 1985) is planted in the hollowed-out trunk of a tree fern, placed horizontally or vertically according to Guiart. Today, the second method seems to be the only one still in use.

Whereas the kava cultivated by the usual method can be drunk by all men, this is not the case for **nekava topunga**, which is also the kava of the god Mwatiktiki, who is called upon in village magic. In this case it is the custodians of the **nekava topunga** who ritualise the consumption of the plant cultivated that way. They are the only persons entitled to uproot a plant and distribute the pieces which will then be prepared in the usual fashion. Some special stories and forms of village magic apparently exist for this sort of cultivation. Guiart (1956) mentions two guardians of the **nekava topunga** magic.

This information shows that the cultivation and use of *Piper methysticum* was widespread in Tanna around 1952 and that demand was high. Even today, 1987, the Vanuatu Plant Quarantine Department regularly sees Tanna kava being sent abroad by individuals, and from time to time comes across some **nekava topunga**, wrapped up in pandanus leaves, ready to be sent to Noumea or Australia as a gift.

Kava's role as a means of interceding in the supernatural world is particularly obvious on Tanna, but it is also evident on other islands of Vanuatu. Codrington (1891) gives recipes for weather-controlling magic, gathered on Maewo and Ambae, designed to bring sun or rain. These also exist on Tanna, where the association of kava with one plant or another rolls back the clouds or attracts them. Other similar magic is used for controlling the sea, earth tremors, thunder, winds and so on.

According to Bonnemaison (pers. comm.) each Tannese magician, and all the island's important men, or 'big men', are magicians to some extent and only officiate with their magic stones and plants after drinking copious quantities of kava. The healers, or **kleva**, like other village magicians, drink nothing but kava at such occasions. The trance into which they fall enables them to communicate with the spirits and find the secrets of a disease and guides them in their search for the right medicines.

On Malakula, kava is used in the rites for attaining the highest grade of **nimangki**, or in the **nogho-tilabwe** ('making man') ritual (Deacon, 1934-337-746) according to Sterly (1970).

In war, kava when used advisedly enables a person to become invisible or invincible or even invulnerable and to deny such advantages to enemies.

Fertility magic is known on Tanna and among the Big Nambas on Malakula, as stated above.

The opposite was also possible and each of these pieces of magic has its negative corollary. If it is used wrongly, fertility magic can indispose the spirit or god invoked and cause sterility. It is also possible to cast spells, and here again kava was prominent. On Tanna, for example, the name of the victim chosen to die was pronounced after drinking kava, during the **tamafa**, i.e. when the last mouthful of the liquid is spat out again. Black magic was then performed, and the spirit which was invoked received the message and accomplished its task (Bonnemaison 1985, and pers. comm.).

Papua New Guinea

In New Guinea, divination through kava also existed, to favour population growth, guarantee a succesful conclusion to hunting, fishing and war or to bring back the wandering soul of a sick person (Landtman, 1927; Riley, 1925; Haddon, 1916) according to Sterly (1970).

Fiji

The case seems to have been the same in Fiji. Fr.Rougier (1907) reported a set of beliefs which confirmed the importance of kava in ceremonies performed to counter the spirits and seek reconciliation with the gods:

'If a spirit disturbs a family by causing a member to fall sick, a feast is quickly organized and kava is prepared and offered together with urgings to the spirit to be gone'.

To avoid alienating a spirit which has materialized as a shark, 'kava and food must be thrown in the sea when the shark appears' as an offering or an exorcism called 'counter-operation' by Rougier. (The shark is apparently in some cases considered as being the mythical origin of some clans in Fiji and also in Vanuatu).

'It is certainly for similar reasons that, after returning from the garden, the point of the yam stick (1) was dipped in the kava basin before serving oneself'.

'During the preparation of kava, it was important not to spill any because the direction the drops flew in could point out a thief or a liar'.

In Fiji again recurs the role of kava in divination. 'The seer drinks kava, sleeps and in his dream sees the culprit of some misdeed, theft or sorcery' Divination was not necessarily done during sleep, after drinking kava, but also by reading in the kava.

Other magic or 'tabu' acts also existed in Fiji. It was forbidden to drink hot kava during the planting season because the plant would dry out on the spot.

(According to Bonnemaison (pers. comm.) on some dancing places on Tanna, nobody is allowed to touch the glowing embers of a fire when people are drinking kava, or a sudden death would throw a member of the local group into mourning.)

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(1) Digging stick used for planting yams.

In Fiji once more 'a drinker's beard could fall out if he drank kava from a dish. The person who masticated the kava root must not rinse his mouth out because this would change the kava into clear water (1), or spill a single drop on the ground during straining because this would mean the imminent death of somebody present'.

These remarks by Rougier seem somewhat out of place and lacking in value in the context of the present study on kava in Vanuatu. They are only mentioned here to demonstrate that a code of correct behaviour existed in relation to kava, which is at the centre of traditional social life.

Rougier also described some medicinal uses of kava which are referred to later.

Spencer (1914) arrived at similar conclusions. He did not state the uses of kava as a medicine, especially those mentioned by Rougier, but his article did describe clearly the beliefs on the origin of diseases in a mountain village in North-East Viti Levu (Fiji).

The Fijians, he reported, distinguished two categories of disease according to their terminology and three in practice : the 'diseases of the body', incidental or accidental and the 'diseases of the land' due to reactions by the local spirits to the breaching of tabus or for lack of respect towards them by the local inhabitants. The third category of disease is that caused by sorcery. Most of the ritual, ceremonial and medicinal operations use kava as a gift to placate the spirits before, during and after their spates of anger and to show the respect owed to them.

Spencer also stated that the persons performing the role of sorcerer for the 'medicine of death' or of healer (2) for the 'medicine of life' had to drink considerable amounts of kava when performing their duties. These people sometimes acted as prophesiers, performing what should be called 'kavamancy' to divine the origin of an illness, confirm the diagnosis and to see in the kava what treatment to use. The same practice was probably followed on the island of Manus, in New Guinea, where the leaves of the plant were used as a means of divination (Fortune, 1935-31 and 257) according to Sterly (1970), and on Tanna.

Spencer's article confirms the nature of the role played by kava in Vanuatu and Fijian society, even if the spirits and the gods responsible for the events occurring in traditional life were not the same. This plant was the medium for an infinite variety of votive, invocatory, malevolent and indirectly medicinal magic acts. It is tempting to draw a parallel with certain regions of Europe, such as the Bocage in the west of France, described by Favret-Saada. If the magic worked, the magician was responsible; if it failed, it was because the spirit, or the evil spell, had more power than the 'medicine' or because a ritual had not been properly carried out or a word had been mispronounced.

1.3.1.2 Kava in traditional pharmacopeia and medicine

If, in the traditional scheme of things, gods and spirits are the sole arbiters of the world's destiny, why should the same not be true for medicine. To bring the rationalists down to earth, we have only to remember the meteorologist's frog, who was supposed to climb the ladder in his jar when fine weather was approaching, or to recall that well-known medical saying 'only for the last century has medicine saved more lines than it has taken'. The frog in the jar was nevertheless the instrument of a man seeking not to change the weather to come but to know it.

If kava were still an unknown plant, all its traditional therapeutic indications would have to be sifted through. Modern medical science tries to find a logical relation between cause and effect

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(1) In Southern Guinea, on the contrary, the masticator rinses his mouth with clean water or coconut juice to eliminate the nasty taste left by the kava (Nevermann 1938-184; Haddon, 1916-146) according to Sterly (1970).

(2) Spencer, 1941

in order to apply an etiological or symptomatic remedy, whereas traditional medicine seeks the causes of illness, primarily in the breaching of tabus, and then treats them with medicines tested empirically. Both often seem to neglect the placebo effect by favouring either the supernatural or the rational explanation only.(1)

Polynesia: Zepernick (1972) noted about thirty syndromes treated with kava-based preparations. They are enumerated below, with a request that the reader refer to the original articles compiled by the author.

PLACE	SYMPTOM	MEDICATION	SOURCE
Tubuai	inflammation of the genito-urinary system	maceration of young kava shoots, orally	(Aitken, 1930-86)
Pacific Islands	gonorrhoea and chronic cystitis	the drink, orally	(Steinmetz, 1960-41)
Hawaii	difficulties in urinating	the rhizome	(Handy *et al.*, 1934-20) (Titcomb, 1948-126)
"	irritation of the genito-urinary system	the rhizome	(Handy *et al.*, 1940-204)
"	feminine puberty syndromes, weakness	drinking masticated kava	(Titcomb, 1948-126)
"	menstrual problems, dysmenorrhea	kava-based medication	(Handy *et al.*, 1934-20)
"	painful migraine headache (related to women's sicknesses according to Zepernick)	drinking masticated kava	(Titcomb, 1948-126)
"	vaginal prolapsus	maceration of kava	(Titcomb, 1948-126)
"	to provoke an abortion	kava leaves in situ	(Handy *et al.*, 1934-20)
"	headaches	masticated kava as a drink or masticated kava as such	(Handy *et al.*, 1934-20) (Handy, 1940-204) (Titcomb,1948-126)

(1) The placebo effect can be measured in terms of the 'morale' of the patient and the degree of trust he places in the practitioner and his medicine. It is, therefore, difficult but not impossible to quantify objectively this state of mind which is essentially subjective.
A placebo is a preparation which does not contain active ingredients, intended for the performance of clinical experiments or used to reduce the doses administered to the patient if he is not agreeable to a reduction.

PLACE	SYMPTOM	MEDICATION	SOURCE
Hawaii	general weakness	Maceration of masticated kava diluted with water and boiled, orally	(Titcomb, 1948-126)
"	chills	maceration of kava	(Titcomb,1948-126)
"	chills and sleeping problems	maceration of masticated kava diluted in water and boiled, orally	(Handy *et al.*, 1934-20) (Handy, 1940-204) (Titcomb, 1948-125-6) (Hänsel,1964) (Henry,1948-57)
"	chills and general treatment of diseases	fumigation with the leaves	(Handy, 1940-204)
"	to prevent the risk of infection	drinking of masticated kava	(Handy *et al.*, 1934-20)
"	rheumatism	the rhizome	(Handy, 1940-204)
"	against a fat intake (considered excessive)	maceration of the rhizomes, orally	(Titcomb, 1948-126)
"	gastro-intestinal upsets in general	maceration of rhizome, orally	(Titcomb, 1948-126)
"	irritation of the respiratory tracts and asthma	preparation containing the kava rhizome	(Handy *et al.*, 1934-20) (Handy, 1940-204
"	pulmonary pains	drinking masticated kava	(Titcomb, 1948-126
"	tuberculosis	medication containing the juice extracted from the rhizome, orally	(Degener, 1945-284)
"	leprosy	medication containing masticated rhizome,external application	(Degener, 1945-152) (Hänsel *et al.*, 1966-1)
"	skin diseases	masticated rhizome in a poultice	(Hänsel *et al.*, 1966-1)

PLACE	SYMPTOM	MEDICATION	SOURCE *
Hawaii	certain skin diseases	kava cure to cause desquamations: at the end of the cure, new healthy skin is formed.	(Titcomb, 1948-126)
"	against suppuration	masticated rhizome as a poultice	(Titcomb, 1948-126)
"	to calm nervous children	kava drink prepared from the **nene** variety, orally	(Titcomb, 1948-126)

Other articles also contribute to the completion of this table. In Irian-Jaya (1) the internal skin of the kava plant is used for toothache. (Aufenanger *et al.*, 1940). In Papua New Guinea, three samples identified as probably being *Piper methysticum* have produced the following indications: the skin of the scraped and masticated roots is used to relieve sore throats; the juice from the leaves is used to treat cuts and is also drunk as a tonic (Holdsworth, 1977).

The use of kava as an anaesthetic and stimulant of lactation in Papua New Guinea has already been mentioned in the previous chapter (Steinmetz, 1960).

In Tahiti, according to Sterly (1970), the masticated root is considered a remedy for gonorrhoea (Maclet and Barrau, 1959-170; Steinmetz,1960-41).

In American Samoa, kava is also used against gonorrhoea (MacCuddin, 1974). Four small underground kava roots are ground together with twelve chilis, *Capsicum annuum*, twenty-four *Colubrina asiatica* leaves and the pith of the sweet orange tree, *Citrus sinensis*. The extracted juice is administered orally.

Kava is also used in the relief of a syndrome which affects both adults and children and causes ocular pains, some difficulty in opening the eyes and a feeling of having a swollen head. This is accompanied by a cold sweat, dizziness and numbing of the legs. Eight **ava** leaves (from the **aano a tamali'i** variety) are ground, placed in a piece of clean cloth and strained into a glass of water. The mixture is then imbibed by the sick person *(ibid.)*.

A third remedy is used against a urinary infection which is supposedly caused by the spirit of a dead person and whose symptoms are a distended bladder, a small emission of urine and painful micturition (2). The therapy involves scraping the internal skin of a kava stalk, extracting the juice and mixing it with the juice of a dried *Pandanus* sp. root, then adding water and giving to the patient to drink *(ibid.)*.

Finally, in the case of an injury caused by a fish spine, a dried kava root is burnt and a dry coconut shell placed over the embers, so as to allow the smoke to escape through the eye of the nut. The injury is then exposed to the escaping smoke. (The kava in this remedy clearly only plays a symbolic role).

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(1) Western New Guinea, presently part of Indonesia.

(2) The odds are that this is a simple gonoccocus, whose origin is generously attributed to the spirits of the dead.

Fiji: Father Rougier in 1907 noted the following medicinal uses :

A sickness characterized by a pain inside the head and both ears followed by 'blurred vision' which 'sometimes disappears at high tide, and in other cases at sunset' is treated with various remedies, one of which consists of *Ipomoea (= Merremia) peltata* and kava leaves.

Furthermore, 'the best sedative drug is a draught prepared by scraping and pounding the kava root'.

'In Fiji, there were various means of contraception, one of which was masticating and swallowing kava leaves'.

The names for kava are **yaqona** or **yaqayaqona** (1), the root being a sedative drug and the roots and leaves together a narcotic.

According to Degener (1949-183 ex Zepernick, 1972), the leaves softened in the fire are applied as a poultice against suppurations.

Hocart (1929) mentions a Fijian treatment for convalescence. The kava leaves are used for the preparation of a remedy to be taken orally. The recipe seems incomplete, both in the definition of its purpose (during, or for, convalescence? from which disease?) and in its composition.

It would appear difficult to swallow the coconut leaves in question (which are probably used only for wrapping).

In Fiji, **yanggona** is considered as a powerful diaphoretic (Parham, 1939-41, 137). It is also consumed by women as a fortifying drink, laxative and diuretic. In pregnancy, the absorption of small quantities of kava is said to facilitate delivery. During breast-feeding, the absorption of **yanggona** is thought to favour the production of milk. The absorption of many mouthfuls of kava can help clear up the first stage of diarrhoea (Thompson, 1908-347; Steinmetz, 1960-31) according to Sterly (1970).

Such a sudorific property of kava seems to be known only to Fiji. No conclusion can be drawn upon reading Seeman (1865-73), since this author has quoted a French translation of a document today forgotten, by Golding Bird. The translator, O'Rorke, may have added his own remarks on the sudorific and gout-arresting qualities of kava, amongst others. However, the Fijians at that time were reported as using kava against introduced diseases. Lastly, abusive consumption brought about a sudorific effect by 'over-stimulating the skin', 'even occasionally causing elephantiasis'. One is allowed a smile today about Seeman's somewhat doubtful sources of information concerning the properties of kava.

In *Vanuatu*: (2) On Motalava, the roots are used in a drink to cure constipation and on the same island it is also used against conjunctivitis. The eyes are washed with water mixed with juice squeezed from the leaves (Vienne, 1981-82).

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(1) Pronounced yangona or yangayangona.

(2) New Caledonia: The use of kava was wrongly noted in Rageau's (1957) provisional manuscript, a mistake which was reproduced in publication by the W.H.O. in 1980. Rageau's final version (1973) does not mention Piper methysticum. In fact, although often imported by ni-Vanuatu(*) residing in New Caledonia, kava does not grow well there. It is occasionally found as a curiosity obtained from cuttings from Port Vila.
(*) proper term to describe the citizens of Vanuatu.

In Melsisi, on Pentecost, the juice expressed from the leaves is instilled into the ears to treat earache (1). Annie Walter (2) noted a similar use of the leaves for the same reason in Vansemakul, another Apma-speaking village in the same area (3), and stated the symptom, painful running ear infection or otitis.

Other indications of medicine made from kava were noted by Annie Walter in this Apma region. To relieve upset stomachs without pain or breathlessness a plaster made from heated and pounded kava leaves is applied to the stomach. Against feverish coughing, a handful of bark is ground up in a little water and the patient drinks a small dose. To counter a sickness characterized by fever followed by asthenia, drink a half-glass of juice extracted from the leaves. To burst a boil, grind some kava leaves, leaving one aside, wrap them in a lap-lap leaf (4) and heat them over a fire. The warm leaves are pressed and the juice obtained is applied to the boil and covered with the ground leaves, which are held in place by the unground leaf. Against headaches, heated and still scalding leaves are placed on the head. A locally-known sickness bears the generic name of kava in the Apma region, **sini**; the symptom is swollen legs followed by fever. It is treated by washing with a maceration of four ground leaves in a bowl of water. In this case it is the **sinibo** variety which is used, as it is for a similar illness but without fever against which a poultice made from four leaves heated in the fire is applied on very swollen legs.

On Tongoa, the kava leaves are ground (5), cold water added and the juice extracted is applied by massage to the body, in case of general indisposition and lack of energy.

The soporific properties of kava have been known on Efate for years. Garanger (1972) relates that during the excavation of the funeral site of Roimata who reigned over the Shepherd islands and Efate in the 13th century, the position of the skeletons of the servants and main dignitaries revealed that they were probably buried alive in a peaceful attitude, whereas the position of the women, on the contrary, shows a sensation of horror. According to oral tradition, this is explained by the fact that the men who were interred alive were under the influence of kava, whereas their wives, who were not allowed this potion, were so buried without being under any narcotic effect.

On Erromango, according to some informants, a complex preparation containing kava was reputed to act against asthma and also tuberculosis, according to others. Against asthma, the ingredients for the remedy were the leaves of a Compositae (6), a Papilionaceae (7), two varieties of a Musaceae (8) (9) and kava, called **naghave** (10). The combination is pressed and the juice extracted and drunk. The sick person does not prepare his medicine himself and is restricted to a salt-free diet, 'no sea water', thoughout the course of treatment. Furthermore, this medication cannot be administered to pregnant or menstruating women.

---

(1) P.C. 4-3-1979.

(2) Personal communication.

(3) No. 31 of Tryon's linguistic classification (1976).

(4) Leaves used for wrapping culinary preparations called lap-lap, before putting them in the oven. The species which is most used is Heliconia indica, indica variety.

(5) Chanel Sam, No. 128 (herbarium in flower, Port Vila, Noumea and Paris).

(6) P.C. 1643: cf: Crassocephalum crepidioides, 'sarndoo'

(7) P.C. 2038: Abrus precatorius, 'tamsi'.

(8) P.C. 2172, 2173: Heliconia indica, var. indica, 'mevong'.

(9) Chanel Sam 265: H. indica var indica, different cultivar, 'mevong netukus'.

(10) - or 'nagave' according to Lynch J. 1983, Studies in the Languages of Erromango, Pacific Linguistics, Series, C. No. 79.
- The language spoken today is 'sie', classified No.161 by Tryon (1976).

In the medications indicated against tuberculosis, the leaves are replaced by the bark of the stalks and the two varieties of *Heliconia* by an Ebenaceae (1). The salt-free diet and other contra-indications were not noted in this remedy.

On the same island again, the juice extracted from the kava leaves and that of a Cyperaceae (2) is given to pregnant women who are approaching their delivery date 'when the baby has to turn round' and to be sure it presents itself favourably. If this remedy proved ineffective, another one would be used (Cabalion, 1983).

Once more on Erromango, there are tales of a 'kava sickness' or **naghave** attributed to an evil magic performed with various 'leaves' whose symptoms (blurred vision,dizziness) resemble an overdose of kava. This could simply be jaundice. In 1982, two people in the South West of the island still knew the method of casting this spell . More than ten local plants are used in preparing the various remedies for kava sickness (Cabalion, 1984) (3).

To conclude with an anecdote, the Japanese newspapers in early 1985 reported the virtues of Fijian yagona as a remedy against colds and coughing. While making an official visit to the Pacific, the Japanese Prime Minister, Mr. Nakasone, was badly affected by these symptoms and a bowl of kava is boasted to have cured him within twenty-four hours.

1.3.1.3 Summary of the ethno-botany of kava

As a present or offering to the gods, ancestors and spirits:

- as a sign of respect towards them,
- to obtain their favour,
- to appease their resentment or anger if due respect has not been shown them,
- through divination, to communicate with them and to accede to the supernatural world and to secrets hidden from the mere mortal.

As a gift to people:

- for the same reasons, especially the first one, if it is to a chief,
- to seal an agreement made between two partners or to make it publicly binding,
- as a sign of sociability,
- for pleasure and to enjoy the physiological effect of the drink in society,
- as a material or ritual payment,
- as a ritual sign of the sacred character of a place or occasion.

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(1) P.C. 1651: Maba buxifolia.

(2) P.C. 2228: Fimbristylis cymosa.

(3) There is another 'kava sickness' known in New Guinea, or 'kial sickness' as the plant is called. According to the Tammos, kial has a special effect on the backbone. Old people who walk with a hunch prematurely are said to have ringworm, or 'kial's sickness', (Hagen, 1899-246) according to Sterly (1970).
On Erromango, as in New Guinea, the symptoms mentioned seem to have no direct link with kava. See previous reference to Pentecost.

Almost complete ban:

- women and children are not allowed to drink kava (1).

Exchange commodity:

- today it is being used more and more in the cash economy.

Medicinal uses of kava:

General:

- general weakness: Hawaii; Papua New Guinea; Vanuatu: Tongoa, Pentecost; Fiji,
- dizziness: American Samoa,
- numb legs: American Samoa,
- swollen legs: Vanuatu: Pentecost,
- headaches: Hawaii; Fiji; Vanuatu: Pentecost; American Samoa,
- rheumatism: Hawaii,
- excess fat: Hawaii,
- powerful sudorific (doubtful information): Fiji,
- diuretic: Fiji (Papua New Guinea?, Haddon 1916-146 according to Sterly 1970),
- loss of appetite: Vanuatu,
- anaesthetic: Papua New Guinea (toothache and tattooing),
- sedative, narcotic for medicinal purposes: Fiji, Hawaii - Hawaii : children,
- fever, sweating: American Samoa; Vanuatu: Pentecost.

As an anti-infection agent:

- chills: Hawaii,
- against contagion: Hawaii,
- ENT: teeth : Irian Jaya,
- throat : Papua New Guinea; Vanuatu: Pentecost,
- ears : Fiji; Vanuatu: Pentecost,
- opthalmology : Fiji; Vanuatu : Pentecost.

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(1) On Tanna, young circumcised boys or youths may prepare kava for adults, but are not allowed to drink it until they have reached adulthood. A small ceremony takes place when a young man drinks his first kava (Bonnemaison, pers. comm.).

- urinary system : Polynesia: Tubuai; Hawaii; American Samoa; Vanuatu: Pentecost,
- respiratory system, asthma, tuberculosis, coughing: Hawaii; Vanuatu: Erromango, Pentecost,
- suppuration and skin infections: Hawaii; Vanuatu: Pentecost,
- cuts: Papua New Guinea
- fish stings: American Samoa (probably symbolic),
- leprosy: Hawaii, (1)
- skin diseases (some): see the contra-indications,
- gastro-intestinal upsets: Hawaii; Vanuatu: Pentecost, Motalava; Fiji.

Women's complaints:

- women's diseases: Hawaii,
- contraception: Fiji, Papua New Guinea (Dam-Bakker *et al.*, 1958),
- abortion: Hawaii,
- pregnancy: Fiji,
- delivery: Vanuatu: Erromango; Fiji,
- stimulant of lactation: Papua New Guinea, Fiji.

Contra-indications, side effects:

- pregnant or menstruating women: Vanuatu: Erromango,
- fear of barrenness: Papua New Guinea (Neverman, 1938) and Fiji (Rougier, 1907), and male impotency: Papua New Guinea. (Neverman, 1938),
- scaling off of the skin due to excess kava consumption. This contra-indication is sometimes used to obtain a new skin: Hawaii,
- temporary eye problems, due to excess kava (Thomson, 1908; Steinmetz, 1960) according to Sterly (1970).

Related diets:

- different food tabus including salt-free diet (Vanuatu: Erromango).

Preparation of remedies:

- By the practitioner and not the patient, personalisation of the healer's role.

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(1) This indication of kava against leprosy can be related to the side effects of chronic absorption of the plant and also a form of Fijian sorcery, which was used to cast a disease on an enemy (Spencer, 1941-43).

'Kava sickness': Vanuatu: Erromango:

- Jaundice?

In conclusion, an awareness of kava's traditional reputation and the properties of kava lactones makes it possible to explain most of the above-mentioned indications.

This does not apply to 'women's complaints' however. How could kava, according to what is known, play a role in hormonally-regulated physiological mechanisms ? The bactericidal or bacteriostatic activity of kavalactones helps understand kava's reputation as a remedy for urogenital infections, but does not leave room for a hormonal explanation. The plant's indications as a contraceptive, abortifacient or stimulant of lactation therefore remain to be verified and explained, perhaps by research to identify compounds other than lactones.

Furthermore, it should be noted that these reputations form a coherent group, whereas the use of kava as a poison for fish (Hillebrand, 1888) was noted only once, as pointed out by Stokes (1921).

The next chapter will consequently require expansion in the future, when more light is shed on the question of the possible hormonal activity of kava extract.

1.3.2 The active substances of kava

Chemical and pharmacological studies have produced a wealth of documentation and many publications. Such research has a dual aim: to identify the active principles responsible for the properties listed above and also to analyse the physiological activity of those ingredients.

1.3.2.1 Research on kava's active principles: history

Last century, great controversy surrounded attempts to find out who had been the first person to isolate and describe 'the' inebriating substance of kava and the origin of its activity. The authors have not had a chance to read Morson's article, 1844, quoted by Cuzent in 1860 (reprinted 1983), published when the 'kavahine affair' became news.

At the time Cuzent was in Tahiti as a Navy pharmacist. On April 10, 1857 he isolated an apparently pure crystalline substance which he named kavahine, 'to perpetuate the name of kava given to *Piper methysticum* by the Polynesians'. Meanwhile Gobley had obtained 'methysticin' (1) from a sample supplied by Cuzent through his Ministry to O'Rorke (Cuzent, 10th May 1857), another pharmacist who had just travelled round the world via Polynesia. The name of methysticin characterizes 'the inebriating substance in the drink' (2).

Various authors are of the opinion that the two compounds isolated by Cuzent and Gobley are one and the same and correspond to methysticin as it is today known.

Although this discussion is a little pointless, the authors believe that if Cuzent did in fact precede Gobley, his kavahine is more similar to dihydromethysticin (DHM) than to methysticin.

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(1) Composition of the kava root according to Gobley: 26 per cent cellulose, 1 per cent of a crystalline substance (methysticin), 49 per cent starch, 2 per cent resin combined with an essential oil, lemon yellow in colour, 15 per cent water (after being hot air dried), 7 per cent substances of lesser importance including 4 per cent ash containing 1 per cent potassium chloride and 3 per cent calcium carbonate. The active ingredients are contained in the resin and vary between 3 and 8 per cent depending on the age of the root, the variety and the method used to conduct the analysis.

(2) The authors' notes.

In fact, the percentage analysis given, 65.847 per cent carbon, 5.643 per cent hydrogen and 28.510 per cent oxygen (Cuzent, 1860, reprinted 1983) seems to correspond more closely to the composition of DHM (C: 65.21 per cent, H: 5.84 per cent, 0: 28.95 per cent calculated by the authors) than to that of methysticin (C: 65.69 per cent; H: 5.15 per cent, 0: 29.17 per cent, calculated by the authors). Furthermore, the melting point, from 120 to 130 deg. C, is nearer to that of DHM, 116-118 deg. C (Winzheimer, 1908), 117-118 deg. C (Borsche and Bodenstein, 1929, according to Duve, 1981) and 118 deg. C (Jössang and Molho, 1970), than to that of methysticin, 132-135 deg. C (Sauer and Hänsel, 1967), 136-137 deg. C (Rasmussen *et al.*, 1979) and 139-140 deg. C (Borsche and Peitzsch, 1929, according to Duve, 1981).

The differences observed between these figures would be easy to explain if Cuzent had actually obtained and analysed the syncrystals, but as fusion spread over a temperature range of 10 deg. C, the analysed substance must have been impure. According to the figures available, Cuzent's 'kavahine' was therefore probably a mixture, consisting essentially of dihydromethysticin and some methysticin. Additionally, according to Cuzent (1860, reprinted 1983), the substance isolated by Gobley contained 1.12 per cent nitrogen, in which case it would be different from 'kavahine', whereas Seeman (1868) quoted the same figure of 1.12 per cent as the nitrogen content in the 'chemical constituents' of kava, methysticin representing 1 per cent of the dry weight. Seeman probably quoted Gobley.

When Lewin published his monograph in 1886, he also claimed to have been the first, but was forgetting Morson, Cuzent, Gobley and O'Rorke, and later Nolting and Kopp, who had already isolated yangonin (1) in 1874. Lewin in turn found methysticin and yangonin and thought, as Gobley did, that the active part was the resin which he broke down into 'alpha resin and beta resin' using a 'personal process'.

The emergence of a knowledge of kava's chemistry was thus very laborious and controversial. Lewin did not find any new kava lactones in 1886, but his pharmacological work and the favourable publicity he gave *Piper methysticum* encouraged many teams, especially Germans, to take an interest in the question from both the chemical and the pharmacological viewpoints.

In 1908, Winzheimer isolated dihydromethysticin. However, the fundamental work had been carried out by Borsche's team, who between 1913 and 1933 described the isolation of a first series of compounds baptised kavalactones, yangonin, kavain (2), methysticin, dihydrokavain (2) and dihydromethysticin (2). This meticulous and methodical approach produced 14 dissertations. The chemical substances were isolated from the rhizome and their structure determined, but without the main active substance being identified. Borsche himself admitted in the conclusion of his last publication that 'these observations have not been very helpful in attempting to answer the original question because they did not lead to the discovery of a well-defined chemical substance which could be considered as the principle vector of kava's effect'.

The formulae were given as follows: methysticin: C15 H14 05; yangonin: C15 H14 03; and kavain: C14 H14 03, a resinous substance insoluble in water but soluble in gastric juices (Borsche *et al.*, 1914). These molecules are lactones i.e. organic compounds containing oxygen and all having very similar structures (3). Borsche attempted to confirm the structure of kavain by synthesis, but failed, and was compelled to admit that none of the isolated substances possessed a specific physiological activity. Neither did he realise the important role of dihydrokavain, which he had just isolated.

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(1) Thus named by Lewin following the Fijian name for kava, yaqona pronounced yangona.

(2) Kavalactones new at that time, although dihydromethysticin had been obtained by Cuzent in 1857 ; see previous paragraph.

(3) Figures 9 and 10.

In 1920, when much study and analysis remained to be done, kava appeared on the European market, where it was presented as being 'an efficaceous sedative and hypotensive agent' (Schübel 1924).

Not until 1938, when Van Veen applied the adsorption column technique, could an active substance easily be isolated in its crystalline form by combining the extraction method with chromatographic analysis. He named this crystallisable substance marindinin: C14 H16 03, from the name of the tribal territory of the Marind-anim people in Papua New Guinea, where the sample used originated. He carried out a number of tests on the soporific effects of marindinin (dihydrokavain) which is responsible for the drug's physiological activity on the nervous system and believed that it was the only substance in kava to have such an effect (Van Veen, 1939). Since then, the number of studies and results has considerably increased.

1.3.2.2 Molecular structure of isolated kava compounds

Alkaloids

A number of scientists thought they had found alkaloids amongst the substances extracted from the rhizome without succeeding in isolating them. The effect felt on consuming kava is so close to the one produced by an extract of coca leaves that the temptation to seek alkaloid structures is easily understandable. However, nitrogen was absent from the products obtained from the plant (1), whereas alkaloids contain nitrogen. Some authors have confirmed that the presence of these compounds has been demonstrated by reactions in thin-layer chromatography but, as Hänsel (1968) stated, the reagents used were not specific to alkaloids and the demonstration was therefore not valid. Hänsel stated that these authors did not know that lactones, nitrogen-free compounds, could nevertheless react like alkaloids and quoted the tests carried out by Farnsworth *et al.* (1962) as evidence.

Later, Achenbach and Karl (1970), using more sophisticated methods of analysis, succeeded in identifying the presence of two alkaloids. Finally, in 1979, Smith isolated and identified an alkaloid specific to *Piper methysticum* which he named Pipermethystin but, contrary to the others, this substance was found only in the plant's leaves.

Lactones

The skeleton of these lactonic molecules isolated from kava consists of 13 carbon atoms, 6 of which form a benzene ring attached by a double bond to a saturated lactone. A total of 15 compounds has been isolated, 9 of which have been fully identified (Hänsel, 1968). 7 of these compounds are of major importance: these are yangonin, methysticin, dihydromethysticin, dehydrokavain, kavain, dihydrokavain (2) and tetrahydroyangonin (3) and 8 others of minor importance (4) (Duve, 1981).

After Hänsel (1968), Jössang and Molho (1970) tried to explain the formation of kava lactones by two biosynthetic processes, one starting from cinnamic acid and ending up with styrylpyrones like dehydrokavain, and the other from the corresponding alcohol to arrive at the styryldihydropyrones like kavain. The absence of the latter in the leaves was explained by the immediate reduction of their double bond, 7,8 by ascorbic acid.

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(1) Gobley's 'methysticin', 1,12% according to that author (1860).

(2) Other synomym of DHK: lewinin, and of DHM: pseudomethysticin.

(3) Figures 9 and 10: structures 1 to 7.

(4) Figures 9 and 10: structures 8 to 15.

Yangonin and dehydrokavain are however found in the leaves, but only in traces. In fact, not much is known about the biochemistry of the various kava cultivars. The most that is known, thanks to Smith (1983), is that the biogenetic activity is essentially the same in the various parts of the vegetative system and that it leads to different compositions in the rhizome and roots.

Some authors have tried to classify these lactonic compounds, of very similar structure, by reference to common characteristics. The simplest method of grouping was that suggested by Hänsel (1968), which classifies the molecules according to the presence or absence of double bonds (5,6 and 7,8) and divides them into two major groups: the enols, with one double bond, and the dienols, with two double bonds.

The *flavokavins A, B and C* (1) have a different skeleton (Duve, 1976, Hänsel *et al.*, 1963, Dutta *et al.*, 1973 a and b, Dutta *et al.* 1976).

Other substances: an alcohol (Achenbach and Wittman, 1970), ketones (Jossang and Molho, 1967), a phytosterol (Jössang and Molho, 1970) and organic acids (Achenbach and Karl, 1971) were also extracted from kava and isolated.

1.3.2.3 Physiological activity of kava lactones

A complete and precise study on the physiological activity of kavalactones was undertaken by a team of research scientists from the Fribourg University Institute of Pharmacology (Germany) under the leadership of H.J. Meyer. The main properties of these compounds are the potentiation of barbituric narcosis (Klohs *et al.*, 1959; Meyer, 1962), the analgesic effect (Brüggemann and Meyer, 1963); local anaesthetic (Meyer, Burg, 1964; Kretzcshmar and Meyer, 1965); muscular - relaxant (Meyer, 1965); and antimycotic activity (Hänsel, Weiss and Schmidt, 1966).

Kretzschmar (1970), according to Sterly (1970), described the 'excellent psychopharmacological activity' of kavain: 'Emotional and muscular relaxation, stabilisation of the feelings and stimulation of the ability to think and act'.

1. Potentiation of barbituric narcosis

Hänsel (1968) quoting Meyer (1962) noted that amongst these active principles, dihydromethysticin (1) was the one which had the greatest potentiating effect on the action of barbiturates and gave as an example an experiment carried out by Meyer, who injected white mice with a dose of 150 mg/kg of hexobarbital sodium, causing the animals to sleep for an average of 2 hours. He then repeated the operation, having previously injected 240 mg/kg of DHM and observed that the same dose of hexobarbital sodium put the animals to sleep for 27 hours. Hansel nevertheless stated that the potentiating activity of the barbituric hypnosis, which was common to a number of known compounds, was in the case of DHM particularly pronounced. Furthermore, by an experiment carried out to determine the soporific properties of the root, he demonstrated that doses of 50 to 200 mg/kg of dihydrokavain (2) and dihydromethysticin, administered in the stomach, put a mouse to sleep in 20 minutes. He concluded that DHK, not soluble in water, was 95 per cent soluble in ground-nut oil at a temperature of 37 deg. C and in gastric juices. He finally came to the same conclusion as Van Veen (1939) that DHK was one of the most active elements of kava. Klohs *et al.* (1959) and Hansel (1968) confirmed these authors' findings and pointed out that the DHK and DHM were beyond

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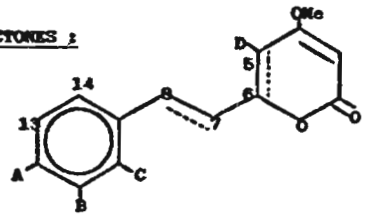
(1) Dihydromethysticin = DHM.

(2) Dihydrokavain = DHK.

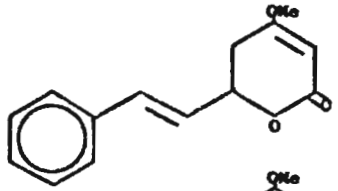
Fig. 9(a) : ELEMENTAL STRUCTURE OF KAVALACTONES :



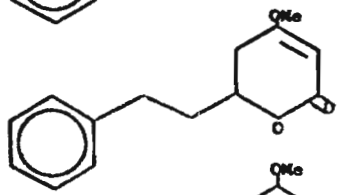
	A	B	C	D	C5–C6	C7–C8
1) Kavain :					–	=
2) 7,8-Dihydrokavain					–	–
3) 5,6-Dehydrokavain					=	=
4) Yangonin	OMe				=	=
5) 5,6,7,8-Tetrahydroyangonin	OMe				–	–
6) Methysticin	O-CH2-O				–	=
7) Dihydromethysticin	O-CH2-O				–	–
8) 5,6-Dehydromethysticin	O-CH2-O				=	=
9) 5,6-Dihydroyangonin	OMe				–	=
10) 7,8-Dihydroyangonin	OMe				=	–
11) 10-Methoxyyangonin	OMe		OMe		=	=
12) 11-Methoxyyangonin	OMe	OMe			=	=
13) 11-Hydroxyyangonin	OMe	HO			=	=
14) Hydroxykavain				OH	–	=
15) 11-Methoxy-12-hydroxy-dehydrokavain	OH	OMe			=	=

(according to HANSEL 1968, JOSSANG and MOLHO 1971, DUVE 1981)

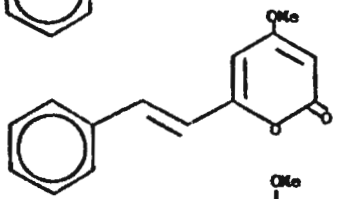
1) Kavain :



2) 7,8-Dihydrokavain



3) 5,6-Dehydrokavain



4) Yangonin

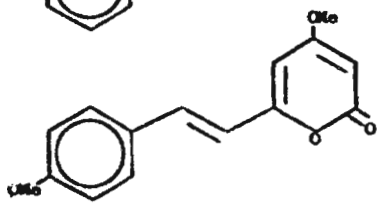
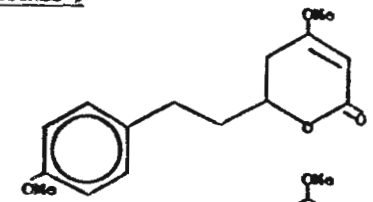
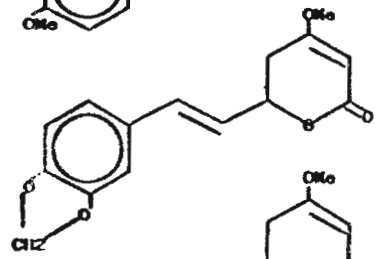


Fig. 9(b) : MOLECULAR STRUCTURE OF KAVALACTONES :

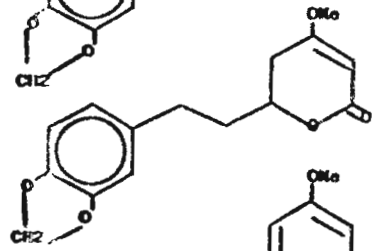
5) 5,6,7,8-Tetrahydroyangonin



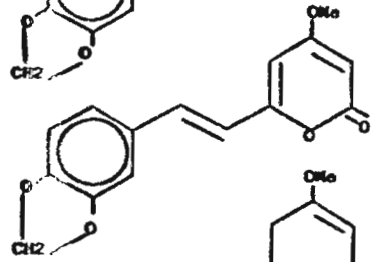
6) Methysticin



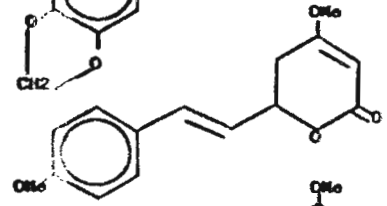
7) Dihydromethysticin



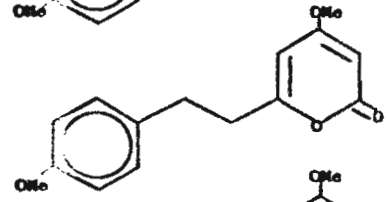
8) 5,6-Dehydromethysticin



9) 5,6-Dihydroyangonin



10) 7,8-Dihydroyangonin



11) 10-Methoxyyangonin

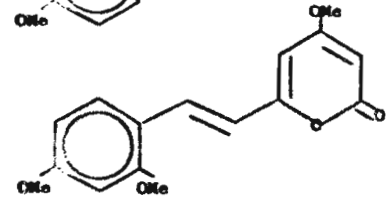
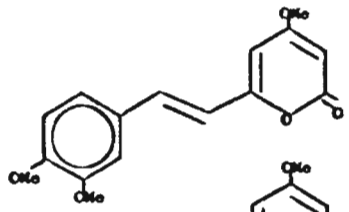
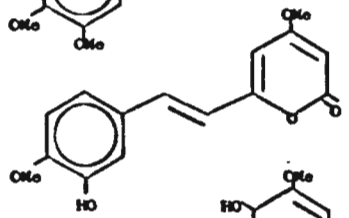


Fig. 10

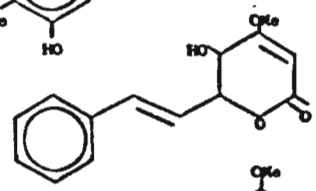
12) 11-Methoxyyangonin



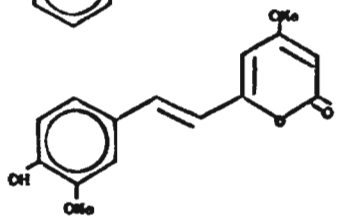
13) 11-Hydroxyyangonin



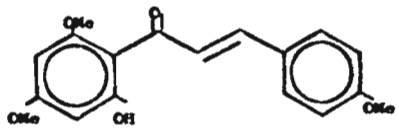
14) Hydroxykavain



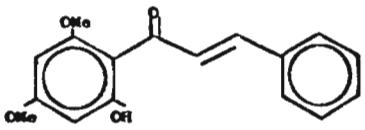
15) 11-Methoxy-12-hydroxy-dehydrokavain



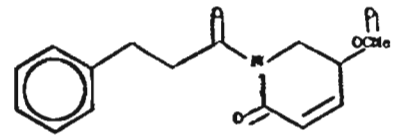
Flavokavin A



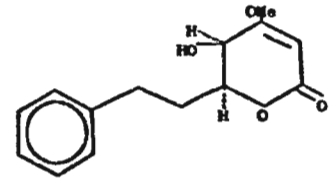
Flavokavin B



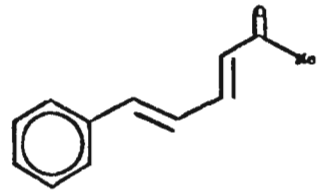
Piperwethystine (alkaloid)



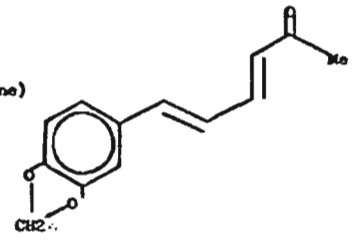
Dihydrokavain-5-ol (alcohol)



Cinnamalaketone (ketone)



Methylene dioxy-3,4-cinnamalaketone (ketone)



MOLECULE	CO-LOUR	RAW (FORMULAE)	CALCULATED P.M.	MELTING POINT °c	ORIGIN OF MEASURES OF P.°F
Kavain	W	C14 H14 03	230.263	106(7 ex 3), 106-108(8) 106.5-108(7 ex 4) 107(13 ex 3) 145-146(11)	(1) Borsche & Bodenstein 1929 (2) Borsche & Peitzsch 1929
7.8-Dihydrokavain	W	C14 H16 03	232.279	55-57(13 ex 3) 55.2-56.2(7 ex 4) 55.5-57(8) 56-58(7 ex 3) 57(10) 58(9) 71-73(11)	(3) Borsche & Peitzsch 1929 (4) Klohs et al. 1930
Methysticin	W	C15 H14 05	274.272	133-135(9) 136-137(7 ex 2) (11) 139-140 139-140.5(7 ex 4) (13 ex 2) 141-143(8)	(5) Hänsel,Bæhr & Elich 1961 (6) Mors et al. 1966
Yangonin	W	C15 H14 04	258.273	153-154(7 ex 1) 155-156.5(7 ex 4), 155-157(8) (13 ex 1) 156(9) 156-157(11)	(7) Keller & Klohs 1963 (8) Young et al. 1966
7.8-Dihydromethysticin	W	C15 H16 05	276.288	116-118(9) 117-118(7 ex 4)(13 ex 2) 117.5-119(8) 118(10)	(9) Sauer & Hänsel 1967 (10) Jössang & Molho 1970
Demethoxy-yangonin = 5.6-dehydrokavain	Y	C14 H12 03	229.247	138-139(13 ex 4) 138-140(7 ex 4)(8) 139-141(9)	(11) Rasmussen et al. 1979 (12) Hänsel pers comm. to Duve 1981
Tetrahydroyangonin		C15 H18 04	262.305	99-100(13 ex 12)	(13) Duve 1981
Cis-5 hydroxykavain		C14 H14 04	246.262	120-122(13 ex 12)	Colour of crystals
7.8 dihydromethysticin		C15 H16 04	260.289	102-106(11) 104-106(13 ex 12)	W: white) Keller & Klohs 1963
5.6 dihydroyangonin		C15 H16 04	260.289	122-124 (13 ex 12)	Y: yellow)
5.6-dehydromethysticin	Y	C15 H12 05	272.256	230-231(13 ex 12) 233-234(7 ex 6)	O: orange: Dutta & Som 1978
11-methoxy-yangonin	Y	C16 H16 05	288.299	155-157(13 ex 12) 160-161(7 ex 6) 162-164(9)	
11-hydroxy-yangonin		C15 H14 05	274.272	196-200(13 ex 12)	
11-methoxy-12-hydroxy		C15 H14 05	274.272	119-120(13 ex 12)	
10-methoxy-yangonin		C16 H16 05	288.283	191-192(13 ex 12)	
Flavokavin A	Y	C18 H18 05	314.337	110-115(4) 114-116(2 ex 1)	(1) Hänsel,Baehr & Elich 1961
B	Y	C17 H16 04	300.310	80-82(2 ex 1) 90-91(3)	(2) Keller & Klohs 1963
C	O	C17 H16 05	284.310	195-196(4)	(3) Sauer & Hänsel 1967 (4) Dutta et al. 1976-1976 & 81 (5) Duve (6) Smith 1983

any doubt the products with the most potential. Meyer and Kretschmar (1966) ascertained that potentiation by these two lactones also applied to the narcotic effect of nitrogen protoxide and to ether (1).

2. Analgesic effect

Brüggemann and Meyer (1963) performed a number of tests in order to determine the analgesic effect of the two most promising lactones: DHK and DHM. The results of these tests are summarized in the table below:

Analgesic substance	Dose (in mg/kg)
Morphine	002.5
Dimethylaminophenazone	100.0
Dihydrokavain	120.0
Dihydromethysticin	120.0
Acetylsalicylic acid (aspirin)	200.0

*quoted by Hänsel, 1968, according to Brüggeman and Meyer, 1963

3. Local anaesthetic

When fresh kava is prepared by mastication, it causes local anaesthesia of the chewer's mouth due to the DHK. Van Veen had already observed this phenomenon in 1938, but it is again to Meyer that we owe the detailed description. He stated that most kavalactones possesed this property, but that it was most marked in DHK and kavain. As for superficial anaesthesia due to DHK (Hänsel, 1968), the effect was equivalent to and lasted as long as that of cocaine during a test carried out on a rabbit's cornea. He observed that the kavalactones were particularly interesting because they were not in any way toxic for the tissues. However, according to Baldi's research (1980), the subcutaneous injection of an alcoholic kavain solution caused local anaesthesia for several hours and sometimes many days. If the injected dose was high enough, it caused paralysis of the peripheral nerves. Baldi concluded that this active substance could not be used as a local anaesthetic except perhaps in very small doses.

4. Anticonvulsive and muscular-relaxant action

Again according to the Fribourg team, DHM and DHK inhibit nervous and muscular contractions. Meyer and Kretzschmar (1966) remarked that these compounds had an effect which, in terms of quality and quantity, was comparable to the best synthetic products of the phenobarbital, pyrimidin and diphenyhydantoin types in current use (Hänsel, 1968; Jössang and Molho, 1970). Klohs *et al.*, (1959), noted that kavalactones inhibited the convulsions caused by strychnine and were more effective than mephenesin, the conventional antidote. It should be added that a clinical test revealed a degree of antiepileptic action in DHM which could also be used against schizophrenia (Klohs and Keller, 1962).

(1) A traditional form of potentiation is used on Pentecost to over-inebriate a pretentious kava-drinker. Some lichen P.C. 1161, Usnea (Port Vila, Paris) is mixed with the rhizome for grinding. The strong effect of this drink could be explained by a synergy between the kavalactones and certain lactonic acids contained in this Usnea, identified by Pr. D. Molho, of the National Museum of Natural History in Paris, whom we thank.

Jössang and Molho (1970) quoting Meyer and Kretzschmar (1966) recorded that, according to these authors, DHM and DHK were superior muscular relaxants to the substances normally used (propanediol, benzazoles, benzodiazepines). Hänsel (1968) pointed out that these two lactones had a similar effect to that of papaverine on the muscle.

5. Antimycotic activity

Hänsel (1968) took a particular interest in this activity. Used to observing aqueous solutions of vegetable extracts attacked by yeasts, bacteria or fungi, he had never observed this phenomenon with a kava extract. Any regular visitor to the nakamals will be able to observe the same occurrence with kava prepared a number of days in advance. Hänsel reported the results obtained in this respect to the Institute of Bacteriology of the University of Berlin (Hänsel, Weiss and Schmidt, 1966) and summed them up by saying that kava lactones could not be considered as bactericides but that they did on the other hand possess remarkable antimycotic properties. However, before that, Marpmann had already proven in 1905 that kavain possessed bactericidal properties, especially with regard to gonococcus, the specific pathogenic agent of blennorrhea, and colon bacillus. Hänsel added that the number of known bactericides was already high but that substances capable of stopping the growth of dermatophytic mycoses were rare. He quoted as an example the case of griseofulvine, a substance in common use for treating this kind of ailment, but which had no effect on strains of the *Aspergillus niger* type, whereas DHK was a perfect remedy. Hänsel went on to express the wish that clinical tests be carried out on strains pathogenic for man and believed that such substances could be used to prepare antimycotics to be taken orally. Duve (1976) suggested that the potential of these substances as preservatives ought to be studied and stressed that most of these agents were used in limited concentrations because of their toxic effects.

6. Metabolisation and present reseach

Rasmussen *et al.* (1979), seem to be the first to have studied the metabolisation of kavalactones especially dihydrokavain (1), methysticin, yangonin and 7,8- dihydroyangonin, on rats by oral intake and peritoneally. The metabolites were identified by gas chromatography (GC), by mass spectrography (MS) and by GC and MS combined.

Of 400 mg of DHK administered per kg orally, 50 per cent is found in the urine within 48 hrs, in the form of hydroxylated derivatives (2/3) and other derivatives resulting from the opening of the 5,6- dihydro-alpha-pyrone cycle, giving 9 metabolites altogether including hippuric acid. The same studies have revealed 10 metabolites in the case of kavain.

On the other hand, methysticin did not seem to undergo any modification of its pyrone cycle and only provided two metabolites, the hydroxilated derivatives, dihydrokavain in the meta and dihydroxydihydrokavain in the para positions of the benzene ring.

Yangonin and 7.8- dihydroyangonin each yield two O-demethylated derivatives in the para position. The authors found only a very small amount of DHK in the faeces, but kavain in large concentrations and also methysticin.

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(1) It is surprising that Rassmusen et al. found melting points so far from the norm for kavain and DHK (respectively 145-146 deg. instead of 106-107, and 71-73 deg. instead of 55-57), whereas such compounds would be verified by their spectral data (NMR and IR) and their elemental composition. There is still some doubt here, therefore.

According to these authors, unsaturated 7,8 kava lactones, like kavain, methysticin and yangonin, are less well absorbed and relatively less metabolised then the saturated compounds of the same position. Only the latter are attacked in their alpha-pyrone cycle.

It is to be hoped that more research will be conducted in this field and that the pharmacological activity of the metabolites will also be analysed, in association with study on the physiological receptors.

Progress in this field has been achieved by Singh (1983). According to this author, kava acts less by inhibition of neuromuscular transmission than by a direct effect on muscular contractility. The post-synaptic depression obtained is postulated to be similar to that caused by lignocain and other local anaesthetics. In his conclusion, he suggested that kava acted on the ionic mechanisms occurring with muscular contractions, at least in the frog.

Identification of the receptors is essential in understanding the pharmacology of kava. In the experiment, the administered extract was chosen so as to resemble the drink as much as possible. Nevertheless, it can be regretted that the active substances and their concentrations were not determined, because the 'kava' content is expressed in terms of mass of powder per unit of solution.

1.3.2.4 Use of kava and kavalactones in medicines and problems related to pharmacology, pharmacognosy and galenical pharmacy

To attempt to find an answer to this sort of question means taking into account the sometimes opposing and often contradictory requirements of the patient, the laws governing medicine, the pharmaceutical industry and scientific knowledge. A new medicine must be more efficient or cheaper than the one it is replacing, or offer a hitherto undiscovered therapeutic interest. Within such limits, any proposition to reduce production costs is welcome, but often comes up against scientific or technical problems, generating costs which are sometimes prohibitive. The history of the use of kava clearly illustrates the problem of using plants in pharmacopeia : which should be used, the powder or the extracts, the extracts or the synthetic products, the natural compounds or the most suitable by-products?

The remedies of traditional pharmacopeia are similar to magistral preparations, whose apparent trend is to disappear from chemists' shops. These medications were generally prepared upon request and were sometimes highly perishable. One of the requirements of the trade is to meet demand as soon as it appears and Cuzent seems to have been the first to prepare various durable galenical forms from the kava rhizome, at least out of curiosity, because he quoted the list of possibilities without stating the uses (1860): alcoholate, an alcoholic tincture containing 'kavahine', oenolate, alcohol extract, pills, oleoresin, essential oil, 'kavahine' and 'kavahine' syrup. Towards the end of the last century only the kava extract or 'methysticum' of the Germans was still known (Sterly, 1970). Today the issue is no longer the form but the content, through study of the various organs of the plant, analysis of all the active compounds and the search for cultivars rich in lactones. Hegnauer's assertion (1969-318) that the activities of the many varieties of *Piper methysticum* varied only insignificantly was the result of chemical and pharmacological work carried out on a drug of essentially Polynesian origin with a composition probably more uniform than that of Melanesian kava. The first research carried out on plants in Vanuatu confirmed the authors' view, in agreement with Young *et al.* (1966) and Duve (1981), that the composition of the mixture of lactones is highly dependent on the nature of the cultivar.

A number of scientists have already taken an interest in the composition of the stems (Duve and Prasad, 1981 ; Smith, 1983), the leaves (Jössang and Molho, 1970 ; Smith, 1983), the seasonal and anatomical distribution of the lactones in the plant and also the chimiotaxonomy of

two cultivars (Smith, 1983). According to that author, the differences in chemical composition observed between the vegetative system and the root system was such that it appeared worthwhile dividing the stalk into several segments, from the base to the apex, to study them separately. The chromatograms were, however, quite similar and the analyses, carried out at different times of the year, did not show any seasonal changes in the active substance content. On the other hand, the variations were considerable between the organs of the same plant because 'kavain and demethoxy-yangonin are the major constituents of the roots, whereas dihydrokavain and dihydromethysticin are predominant in the stalks and leaves'.

Jössang and Molho (1970) found Hänsel's method of extraction of DHM and DHK (4 and 3.3 g respectively from a kilo of roots) (1960) inefficient and evolved a method of isolating DHM through simple cold crystallisation of the solutions obtained from the extraction of the ground and dried leaves using hexane or petroleum ether. They also pointed out that the leaves represented a 'particularly convenient' source for obtaining active substances at low cost because harvesting the leaves did not destroy the plant, contrary to the processing of the rhizome. Jössang and Molho also believed that 'from a pharmacodynamic point of view, the leaves should be studied for their properties because of their high dihydrokavain and dihydromethysticin contents, these compounds being by far the most effective of the various constituents in terms of their mood-elevating and anticonvulsive activity'.

Other studies were carried out with a view to chemical synthesis and in the hope of solving the problems caused by supply, variations in the natural composition and the purity of the active substances.

Following Klohs' work (1962) the Riker laboratories, Northridge, California, the same year registered a patent protecting the synthesis of d,l-methysticin and d,l-dihydromethysticin. Steinmetz (1960) had previously taken an interest in this problem and said that kava, like most medicinal plants, contained more than a single active principle. These active substances, often very similar in structure, form in the extract a very complex mixture of elements with often very different activities. Furthermore, the methods of extraction, isolation and analysis can encourage the formation of artefacts or substances which are naturally absent from the plant. The composition of the extract can therefore vary according to the type of extraction process used. This could modify the activity of the extract as compared with that of the fresh plant. In the case of kava, if the drink or extract is prepared by means of infusion or decoction the enzymes could be destroyed, whereas if the extract is prepared by maceration in cold water, the enzymes may be preserved. However, although the synthesis of kavain and methysticin hold no more secrets, these substances do not in any way induce the same physiological effect as the natural extract. The latter's activity does not stem from a single substance, but rather from a mixture, a natural blending of several compounds bringing about a resulting activity. Certain constituents are of secondary importance, but most certainly play a role. In fact, each element is so dependent on the presence of the others that the extract used without the slightest alteration gives much better results than any single one of these substances isolated (Steinmetz, 1960). This author pointed out that kavain was synthesized for the first time in 1942, and dihydrokavain a little later.

When Hänsel concluded his studies on *Piper methysticum* - kava in 1968, he wondered why kava was so little used in modern pharmacopoeia despite its potential and had to admit that the answer was not clear, because although a fair number of synthetic products with the same properties already existed, the chemical method was not always as advantageous as extraction. Modern pharmacopoeia has not totally rejected the use of natural extracts of kava but has never been capable of realising their full potential, no doubt because the production of raw materials has always been inadequate. Barrau (1956) pointed out that the kava root appeared for a number

of years in the official English pharmacopoeia (1) and in the British pharmaceutical codex, from which it disappeared only in 1949. It also appeared in the American pharmacopoeia (U.S Dispensatory). It was mainly used to treat chronic irritations of the genito-urinary tract resulting from blennorrhoea. The effectiveness of this treatment was said to have been discovered last century by some European castaways, in Polynesia.

The Japanese until the last war used *Piper methysticum* plants cultivated on the island of Ponape to prepare a pharmaceutical product. It is believed that this plant was also mentioned in the Finnish and Venezuelan pharmacopoeia, but it has not been possible to establish exactly until what date ; before 1975 in Finland and 1942 in Venezuela in any event.

Bezanger-Beauquesne *et al.* quoted in 1975 five allopathic and one homeopathic medecines containing **kava-kava** and distributed on the French market. In fact the Vidal dictionary, a commercial pharmaceutical directory, only indicated three in 1972 and two in 1980, while kava has disappeared from the formula of one of the products. The medicines which remain are indicated for a decongestive action in the pelvic area associated with an antiseptic and sedative effect. In France, for example, **Kaviase** containing kava extract is used and in Switzerland, **Kavaform**, containing synthetic kavain, is on the market.

The advantages and disadvantages of synthesis on the extraction of active substances are arguable for kava as they are for other medicinal plants. The same goes for total extracts as opposed to pure products.

The orientation of future pharmacological studies to elucidate the activity of the various lactones on the physiological and chemical receptors, to extend the knowledge of known cultivars, will provide a clearer answer to this question. It is nevertheless amusing to reflect that all this work stems from some old sea-dogs being cured of the 'gleet' after a few stiff bowls of kava.

1.3.2.5 Quality control, constituents of kava

The adulteration of the powder on the Fijian market was revealed by Duve and Prasad (1981) and this type of problem could be aggravated with the present increase in the sales of kava in powdered form.

The question of quality control is, therefore, clearly topical. But to find proof of adulteration both authentic samples and corroborating results are required. The above-named authors give several answers for Fijian kava: adulteration creates an increase in fibre content, at the same time reducing the lactone level.

These observations will not enable Duve and Prasad to set a standard until the variations due to the influence of the climate, soil, cultivar and age are more accurately known.

The nature of the adulterants was not stated, but it would seem that the residue from the extraction, called **makas** in Vanuatu Bislama, is the most logical and most probable adulteration. This would very well explain all the variations in composition between the authentic raw materials and the powder found on the Fijian market: after the preparation of the drink, the residues are relatively rich in fibre, whereas the total lactone concentration diminishes and the

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(1) Under the name of 'Kavae rhizoma', kava is found in the British Pharmacopeia of 1914, but had disappeared from the 1932 edition. The second part of the 'U.S. Dispensatory' of 1950 prescribed the fluid extract in doses of 1 to 3cc. The names of the specialities were 'gonosan' and 'neurocardin'. (Raymond,1951-47, Keller and Klohs, 1963).

relative active substance compositions vary. This proves (1) that the adulteration involves products containing lactones and is not, for example, done with dregs from the extraction of sugarcane, abundant in Fiji in the harvesting period, but which does not contain these types of substances.

It therefore appears that the most likely tampering is to add some residue from the kava extraction or some less appreciated cultivars of low lactonic concentration to the genuine powder.

We were able to witness considerable variations in the lactonic concentration, from 4 to 18 per ent in terms of dry rhizome weight depending on the cultivar, in Vanuatu. Only some of these are consumed regularly. All the others can be used to meet an order for 'kava', without any misrepresentation about the name of the plant species. It must be the same in Fiji and probably elsewhere.

The need therefore arises to define what is genuine kava. The only kava buyers are the pharmaceutical industry, which is mainly interested in seeing whether the raw product contains sufficient total kavalactones and the drinker, who wants a drink that suits his requirements as regards the taste, the smell and the physiological effect.

In addition, the exported product can take different forms - roots, peelings or dried rhizomes - whereas drinking kava can consist in Vanuatu, depending on the region, of fresh or dried plant, rhizomes or roots, and of rhizomes or stalks in Fiji. The scope for adulteration is therefore wide especially if species different from *Piper methysticum* are used under this name.

In the present state of knowledge, it would be unrealistic to try and propose a perfect quality control method, while the name 'kava' covers so much disparity.

A comparison of kava and wine comes to mind. The same variations can be observed in both cases and it can be said, to take the similarity to its logical conclusion, that the pharmaceutical industry purchases kava for its strength - this is 'table kava' - whereas the drinker is interested in its taste and quality - this is the good or 'vintage' kava.

What remains to be drawn up, despite the reservations expressed so far, is a table of 'kava's' chemical data (2) so as to obtain a picture of the usually observed values, asking the reader to remember that these are only average figures and that individual variations and variations between cultivars can be highly marked, preventing these figures from being used for comparison purposes with a small sample (see the tables on pages 46-48).

The minor lactonic constituents are present in variable concentrations according to Duve's analysis of Fiji kava (1981), 1.06 per cent in the roots (average of 6 samples), 0.78 per cent in the rhizomes (average of 6 samples). These minor lactones are cis-5-hydroxykavain, 7,8-dihydroyangonin, 5,6-dihydroyangonin, 5,6-dehydromethysticin, 11-methoxy-yangonin, 11-hydroxy-yangonin, 11-methoxy-12-hydroxy-dehydrokavain and 10-methoxy-yangonin.

The leaves' chemical composition has been studied by Jössang and Molho (1970) and Smith (1983) on a sample from Fiji. The main elements found by the two former were dihydromethysticin and dihydrokavain, as mentioned above, but they also discovered traces of yangonin and dehydrokavain, beta-sitosterol and flavokavins A and B, kavain and methysticin being absent. Smith studied two cultivars, one 'white' and one 'black', whose leaves contained an alkaloid, piper methystin (absent from the roots), as their main isolated element, dihydrokavain

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(1) Statistically.

(2) Without regard to the cultivars.

and dihydromethysticin as their major lactones, tetrahydroyangonin, yangonin, demethoxy - yangonin and kavain, the last two of which compounds were present in small quantities in the 'black' variety and as traces in the 'white' variety.

The chemical composition of the 'stems' was also investigated by Smith (1983). They contain the seven compounds recorded for the leaves, with dihydrokavain and dihydromethysticin predominating, then yangonin, and then the others.

Lastly, flavokavin C was found by Dutta *et al.*, (1976) in the roots of Fiji kava (0.07g/kg).

Discussion

This brief review of what is known about the composition of kava reveals both the inadequacy of the chemical study so far carried out and the pointlessness of setting standards for such a variable product. Once the characteristics of kava's various forms are known, standards can be established on a sounder footing. One of the authors (1) will soon be in a position to attach values to the compositions and major lactone contents of each of Vanuatu's cultivars as a first step towards determining such standards.

Once this is done, the analyst will be able to define forms of adulteration and the consumer, whether drinker or pharmaceutical industry, will have a choice between the various cultivars and at the same time a guarantee that his choice can be made on a reliable basis.

1.4 PREVIOUS WORK ON THE AGRONOMY OF KAVA

Although kava's socio-cultural role, chemistry and pharmacology have been the subject of much attention, the agronomic considerations would appear to have been neglected. There can however be no doubt that progress in this area could give fresh impetus to the consumption of drinking kava and the export of the medicinal plant by securing regular supplies for the market and keeping the natural kava lactones competitive.

B.E.V. Parham (1935), Director of Agriculture in Fiji and a botanist, was probably the first person to come to grips with this plant's cultivation. Referring to Suva (Fiji), he stated that commercial kava production was mainly the affair of Indians working within family plantations. The situation has barely evolved today. In his day Parham had already observed what he described as 'wilt disease', whose symptoms are indeed such as the name suggests but in which the main pathogen is as yet unidentified.

Most authors describe kava as a traditional crop suited to existing production systems and highly flexible in cultivation. Kava is often quoted but rarely studied. Not until Fakalata (1981) was the first identification made of a stem-boring weevil dangerous for the crop in Tonga. Then came Ellis (1984) who, in an article devoted to the development of kava-growing in Vanuatu, made it clear that the regional significance of this plant, whose economic potential was beyond doubt, required agronomic research to be carried out. This the author has tried to do.

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(1) Lebot V., research in progress with J. Levesque.

CONSTITUENTS OF 'KAVA'

	% dry drug								
	Moisture in drug (%)	Carbody-drates	Syrup	Fibres	Chloroform extract	Ash	Protein	Animo acids	
Basal stems (31 spls)	14.60	74.11	-	10.66	07.07	5.83	2.33	-	Fiji (Duve & & Prasad 1981)
Roots (35 spls)	13.66	64.22	-	13.09	12.09	6.99	3.57	-	
Commercial power (1 spl)	-	-	3.2 (1)	-	- (3) (4)	5.78		1.70 (2)	Vanuatu

(1) Sugars % (IRCC analysis 1983 commercial power Vanuatu)

Saccharose	0.50
Maltose	0.10
Fructose	1.75
Glucose	0.85

(2) Amino Acids % (IRCC Analysis commercial power Vanuatu)

Aspartic Acid	0.28	Arginin	0.08
Threonin	0.08	Alanin	0.16
Serin	0.11	Valin	0.11
Glutamic Acid	0.26	Methionin	0.02
Prolin	-	Isoleucin	0.07
Glycin	0.11	Leucin	0.14
Phenylalanin	0.07	Tyrosine	0.06
Histidin	0.05		
Lysin	0.10		

(3) Kavalactones % (IRCC Analysis commercial power Vanuatu)

5.23% dihydro-5,6 kavalactones + dehydro-5-6 kavalactones

(4) Chloromethylene Extract from 4.33 to 17.17% according to cultivar (rhizomes, Vanuatu, Levesque, J., pers. comm., 1985)

(Sample from Kava Store, Box 654, Port Vila, Vanuatu.
Analysis by Laboratoires de l'Institut de Recherches sur le Café et le Cacao (IRCC))

MINERAL COMPOSITION OF 'KAVAS' (ASH)

	Major (%)			Minor (%)				Traces (ppm = ug/g)						
	K	CA	Mg	SiO2	Na	Al	Fe	Zn	Mn	Cu	Cl	S	B	
Basal stems (31 spls)	2.016	0.455	0.105	-	0.0362	0.0202	0.017	60.66	12.04	13.08	-	-	-	Fiji (Duve & Prasad 1981)
Roots (35 spls)	2.00	0.201	0.179	-	0.06	0.15	0.106	55.35	51.77	16.95	-	-	-	
Commercial powder (1 spl)	2.237	0.372	0.099	0.09	0.111	-	0.017	22.07	7.3	16.0	0.012	0.018	11.6	Vanuatu (IRCC analysis 1983)

LACTONIC COMPOSITION AND CONCENTRATION OF FIJI KAVA, SCALE OF VARIATION OF THE LACTONE CONCENTRATIONS OF VARIOUS KAVA CULTIVARS FROM VANUATU AND FROM HAWAII

	Kavain	Dihydro kavain	Methysti-cin	Yangonin	Dihydro methy-sticin	Demethoxy yangonin	Tetrahy-dro-yangonin	Total	Extract	Other constituents	
Basal stems (31 spls)	1.052	1.356	1.087	718	0.946	0.291	0.196	5.65 (79.91%)	7.07 (CH C13)	1.42 (20.09%)	Fiji (Duve & Prasad 1981)
Roots (31 spls)	2.21	1.78	2.386	1.75	1.2	0.71	0.3	10.34 (85.53%)	12.09 (CH C13)	1.35 (14.47%)	Fiji (Duve & Prasad 1981)
Roots (6 spl)	1.9	2.37	2.12	1.73	1.12	0.81	0.39	10.44	12.21 (CH C13)	71	Fiji (Duve 1981)
Rhizome (1 spls)	1.26	1.08	1.16	0.84	0.67	0.30	0.127	-	6.28	67	Fiji (Duve & Prasad 1981)
Rhizomes (7 spls)	1.17	1.2	1.0	0.7	0.69	0.32	0.2	5.28	6.61	55	Fiji (Duve 1981)
Rhizomes (40 spls) Scale of variations between concentrations in the CH2 C12 extracts	1 to 17	1 to 3	1 to 4	1 to 5	1 to 8	1 to 3	-	-	4.330 to 17.170 (CH2 C12)	-	Vanuatu (Levesque 1985, pers. comm.)
Rhizomes (6 spls) Scale of variations between concentrations in the ether	1 to 3.3	1 to 2.3	1 to 1.7	1 to 1.8	1 to 1.7	1 to 2.4	-	-	-	-	Hawaii (according to Young et al., 1966)

PART TWO
THE KAVA CULTIVARS OF VANUATU

The variations observed amongst Vanuatu's kava populations do not, according to the botanists, warrant their classification as distinct species or even distinct varieties, but differences do exist at the intraspecific level. These differences are of ethnobotanical interest in terms of their significance for the societies that are aware of them and in terms of the use to which such variations are put. In Vanuatu, the variability of the species has to be studied on the basis of the different plant forms of which it is composed, i.e. the cultivars . Of all the Pacific countries where kava is cultivated, Vanuatu has certainly preserved the richest tradition; its ceremonies, methods of cultivation and cultivar classification systems are as highly varied as the archipelago itself. Each island has evolved its own and identifies with them.

During investigation in the field, the ethnological component plays a vital role ; the methodology to be applied therefore has to be carefully chosen, in particular when seeking descriptions during discussions with chiefs or other custodians of traditional knowledge. The information gathered derives from oral tradition and needs to be given greater precision using more objective data. An inventory of local cultivars is not always easy to make in the field, as the researcher is dealing with a very localised and varied vernacular nomenclature. One of the aims of the authors' enquiries is to define accurately the nature and scope of this diversity.

2.1 TRADITIONAL CLASSIFICATIONS

Like all traditional crops, including yam and taro, kava possesses great cultural significance. Kava cultivars are classified according to principles and criteria which vary from island to island.

This plant does not receive such elaborate care as yams and taro, but each cultivar is grown using a cultivation technique based on its position in the local ranking order. Cultivars are classified by order of importance in the exchange system, in other words according to their social and ritual uses.

This classification covers all the different kinds of kava to be observed in the field, which have been compared with each other by the authors in their research. These local plant forms are clones. A single clone, which corresponds to a single genotype, may occur as different phenotypes according to the circumstances. The classification of clones amounts to a study of the uniformity of a population produced by vegetative propagation (from cuttings) from a single selected individual of which genetically identical specimens are reproduced. The purpose of traditional classification is therefore to observe interclonal variability, but also, where it occurs, intraclonal variability. Through its minutely detailed observations, such a classification reveals the existence of a highly sophisticated science of kava, used only by elders, but which young ni-Vanuatu continue to learn today through observation of the characteristics of each cultivated form.

These local plant forms correspond to ecotypes rather than genuine botanical varieties (genotypes). The term variety, which refers to a subdivision lower than a species, would therefore not be appropriate. These are mostly cultivars occurring by chance or obtained by natural selection but which theoretically originate in a cross between genetically different parents belonging either to the same species or to different species or genera. Although no counting of chromosomes has been carried out, it is highly likely that the basic chromosome numbers of these cultivars vary greatly.

These cultivars, or convars (1), have remained in the same place for a long time, are known by a precise name in the vernacular language and are very likely to be the result of local selection carried out by the farmers themselves. Some cultivars are used only in ceremonies and restricted to use by chiefs, as presents or as an exchange commodity on the occasion of marriages, burials or grade-taking. The classification distinguishes between cultivars for custom use or daily consumption. (The same principle applies to traditional yams, bananas, and taro, Bonnemaison, 1985).

It is by comparing the apparent characteristics that a cultivar may be identified in the field. The features used in custom to identify a kava, however, are only useful for classification purposes in relation to other cultivars. There can be no confusion between cultivars because the amount of data used by farmers for identification is sufficient for accurate differentiation. This occurs at various times. When cuttings are planted, the method of cultivation chosen depends on the origin of the plant material. Subsequently, in the garden, the plant's morphology and the way it develops in growth confirm the botanical determination. In the nakamal itself, the organoleptic characteristics of smell and taste as well as the effect felt by the drinker are used to confirm field observations. Certain techniques and cultivars are restricted to certain islands or areas and when found outside their place of origin, frequently as a result of a custom offering, the local population continues to consider them as 'foreign'. Few species in Vanuatu have such a degree of geographical mobility, however, because cuttings are freely exchanged during traditional ceremonies. The various forms of kava possess a set of morphological features which are significant for one island's or one region's farmers (2) and valid for the identification of local cultivars but do not lend themselves to the task of identifying these same forms in other islands. These features relate principally to the aerial part of the plant and vary greatly according to the ecosystem. Although traditionally used, the efficiency of these local methods of differentiation between cultivars is reduced when applied outside the original environment. The descriptions obtained during ethno-botanical inquiries are in fact only significant for the area of cultivation concerned. Similarly, the same cultivar may be classified differently in the ranking order (3) of two different islands. Classifications and descriptions of such forms are therefore only valid for very localised areas.

2.2 VERNACULAR NOMENCLATURES

The first part of this section reviews known variety names from Papua New Guinea, Fiji, Samoa, Wallis, Hawaii and Tahiti, while the second looks at the case of Vanuatu, the islands of Pentecost and Tanna in particular. (The vernacular generic names were covered in 1.1.4 ; what is dealt with here is names of varieties).

2.2.1 Names used in the Pacific elsewhere than Vanuatu

Papua New Guinea

Sterly (1970) recorded the following vernacular variety names:

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(1) A convar is a group of related cultivars.

(2) Each locally distinguished cultivar usually carries a local vernacular name consisting of two words. This binomial appellation therefore amounts to a 'traditional taxon' - see 2.2.2.

(3) Some cultivars are used only for ceremonies, medicine or magic, or for the preparation of the beverage, or sometimes more than one such purpose.

Amongst the Marind-anim: **Sipur**
Mahum
Parima
Kambiru
Amnangib urave
Sav urave

In Upper Bian: **Wara**

In Upper Bulaka: **Babina**
(Nevermann, 1938-184)

At Bamol, on Frederick Henry island, 5 different varieties of **tigwa** are referred to:

Kuraka: black stems, plants widely spaced out amongst crops
Dikoie: black stems, plants grown close together
Namuru: long green stems
Kawadarre: very long stems, variety borrowed from the Marind-anim.
(Serpenti, 1965-49)

In the Binandele language area, according to Chinnery (1922), the best **pingi** variety was **pingi beaimana**.

Fiji:

Steinmetz (1960) reported the presence of fifteen or so different 'varieties', recognisable from the height of the plant, the length and thickness of nodes and internodes and the colouring of stems and leaves, being of varying shades of green or purple. The five most cultivated 'varieties' were:

Kasa leka: 'pale' kava. The stems are 3 to 5 cm approx. in diameter, the branches leave fairly wide scars (approx. 2.5 cm), the internodes are short (5 to 7 cm) and the stem is green, with lentil-sized spotting.

Kasa balavu: 'pale' kava. The stem is fine. The nodes are approx. 3 cm in diameter and the internodes 2 cm. The scars left by the branches are small and the internodes are 10 to 25 cm in length, light green in colour with some darker vertical streaks. A rarish cultivar.

Qolobi: 'pale' kava. Very fine-stemmed variety. The nodes are approx. 2 cm in diameter and the internodes 1 cm. The latter are 8 to 10 cm long and of a green hue. The ratio of node diameter to internode diameter is very high: 2/1.

Kasa leka: has the same morphology as its namesake, but this is a 'dark' cultivar and the ratio of node to internode diameter is 3/2. The internodes are 7 to 12 cm long and show random speckling.

Kasa balavu: shares the form and structure of its namesake, but this is a 'dark' cultivar. It has a fine stem and the internodes, 20 to 28 cm long, are approx. 5 cm in diameter. The branch scars measure 1 to 2 cm and the node internode ratio is 3/2. It is bright purple in colour.

The growers maintain that the 'pale varieties' produce the best kava, but many of these are less early-maturing and disease-resistant than the 'dark' varieties.

Heinlein *et al.* (1984) tried to obtain healthy cuttings from the following Fijian varieties, without describing the way they grew:

Cokobana loa
Cokobana vula
Cokobana
Qila
Yaqona loa

According to A.C. Smith (1981), two publications by Parham (1964, 1972) list many Fijian cultivar names, but these have proved unobtainable.

Samoa

Parham (1972) quoting Christophersen (1938) stated that the latter had listed 7 different 'varieties' in Samoa whose vernacular names were as follows:

Ava fiti: meaning a kava from Fiji.
Ava la'au or ava se: very long internode, a highly esteemed kava.
Ava le'a: very short internode, thick roots, a highly esteemed kava.
Ava mumu: short internodes, purple in colour. A sub-variety of **ava le'a**.
Ava talo: long internode. The roots form a tuber, hence the analogy with Talo (*Colocasia esculenta*).
Ava pua le'a.
Ava toga: meaning a kava from Tonga.

Also:

Ava a'ano a Tamali'i (variety ?) (MacCuddin, 1974).

Wallis

Gaillot (1962) observed only 3 varieties, with the following vernacular names:

Kava leka: very thick stems.
Kava kou: longish, dark internodes.
Kava tea: 'very pale variety'.

Hawaii

In 1933 seven different 'varieties' were still known, with the following vernacular names:

Awa apu: very short, green internode.
Awa makea: long internode, light green in colour.
Awa papa: short internode, speckled.
Awa hiwa: long internode, purple, dark.
Awa moi: a form of **hiwa** but lighter.
Awo mokohena: a kind of **papa**.
Awa puna: the strongest and most sought-after kava. According to *The Honolulu Star Bulletin*, 3 November 1933, 'Awa plant once in demand here'.
Kupalii: small leaves (Degener, 1940).
Nene: (Titcomb, 1948).

Tahiti:

In 1860, French navy pharmacist G. Cuzent listed 14 varieties of **ava**:

Hahateaa: ligneous stems, dark green, not very popular.
Avina-ute: ligneous stems, purplish-red, highly appreciated, 'aphrodisiac'.
Avina-tea: thin stems, pale green leaves.
Toaparu, Tooparu, Paru: greenish-grey stems, difficult to chew.
Toa: greenish-yellow thin stems. Hard roots.
Orava, marava: reddish stems and dark leaves.
Aue: dark stems, thick roots.
Fauri: light green stems with dark green flecks.
Taramaete: a tall variety dedicated to the gods.
Marea: root is lemon-yellow on the inside.
Morotoi: dark, blackish stems.
Maopi: the edges of the lamina are wrinkled.
Poihaa: short-stemmed variety.
Ataura: reddish stems.

2.2.2 List of vernacular names of cultivars in Vanuatu

Vanuatu has one of the highest ratios of languages to population number of any country in the world (1). D.T. Tryon recorded 179 vernacular languages and dialects for a population estimated today to have reached 120,000.

Kava and its local cultivars possess a name in most of these tongues (of which some have died out, but 111 are still spoken, according to T. Crowley, linguist at the University of the South Pacific, Port Vila campus) (2) Cultivar names, in accordance with Vanuatu's traditional classification system (P.Cabalion, 1983), consist of a 'big name', the equivalent of the generic name, followed by a 'small name', or the name of the particular cultivar, together forming a double name, as in the Linnean system. Generally, when speaking of a well-known plant or one to which reference has been made in the conversation, and if this 'small name' is a long one, the 'big name' is not repeated, whereas both names will be used if the 'small name' is short. This rule is to be found in other Pacific countries and is not specific to kava or to Vanuatu.

Pronounced affinities exist between different languages on the same island and also between different islands as a result of cultural interaction (Tryon, 1976; Bonnemaison, 1979; Cabalion, 1983b). Such generic or cultivar names therefore help trace the routes travelled by genetic material from island to island and detect connections between different names for the same cultivar.

The vernacular name marks the cultivar's main feature, a legend or, quite simply, the name of the first person to select that clone. The often brief description given by the grower and the meanings of the vernacular names are a guide in forming theories about relationships between names, but their validity can only be confirmed by the use of objective botanical descriptors.

This first inventory of local cultivars is the culmination of a field ethno-botanical survey. It is the forerunner of the description and classification work which will make it possible to establish equivalents between different vernacular names for the same cultivar and amounts to a listing of the vernacular names given to the various kava cultivars present in Vanuatu.

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(1) Tryon, D.T., 1976, New Hebrides Languages. An internal classification. Pacific linguistics no. 50, 545 p. ANU Canberra - Australia. According to this author, Vanuatu had 105 different languages plus 74 dialects, or one language for 1,143 speakers.

(2) Crowley T., 1984, Pacific Islands Monthly.

The following system is used to list these names:

1. Name of island of origin
2. Name of village
3. Name(s) of the vernacular language(s) (language no. as per Tryon, 1976, quoted above)
4. Generic name
- Code no. of cultivar as recorded at Tagabe Agriculture Station, followed by the vernacular name and the description provided by the grower (in some cases the grower cannot describe the cultivar and merely states that it is different).

1. *HIU (Torres group)*

2. Gavinamana

3. **Hiw** (1)

4. **NIGUI**

- TOR/1: **HIN**. Means 'dry', highly lignified (other cultivars exist but are not listed).

1. *UREPARAPARA (Banks group)*

2. Lear

3. **Lehalurup** (4)

4. **NGA**

- URE/1: **NGAKO** - thick stems

- URE/2: **HINYANYIE** - very fine stems

- URE/3: **NOL** - occurring spontaneously in forest, also cultivated: highly esteemed

- URE/4: **NGASIEN** - speckled internode

- URE/5: **NGAWO** - *tudei* type cultivar (1) - very strong

- URE/6: **NGAME** - means 'red' or 'purple'

- URE/7: **TARIVARUS** - *tudei* type cultivar-very strong

1. *MOTALAVA* (Banks group)

2. Var

3. **Motlav** (5)

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(1) Tudei in Bislama, a Pidgin English, is the name given to cultivars with a physiological effect lasting two days.

4. **NAGA**

- MOT/1: **LAB** - thick stems
- MOT/2: **NIPUNSTABAN** - yellow juice, very strong
- MOT/3: **NALIAYANGYIU** - very finely-stemmed variety
- MOT/4: **NGAMIWOK** - (Bislama) the drinker feels in fine fettle the next day, a well-liked variety
- MOT/5: **NAGAME** - meaning 'red' or 'purple'
- MOT/6: **NAMTEMLAO** - internodes with pale speckling, long stems, very strong
- MOT/7: **TARIVARUS** - *tudei* - very strong

1. VANUALAVA (Banks group)

2. Vatratas

3. **Vatrata** (7)

4. **GIE**

- V4/1: **RANRANRE**
- VL/2: **GELAVA**
- VL/3: **WISABANA**
- VL/4: **GEMINE** - means 'red'
- VL/5: **TARVARUS** - very strong
- VL/6: **GIEMONELAGAGKRIS** - very tall, yellow roots
- VL/7: **BAMBOO**
- VL/8: **MAMBALAO**

1. MERELAVA (Banks group)

2. Lekwell

3. **Merlav** (18)

4. **MALOP**

- MER/1: **HIJ** - from Maewo (there is another cultivar, but it is not listed)

1. *MAEWO*

2. Kereibei

3. **Marino, Peterara, Naviso, Tam, Nasawa, Narovaro** and **Baetora** (19, 20, 21, 22, 23, 24, 25) (1)

4. **MALOKU**

- MAE/1: **TARIPARAUS** - speckled internodes, large leaves, very strong
- MAE/2: **DAUMANGAS** - large leaves, bright yellow juice, very strong
- MAE/3: **HAWERARA** - planted along the edges of irrigated taro fields, the best-liked variety
- MAE/4: **BOROGORU** - purple stems, green leaves, fairly tall
- MAE/5: **BUMALOTU** - bright yellow leaves, a popular variety
- MAE/6: **BUARA** - very tall, not drunk because dangerous, grows spontaneously in forest
- MAE/7: **TONGOLAVA** - spontaneous occurrence in forest, not drunk, not cultivated
- MAE/8: **MALOKAI**
- MAE/9: **RESRES**
- MAE/10: **RAIMELMELO**
- MAE/11: **RAIRAIREREGI**
- MAE/12: **GUMAITO**
- MAE/13: **TUMPUINAKAPMATO**
- MAE/14: **BAMBU**
- MAE/15: **TARIHANI**
- MAE/16: **TUFAGI**

1. *PENTECOST (North)*

2. Loltong

3. **Raga** (30)

4. **MALOKU**

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(1) The vernacular names are common to the whole northern part of the island. The south also uses Raga, the language of northern Pentecost.

- PEN/1: **BOROGU** - cultivar identical to PEN/15 and PEN/31
- PEN/2: **BOROGU MAITA** - (PEN/16 and PEN/32)
- PEN/3: **BOROGU MEMEA** - (PEN/17 and PEN/33)
- PEN/4: **SESE** - (PEN/18)
- PEN/5: **FABULAKALAKA** - (PEN/19 and PEN/34)
- PEN/6: **FABUKHAI** - (PEN/20)
- PEN/7: **BUKELITA** - (PEN/21)
- PEN/8: **BOGONGO** - (PEN/22)
- PEN/9: **RARA** - (PEN/23)
- PEN/10: **RONG RONG VULA** - (PEN/24)
- PEN/11: **TARIVARUS** - (PEN/36)
- PEN/12: **SESE JARAKARA**
- PEN/13: **JABUALEVA**
- PEN/14: **BARAETO**

1. *PENTECOST (Central)*
2. Melsisi
3. **Apma** (31)
4. **SINI**

- PEN/15: **BOROGU** - (PEN/1 and PEN/31)
- PEN/16: **BOROGU TEMITI** - (PEN/2 and PEN/32)
- PEN/17: **BOROGU TEMEME** - (PEN/3 and PEN/33)
- PEN/18: **MELMEL** - (PEN/4)
- PEN/19: **LALAHK** - (PEN/5 and PEN/34)
- PEN/20: **ABOGAE** - (PEN/6)
- PEN/21: **BUKULIT** - (PEN/7)
- PEN/22: **BOGONG** - (PEN/8)
- PEN/23: **RARA** - (PEN/9)

- PEN/24: **RONG RONG WUL** - (PEN/10)
- PEN/25: **TAKE** - (PEN/35)
- PEN/26: **BO**
- PEN/27: **MALMALBO**
- PEN/28: **TABAL**
- PEN/29: **MAGA**
- PEN/30: **RENKARU**

1. *PENTECOST (South)*
2. Ranwas
3. **Sa** (33)
4. **MELE**

- PEN/31: **GOROGORO** - (PEN/1 and PEN/15)
- PEN/32: **GOROGORO ENTEPAL** - (PEN/2 and PEN/16)
- PEN/33: **GOROGORO ENTEMET** - (PEN/3 and PEN/17)
- PEN/34: **LAKLAK** - (PEN/5 and PEN/19)
- PEN/35: **TAKERE** - (PEN/25)
- PEN/36: **TARIVARUSI** - (PEN/11)
- PEN/37: **KERAKRA**
- PEN/38: **TAMAEVO**
- PEN/39: **KAVIK**
- PEN/40: **LIAP**

(The Pentecost cultivars are more thoroughly appraised in 2.2.3.1).

1. *AMBAE (West)* (1)
2. Nduindui
3. **Ngwatua** (28)

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(1) Also called Aoba.

4. **AMALOKU**

- AMB/1: **MELOMELO** - used as a welcome offering, dark stems, drinker feels little effect, very well-liked
- AMB/2: **MAVUTE** - means 'white', cultivar very pale in colour
- AMB/3: **TARI** - a *tudei* cultivar, very strong
- AMB/4: **BOROGORU** - boiled extract used to treat a variety of complaints (rheumatism, fever, diarrhoea)
- AMB/5: **MEMEA** - used as a defence against **Nakaimas** (evil spirits) and acts of witchcraft.
- AMB/6: **MINDO**
- AMB/7: **ROGOROGOPULA** - used as an ornamental plant
- AMB/8: **TOLU**
- AMB/9: **TARIPORO**

1. AMBAE (East)

2. Lolosori

3. **Lolomatui** (27)

4. **MALOKU**

- AMB/10: **VAMBU**
- AMB/11: **GANONO**
- AMB/12: **GARAETO**
- AMB/13: **GAWOBOE**
- AMB/14: **BISUIBOE**
- AMB/15: **MAKARU**
- AMB/16: **TARIVORAVORA**
- AMB/17: **TARITAMAEVO**
- AMB/18: **BOROGORU** - (AMB/4)
- AMB/19: **QORO**
- AMB/20: **RANRIKI**
- AMB/21: **MELOMELO** - (AMB/1)

- AMB/22: **SULUSULU**
- AMB/23: **VALEIBOE**
- AMB/24: **MEMEA** - (AMB/5)
- AMB/25: **TARIMAVUTE** - (AMB/2)
- AMB/26: **MOLOGUGEI**
- AMB/27: **MOLOGO MAVUTE**

1. *SANTO (Central)*
2. Fanafo
3. **Tur, Nambel, Polonombauk, Sakao** (62, 62, 60, 65) (1)
4. **BIR**

- SAN/1: **VISUL** - bright yellow leaves and juice, very strong
- SAN/2: **FOCK** - meaning 'white', this cultivar is light green in colour
- SAN/3: **YEVOET** (a) - finely-stemmed, light green in colour
- SAN/4: **YEVOET** (b) - very fine stems, this cultivar is purple
- SAN/5: **MEREI** - women must never go near this cultivar, which does not grow in a very erect manner
- SAN/6: **KAR** - meaning 'red'
- SAN/7: **MARINO** - name of the place where this cultivar is found
- SAN/8: **THYEI**
- SAN/9: **MALOGRO** - from Ambae
- SAN/10: **TUDEI** - Bislama name used in the vernacular language, very strong

1. *SANTO (South-West)*
2. Ipayato
3. **Tasiriki** (55)
4. **MALOU**

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(1) Fanafo is a composite village whose inhabitants are of varying origins - this information should therefore be treated with caution.

- SAN/11: **AHEYOKE**
- SAN/12: **PALAVOKE**
- SAN/13: **URUKARA**
- SAN/14: **PALARASUL**

1. SANTO (West)

2. Kereboa (and Noukouvoula)

3. **Kereboa** (41)

4. **MALOHU**

- SAN/15: **URUKARA**
- SAN/16: **WOKO**
- SAN/17: **PALISI**
- SAN/18: **PIRMEREI**

1. MALO

2. Avunatari

3. **Malo** (72, 73)

4. **HAE**

- MAO/1: **TAPOKA** - small variety, small leaves
- MAO/2: **ROGE** - means 'red', purple leaves, *tudei* kind, very strong
- MAO/3: **VASO** - means 'white', light green cultivar

1. MALAKULA (North-East)

2. Wala, Rano, Atchin

3. **Wala** (98), **Rano** (99), **Atchin** (101)

4. **NEM LEU**

1. MALAKULA (North-West)

2. Leviamp

3. **Leviamp** (108)

4. **MALK** and **MALOCH** or **MALOKH**

- MLK/1: **POUA** - tall dark-coloured stems, means 'pig'. The brew smells unpleasant
- MLK/2: **DAOU** - short green stems, strong effect on drinker, means 'red, authentic'
- MLK/3: **PADE** - streaked internodes, fine stems, small plant
- MLK/4: **SILESE** - yellow rhizome, very strong, thin stems like 'earthworms'
- MLK/5: **TAFANDAI**
- MLK/6: **BAAN**

1. MALAKULA (South-West)

2. South West Bay

3. **Benour** (115)

4. **NIMVULUM**

1. AMBRYM (North)

2. Megam

3. **Fonah** (115)

4. **LEWEWE NDRAME**

- RYM/1: **GORGOR** - from Pentecost, thick stems, pale green
- RYM/2: **LAKLAK** - from Pentecost, very strong

1. PAAMA

2. Liro

3. **Lironesa** (127)

4. **MALOU**

- PAA/1: **TOH** - means 'white'
- PAA/2: **METHANG**
- PAA/3: **TEIHA**

1. EPI (West)

2. Mabvelao

3. **Vowa** (144)

4. **MAK**

- EPI/1: **BAGAVIA** (a) or **MEAWMELO**
- EPI/2: **MAGE** or **MEAWMEIA** - means 'green stems', used in traditional medecine as a remedy for fatigue, grows very easily
- EPI/3: **VIP** (a) - green or yellow stems and leaves, fairly light in colour
- EPI/4: **VIP** (b) - differs from its namesake in that the leaves only are yellow
- EPI/5: **LO** - means 'black stem', short lived effect
- EPI/6: **WARI** - *tudei* type, very strong, used for customary ceremonies, well-rounded leaves
- EPI/7: **MITIPTIP** - *tudei* type, long-lasting effect, clear unspeckled stems
- EPI/8: **VILA** - (Bislama) - round leaves, flecked stems, comes from Port Vila
- EPI/9: **BAGAVIA** (b) - thin, short stems, very long roots, pleasanter taste than its namesake
- EPI/10: **TINBOKAI**
- EPI/11: **PAKAEWA**
- EPI/12: **PURUMEBUE**
- EPI/13: **MEAWLAKE**
- EPI/14: **KAVIUI**
- EPI/15: **MEOLER**

1. TONGOA

2. Mangarisu

3. **Bongabonga** (145)

4. **NAMALUK**

- TOA/1: **PUALIU**
- TOA/2: **PUARIKI**
- TOA/3: **NAKASARA**
- TOA/4: **METOLEI**
- TOA/5: **TAU**
- TOA/6: **OLAIKARO**

- TOA/7: **EWO**
- TOA/8: **RARO**
- TOA/9: **MIEL**

1. *EMAE*
2. Marae
3. **Makatea, Sesake** (149, 151)
4. **NAMALOKU**
- EMA/1: **PUALAPA**
- EMA/2: **PUARIKI**
- EMA/3: **PALIMET**
- EMA/4: **NAKASARA**
- EMA/5: **OLEIKARO**
- EMA/6: **ULUTAO**
- EMA/7: **MIELA**

1. *NGUNA*
2. Mere
3. **Nguna** (152)
4. **NAMALOKU**
- NGU/1: **LOA**
- NGU/2: **PILAKE**
- NGU/3:**MALAKESA** - means 'green'

1. *ERROMANGO*
2. Ipota
3. **Sie** (161)
4. **NAGHAVE**
- ERO/1: **PORE**
- ERO/2: **PIE**

- ERO/3: **VILA** (Bislama) - cultivar from Port Vila
- ERO/4: **AVIA**
- ERO/5: **LIKI** - cultivar from Tongariki

1. *TANNA* (Middle Bush)
2. Lowiakimak
3. **Imreang** (173)
4. **NIKAWA**

- TAN/1: **AHOUIA**
- TAN/2: **AIGEN**
- TAN/3: **APEN**
- TAN/4: **FARE**
- TAN/5: **LEAY**
- TAN/6: **KISKISNIAN**
- TAN/7: **PIA**
- TAN/8: **MALAMALA**
- TAN/9: **MIRA**
- TAN/10: **PAAMA**
- TAN/11: **TIKISKIS**
- TAN/12: **VILA**
- TAN/13: **RHOWEN**
- TAN/14: **YAM**
- TAN/15: **TUAN**
- TAN/16: **NIK**
- TAN/17: **GNARE**
- TAN/18: **KELEIAI**
- TAN/19: **AWOR**
- TAN/20: **KALWAS**
- TAN/21: **PENTECOST**

- TAN/22: **TUDEI**
- TAN/23: **APOL**
- TAN/24: **FIJI**
- TAN/25: **AWKE**

1. TANNA (South-East)

2. Isarkei
3. **Isiai** (163)
4. **NIKAWA**

- TAN/26: **MALAMALA**
- TAN/27: **KOWARWAR**
- TAN/28: **KOWRARIKI**
- TAN/29: **RING**

(The cultivars of Tanna are more thoroughly reviewed in 2.2.3.2).

1. *FUTUNA*
2. Watagi
3. **Futuna** (179)
4. **KAVA**

- FUT/1: **KOKOFE**
- FUT/2: **TUDEI** (Bislama) - very strong
- FUT/3: **TAPUGA** - only consumed by men of chiefly rank, long roots, tall stems

1. ANEITYUM

2. Analghowhat
3. **Anatom** (177)
4. **KAVA**

- ANA/1: **APEG** - means 'black', very dark stems
- ANA/2: **TCHAP** - means 'purple', violet stems
- ANA/3: **NISGINEKRAI** - means 'bat's heart', used in customary ceremonies

- ANA/4: **ASYAIJ** - name given to *Abelmoschus manihot*, or island cabbage, in reference to this plant's thin leaves

- ANA/5: **MOKOM** - means 'round leaf'

- ANA/6: **BIYA** - from Tanna

- ANA/7: **KETCHE** - meaning it has a large rhizome

- ANA/8: **RIKI** - from Tongariki

- ANA/9: **YAG** - 'yellow leaves'

- ANA/10: **METCHE** - means 'the rhizome is dry in the middle'

- ANA/11: **TCHAI** - tall-stemmed variety, difficult to masticate because too 'woody'

- ANA/12: **NIDINOLAI** - means 'the juice of the big-bel fish' (Bislama).

COMMENTS

A total of 222 different vernacular names for local kava cultivars has been recorded in Vanuatu. This list is probably still incomplete, but is representative of the main areas of cultivation and diversification of *Piper methysticum* Forst. in the country. This figure does not represent 222 different genotypes, however, because mixing of genetic stock has taken place along the traditional exchange routes, the patterns of which can be traced through linguistic affinities (figure 6).

1. The cultivar known as **tarivarus** on Ureparapara occurs also on Motalava **(tarivarus)**, Vanualava **(tarvarus)**, Maewo **(tariparaus)**, N. Pentecost **(tarivarusi)** and S. Pentecost **(tarivarus)**. It is worthy of note that this cultivar has kept the same name despite being scattered over some very dissimilar linguistic environments. In the **Ngwatua** language of the Nduindui area of Ambae, **Tari** is a proper name from that western part of the island. Anybody known as **Tari** will be identified throughout Vanuatu as being from that particular place. It is probable that the **tari** variety from Ambae appeared in other places in this part of the group through traditional exchanges, although no particular locality can claim to be its original home. It is everywhere considered as coming from elsewhere, which explains why its name has hardly varied, despite the fact that it has no meaning for the people using it.

2. The cultivar called **ngame** on Ureparapara is undoubtedly the same genotype as that named **nagame** on Motalava, **giemine** on Vanualava, **memea** in North Pentecost, **tememe** in the central part of that island and **memea** on Ambae. All these names in fact mean 'red' This cultivar's purplish stems and the close linguistic affinities between these islands (D.T. Tryon, 1976) support this theory (1).

3. The cultivar known as **rong rong vula** in North Pentecost is very likely to be the same genotype as that called **rogo rogo pula** in West Ambae and **rong rong wul** in central Pentecost. **Vula, pula** and **wul** all mean 'moon' in these three languages respectively, while **rong rong** and **rogo rogo** signify 'to feel'.

4. The cultivar referred to as **marino** in central Santo is surely of very recent introduction, possibly even by plane, and is thought to be native to a place of the same name in North Maewo.

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(1) Neither is it out of the question that several cultivars known as 'red' may exist.

5. It is peculiar to note that the generic names for kava on Maewo (**maloku**), on Ambae (**amaloku**), in northern Pentecost (**moloku**) and at Nokovoula in West Santo (**malohu**) resemble those used by the Big Nambas tribe of North Malakula (**maloch**), on Tongoa (**namaluk**), on Emae (**namaloku**) and on Nguna (**namaloku**), although these islands belong to 3 distinct language groups with little linguistic affinity according to Tryon (1976). Such similarity between names implies that this species, or at least its use, was introduced from outside in at least two of these three regions.

6. In the southern part of the country, the cultivars called **vila** on Erromango and Tanna are not necessarily one and the same and their introduction from Port Vila on Efate (which is no longer today a traditional area of cultivation) is definitely of recent date, suggesting no more than that they passed through that town. The same reasoning is thought to apply to the cultivar known as **lili** on Erromango and that called **riki** on Anatom, which growers believe to be native to Tongariki.

Observations and conjecture such as these can, however, be indulged in without any precise distinction between cultivars emerging. Only the methods in common use for the study of plant polymorphism can yield data suitable for interpretation.

2.2.3 Areas of great varietal diversity

Piper methysticum seems to be more genetically varied in some areas of Vanuatu than others. These are not necessarily the areas where cultivated kavas originated, but merely places where, for ecological or socio-cultural reasons, a substantial genetic endowment has evolved; these areas could therefore be more accurately described as zones of widespread cultivation, where a large part of the gene pool of the species and the cultivars is concentrated.

Surveys have revealed that many such cultivars have adapted to the ecological conditions imposed by altitude, as on Santo, where kava grows at altitudes of up to 1100 m and Maewo where it flourishes at up to 800 m, or by the climatic variations prevailing between Aneityum in the south and the Torres in the north. Kava's great genetic variability, assumed but not so far demonstrated, apparently protects this plant from possible accidents and gives it great potential hardiness, preserved in a number of areas where the growers traditionally maintain what may be described as veritable living collections.

The information gathered during these field surveys has made it possible to draw up a map of cultivation and diversification areas of local cultivars, which also shows the probable genetic material exchange patterns between these areas. Although islands represent very isolated and varied ecosystems, consisting of markedly different environments, this hardy stock travels readily as part of the traditional exchange system and enriches the original collections (Fig.6). A bio-geographical boundary would however appear to prevail south of Efate (1). The phenotypic distance (visible but not measured) is on occasions substantially greater than the geographical distance. In other words, a cultivar from the Banks is closer to an Epi cultivar than the latter is to a cultivar from Tanna or Anatom, from the morphological standpoint. In the case of the two major diversification areas, Pentecost and Tanna, the phenotypes are so different that a farmer from one of these two islands visiting the other is incapable of recognising a single one of the plant forms he is familiar with, whereas if the same grower travels around his own area, without crossing over the ecological boundary referred to above, he will recognise a number of the forms occurring on his island and with which he is acquainted. This experiment has been This experiment has been repeated over and over again during field work, with identical-results. Clearly, the wide differences in climatic conditions between these two areas have a

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(1) Schmid M., 1975, op.cit. 1.1.4.

direct bearing on the forms taken by the relevant phenotypes. In addition, the biogeographical frontier referred to by Schmid also corresponds to a linguistic (Tryon, 1976) and cultural divide. According to Tannese mythology, kava is of late introduction there. The tale goes that it appeared a few centuries ago together with black magic, **netuk**, the pig and the political phratries (Bonnemaison,1985-661-663). If so, then the pig and kava would have arrived in Tanna from Tonga or Samoa, hence via Polynesia. But neither of the two is recorded as having reached New Caledonia (Bonnemaison, pers. comm.). This would also explain the linguistic similarities between the generic name, **kava**, in Vanuatu's southern islands and Polynesia, a situation which does not occur in the north, and the occurrence of the same method of preparing the brew, by chewing.

Vanuatu's kava would therefore seem to have a dual origin, the north for the northern islands and the east for the southern part of the group. This provides added grounds for conducting a more thorough ethno-botanical study in the diversification areas and for taking particular interest in the myths relating to kava's origins on Pentecost and Tanna.

2.2.3.1 Pentecost

The legend relates that (1):

> A very long time ago, orphan twins, a brother and sister, lived happily on Maewo. One night the boy, who loved his sister very much, had to protect her from a stranger who had asked to marry her but to whom she had been refused. In the struggle the stranger loosed an arrow which hit his sister and killed her. The brother, in despair, brought his sister's body home, dug her a grave and buried her. After a week, before any weeds had had time to grow over her tomb, appeared a strange-looking plant which he did not know and which had grown alone on the grave. He decided not to pull it up. A year passed and the sorrowful boy had still not been able to quell the suffering he felt at his sister's death. Often he went to mourn by her grave. One day, he saw a rat gnaw at the plant's roots and fall down dead. His immediate impulse was to commit suicide by consuming large amounts of these roots, but instead of dying he forgot all his worries. So he tried the same thing again frequently and taught other men how to use this plant. That is how kava was discovered.

In fact, Pentecost growers believe kava to have been introduced from Maewo to the north.

Farmers describe the various cultivars grown in the central part of the island (Melsisi area, Apma language) as follows (2):

> **Borogu**: the stems are of regular thickness, brown and turning green at the ends. The leaves, of a fairly pale green hue, turn dark where growing in a seaside or forest site. In dry areas the ends display a yellow tinge. They measure approx. 15 cm in length and 10 cm in width. The internodes are between 15 and 20 cm long. There is a slightly bitter edge to the taste and the effect is quite strong: one cupful will do the trick. **Boro** means small in size. The analogy with **borodam**, a yam with small tubers (*Dioscorea esculenta*) means that this variety's root is fairly compact and does not grow deeply, preferring to spread out at a shallow depth. This kava is the drinkers' favourite. It is called **borogoru** in the north of the island and **gorogoro** in the southern part.
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> **Borogu temit**: The plant's appearance is identical to that of **borogu**, but the stems are lighter in colour **(temit)** means 'white' or 'light'). This cultivar is planted primarily in forest. It has

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(1) From a personal communication by Annie Walter, anthropologist and doctor, ORSTOM, Port Vila.

(2) V. Lebot on the basis of a survey carried out on Pentecost.

a comparable effect. It is known as **borogoru maita** in the north and **gorogoro entepal** in the South.

Borogu tememe: Mostly grown in forest areas, this plant has the appearance of a **borogu**, but with violet stems (**tememe** means 'red'). It is a stronger variety to consume than **temit**. **Borogoru memea** is its name in the north and in the south it is called **gorogoro entemet.**

Melmel: Very fine stems and branches. Small yellow leaves. Its effect is very feeble, which is why it is called **melmel**, which means 'nothing.' No after-effect is felt the next day, even if large quantities are consumed. Usually it is kept for the chiefs, who can carry on drinking it and talking for an extended period without losing control of the situation. This is a small plant, under 2 m tall, and with internodes 20 to 25 cm long ; in the north it is named **sese**.

Lalahk: Its leaves are yellow but a paler shade than **melmel**'s. It may be encountered growing spontaneously in forest areas, having possibly escaped from cultivation. In leaf form and size it is identical to **malmalbo**, referred to below, but is lighter in colour. The same can be said of the stems, which are not so thick but of identical appearance. Its smell is that of **melmel**, but its effect is very potent. It is called **fabulakalaka** in the north and **laklak** in the south.

Abogae: This word is not native to the Apma language and yet this kava is known in the centre of the island. It would appear to come from the north, where it is called **fabukhai**, but to be grown mainly by Pentecost islanders on Santo, where it is known as *tudei* in Bislama. It is highly potent and its stems are slender, like **melmel's**, though green like **lalahk's**.

Bukulit: Its leaves are yellow, but larger than **melmel**'s. **Buku** means small and **lit** the light spots caused by various types of skin fungus (including *Pityriasis versicolor*) found on many Pentecost islanders, by analogy with the pale spots on the kava's internodes. It is known as **bukelita** in the Raga language.

Bogong: This kava is not cultivated but grows wild in the forest. **Bogong** means 'big and strong'. In the north it is called **bogongo** (1) and in the south **liap** (2) (this particular plant may be a species other than *Piper methysticum*).

Bo: This variety is not at all popular. It is used to dilute quality kava on feast days so as to increase the drinkable quantity. It is usually mixed with **melmel** and **borogu**. Its leaves' essence is widely used in traditional medicine to treat boils and ulcers. **Bo** means pig, a reference to the unpleasant odour given off when the roots are soaked.

Malmalbo: **Malmal** means rotten. This kava's taste and smell are reminiscent of meat that has gone off. It is highly potent and the drinker feels the effect for two or three days. It is fairly uncommon and used mainly in traditional medicine to relieve rheumatic pains. Its stems are paler than **borogu's** and its leaves smell the same as **melmel's** or **bukulit's**. The laminae are a darker green than **borogu's**.

Take: The lamina's underside is a reddish-brown. It is about as potent as **melmel** and tastes the same. **Buasitaki** is the name of a little brown bird with a long tail.

Tabal: This kava looks similar to **borogu tememe**, but is much larger. It is often used for a windbreak near huts as it is very strong and decorative. The 5-year old adult is 3 to 4 metres

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(1) Raga language.

(2) Sa language.

tall. It is not popular and is highly potent. Once the drinker has absorbed it, he is reminded of war, **balan**, or doing battle, **ta-balan**, which is what this cultivar's name evokes.

Rong rong wul: This is a dark variety. Its stems and veins are a purplish-blue. It is small and not very popular. **Rong rong** means 'to feel' and **wul** 'moon'. Indeed, it has to be planted at full moon to grow properly.

Maga: This is a large, dark-green variety. **Maga** means 'green'.

Rara: Means 'of a perfectly even colour' or unblemished. Its internodes are indeed even in colour. It is also known as **rara** in the north, in Raga language.

Renkaru: This is a very rare and potent cultivar.

Remarks

It is strange to note that the cultivar known as **tarivarusi** in the north appears in the south as **tarivarus**, but does not exist in the centre. The cultivar called **sese jarakara** in the north is probably a variant of the **sese** cultivar which has been influenced by the environment (ecotype). The cultivar known as **jabualeva** in the north is very rare and only for chiefs during ceremonies. It is difficult to find its equivalent in the centre or south. In the south, the **tamaevo** cultivar, which means 'from Maewo', does not have an equivalent in the centre or north. The same is true of the **kerakra** and **kwik** cultivars.

2.2.3.2 Tanna

Chief Siaka (1) of Henamanu village in the southeast of the island, tells the following legend:

Long ago the islanders drank only one sort of kava, wild kava (*Macropiper latifolium* Forst.) until, one day, a Futunese woman was peeling yams alone by the seaside. As she crouched in the water, an evil spirit took advantage of her posture to slip a magic pebble into her vagina. When she realised it was there, she pulled it out and looked at it. She was intrigued to find that it was slender and covered in knots and buds and decided to take it back to the village. The custom chief claimed it and took it that same evening to the nakamal, where all the village men were assembled. They were gathered around the chief to look at the pebble when the spirit appeared. He showed them a kava plant the size of a banyan tree and told them that was the true kava. He also said the pebble was sacred and should be handled respectfully. They immediately put the pebble in a canoe carved from magic wood and sprinkled it with water. The next day, the canoe was overflowing with thousands of identical pebbles. People came from villages all over the island to take the pebbles home and, because of their magical and sacred powers, people are able to grow kava to this day. Nowadays, kava is grown throughout the island, but women are not allowed to drink it or even watch it being prepared as it once touched the unclean part of their body.

J. Guiart (1956) quotes another version which attributes the kava custom to a god:

The god Kalpapen regularly makes his kava on top of Tukosmere Mountain. He cannot be seen, but he can be heard, shouting in the evening. He uses as a dish a long trough dug from

(1) Interviewed by V. Lebot

the earth on the mountain top. It is because of him that the island has so many rivers. They spring from the water running off his kava... When he went through Loumakiyamapen, he gave the villagers some real kava to replace the false kava they had been drinking up until then and told them that they should henceforth mark nightfall by a kava gathering.

He also states that a rather different legend exists as well:

There used to be only day and no night. Men used to drink red kava and , when they felt tired, would sleep out in the sunlight. The god Kalpapen arrived and, seeing this state of affairs, gave the men some real kava, telling them to drink at night in future, without explaining what it was. 'Watch the sun', he said to them, 'when you see it going down, you should all go to the Yimwayim, taking food and water with you'. (1)

The cultivars used in the island's central region of Lowiakimak are known to the growers as follows:

Pia: Meaning 'glabrous' (in the **Imreang** language (2) of Middle Bush) i.e. smooth or hairless, referring to the internodes' appearance. A variant thereof (ecotype ?), called **erman**, is distinguished by the arrangement of its internodes. This is the kava of reconciliation, traditionally used to settle disputes and misunderstandings or to appease the elements and change the weather.

Rhowen: Meaning 'white', referring to its stems' very pale green colour. It is drunk to guard against the evildoings of sorcerers.

Fare: Meaning 'with roots coming out of the ground' (adventitious roots). When the great Toka festival (3) takes place, this cultivar is used for contests. Growers compete to provide the biggest possible plant. If the plants are the same size, the host and his guests tie and this is announced to the festival participants.

Leay: This is the name of a well-known sorcerer who lived in the south of the island early this century. **Leay** also means 'imp, gnome, dwarf and other little creatures dwelling in the forest'. The sorcerer found this cultivar's first specimen at the bottom of a crater. It is popular, because it is not strong. It measures about 1.5 m in height.

Apen: Meaning 'black'. This kava's stems are a dark purplish-blue. It is not very popular. It is mainly used to treat rheumatism and apparently takes effect against pain on the morning after consumption. It is planted close to the nakamal's 'taboo' area, where people spit. It is held to be a magical kava and grows very slowly.

Ahouia: Meaning 'yellow'. The rhizome is a very distinct yellow inside, meaning that it is very potent.

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(1) Kalpapen was not the bringer of kava, but started its distribution. Kava originated at Ipeukel, where it arrived at the same time as pigs in a canoe from Futuna and the east. This is another kind of link to the first legend (the Futunese woman). Karapamemum was the one who introduced kava on Tanna, but Kalpapen took it to the other parts of the island (Bonnemaison, 1985, vol. II, part 2).

(2) No.173 in Tryon (1976).

(3) J. Guiart - 1956 - Un demi-siècle de contacts culturels à Tanna. (Half a century of cultural contacts on Tanna) '... the festival consists of exchanges of pigs, ceremonies and dances between two groups and their allies. In other words, it involves considerably more than one tribal group at a time and nowadays, in practice, a whole region'.

Tikiskis: This cultivar is named after a very jittery little bird. Indeed, if too much **tikiskis** is drunk, it produces nervousness. It is grown mainly in the north of the island where it grows well on the White Grass plateau.

Kiskisnian: This kava has two colours and is mainly decorative. **Nian** is the name of a coconut tree that grows on the island in two very different varieties: one is called 'green' and the other 'white', in reference to the leaves' mottled appearance (probably due to a virus disease perpetuated by cloning).

Mira: This kava has very thick roots and is extremely heavy. It has slender stems and yellow leaves. It always looks dry and about to die, but this is natural. The leaf laminae are small and the young stems, highly erect, grow in the middle of the bunch. It has a powerful effect.

Malamala: Meaning bat. Its stems are identical to **pia**'s, but have no flecks. It is tall and, when old, grows to over 3 m. Flying foxes (Chiroptera) often perch on it. It grows anywhere very easily and is potent.

Paama: The Bislama name indicates that this cultivar was introduced recently from Paama island. It has thick stems and short internodes and is very popular.

Vila: The Bislama name is evocative of the cultivar's slender stems, by analogy with those of yam (*Dioscorea* spp.). They have a 'rough' texture (perhaps due to cutaneous necrosis).

Nik: Very thick woody stems; hard to cut.

Nare: The young stems have very pale patches on the internodes.

Keleiai: A **yam** variant with very 'rough' laminae.

Tuan: A **pra** variant with much paler leaves.

N.B.: The cultivars known as **pentecost, tudei** and **fiji** were probably introduced very recently. They have no customary significance at all.

PART THREE

CROP MANAGEMENT AND DEVELOPMENT

In accordance with the recommendations of Vanuatu's first five year development plan, on the initiative of one of the authors (1) and as part of the activities of the Agriculture Department, in 1981 Tagabe Agriculture Station started an agronomic research programme whose initial results are summarised in this part.

For *Piper methysticum* Forst., perhaps more than for other cultivated species, a study of polymorphism is fundamental. It is known to be virtually impossible to improve the original genetic material using conventional techniques as fertilisation seems difficult for reasons previously indicated. What should be considered therefore is the potential of the existing material and ways of conserving it.

After proposing action designed to further the study and preservation of this material, the cultivation techniques appropriate to the development of kava are explained and some processing methods discussed. The section concludes with an appraisal of the agricultural economic factors which are thought essential for the successful development of this traditional crop.

3.1 INTRASPECIFIC POLYMORPHISM

The local kava cultivars, or the varieties which are traditionally cultivated, are highly polymorphous. The fruit must have existed, even if none has ever been seen to the authors' knowledge, and may still exist in some exceptional cases, most likely in Papua New Guinea if it is indeed there that kava originated.

The sexuality and origin of this plant is a mystery to which it is still difficult to find an answer. Although male and (more rarely) female inflorescences may be observed, fructification seems to be unknown or at least never to have been observed except by Cuzent (1856) and Barrau (1957) who, however, did not illustrate it (2).

Today's high degree of polymorphism would therefore seem to be the result of natural cross-fertilisation (allogamy), which is very common with dioecious plants, generating multiple combinations of hereditary units. As kava is dioecious, although no-one has ever observed any pollination, the ovules can only be fertilised by the pollen of another plant, producing many hybrids or heterozygous individuals resulting from the crossing of genetically different parents, either of the same species or perhaps of very similar but different species. In the second case, kava could be a sterile hybrid.

There are two possible theories to explain such a polymorphism of sexual origin :

- The variability of the existing varieties (it is still too early to give any explanation concerning their apparent sterility) could be the result of the conservation through the years by man of the progeny of these fertilisations, today unknown in the *Piper methysticum* species. In order to confirm this theory, the geographical origin of the species would have to be located and contain still fertile specimens.

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(1) V. Lebot.

(2) The possibility that the observation made related to a species other than Piper methysticum cannot be ruled out. Even botanists are often confused where the Piper genus is concerned and cases of mistaken identity are quite possible.

- If kava is an intra-specific hybrid, the parents would have to be identified and, once again, we would have to look at the zone of geographical origin. The first stage of the research would be genetic and would make it possible to compare the genomes of the different cultivars of all the regions where the plant is known. In that manner we could establish a possible geographical relationship and support the theory most in line with the facts. This question is far from being resolved.

Whatever the true origin of this polymorphism, these heterozygous individuals would therefore yield very heterogeneous progeny whose variability could be expressed in two ways, chemically and morphologically. However, the characteristics of kava are also influenced to varying degrees by ecological factors. These factors have less influence on the appearance of organs of short life span, such as the inflorescences, than on the vegetative part of the plant. These ecological factors also change the chemical composition and the quality of the drink. The well-known existence of real 'vintage' kavas is the empirical proof. A systematic study of these environmental factors is therefore necessary to establish their influence and that of the genotype.

Such action is designed to group the plants on the basis of chemical and morphological considerations but also according to agronomic characteristics so as to be able to subsequently classify them in different convars (or groups of related cultivars).

3.1.1 The cloning of kava

Cultivated kava cannot be propagated generatively. The plants happened upon in the bush are in fact old plants, overlooked in the turnover of long-cycle crops or planted accidentally. Kava does not produce any seeds and cannot therefore be disseminated by birds as is the case with *Macropiper latifolium*. Kava, consequently, always results from cloning. The clone, a community derived from the same individual by vegetative propagation, is homogeneous, even if it was a heterozygous individual. In the case of propagation of kava by cuttings, the problem faced by the growers is the judicious choice of the initial individuals, by eliminating unsuitable mutations if necessary or by using the favourable mutations as the starting point for new clones. In this connection, ethno-botanical surveys can provide information on the factors which the farmer has to consider when selecting his kava.

If the variability observed can be partly explained by the obligatory reproduction method - allogamy, it is important not to forget the possibilities of vegetative variation which could be responsible for very different phenotypes. In fact, amongst most of the plants which are exclusively propagated vegetatively, variations can occur by the general mutation of the meristematic cells of the bud. This theory of a polymorphism of asexual origin would coincide neatly with the authors' field observations.

The clones from this propagation method can therefore turn out to be heterogeneous after several generations. The mutations can occur even in the absence of viral infection, on a gene, a chromosome or a genome, under the action of a physical or chemical agent, causing the appearance of one or several new and genetically stable characters.

The mutations involve the somatic, i.e. non-sexual cells and produce chimerae or individuals carrying genetically different tissues. These qualitative variations would probably have attracted the attention of the farmer in his selections and he would have produced a new cultivated form.

Present concepts in genetics permit the belief that the risks of degeneration of these clones of kava with time is minimal, insofar as most of them are free of any pathogens. The example of vanilla (*Vanilla* spp.) is particularly relevant. Cases of degeneration occur when bacterial or viral diseases are transmitted, or when disadvantagous mutations are not eliminated. If kava undergoes an intensification of its cultivation, as is the case today, the risks could increase.

3.1.2 Establishing a collection of kava varieties

The morphological description of the cultivars, carried out on plants at their place of origin, can never be an aid in identifying them elsewhere, because the ecological factors will not be the same. It is therefore essential to study the agronomic, chemical and morphological parameters in a single and homogeneous environment.

The setting-up of a collection of cultivars of *Piper methysticum* is a research programme that has been proposed and implemented at Tagabe Agriculture Station, near Port Vila, by one of the authors (1). The programme covers cultivated kavas and related species of the *Piper* or *Macropiper* genus, the taxonomy of the genus and the distribution of the species, the evolution of the cultivated forms and variety selection. It also aims to record, over the whole area of distribution, all the country's cultivars and related wild species. The agronomic characteristics are considered in order to select the appropriate cultivars for intensified cultivation under local conditions.

3.1.3 Method and descriptors

It is possible to preserve the variability observed with kava *in situ* and without risk of genetic erosion, because the cultivated varieties are clones. The many and various biometric data obtained with descriptors make it possible to visualise the variability of the traits taking into account geographical origins. As an adjunct to the statistical studies, systematic chemical research is being carried out to determine the relationship between the genotype, the environment, the kavalactone content (2) and its composition.

The collection of cultivars set up at Tagabe contains only the varieties recorded in Vanuatu under the vernacular names given in 2.2.2. As kava grows slowly, it is not yet feasible to establish a definitive list of the distinguishing characters. It is nevertheless possible to list the descriptors used, which are in line with the standard list issued by the IBPGR. It is too early to guarantee their reliability for differentiation purposes at the intra-specific level. The coding system suggested is therefore not yet final.

Characteristics and initial evaluation

Planting date
- day
- month
- year

Harvesting date
- day
- month
- year

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(1) V. Lebot (under the auspices of the International Board for Phytogenetic Resources (IBPGR) and the University of the South Pacific).

(2) This part of the programme, which is financed by the South Pacific Commission and by the French Ministry of Cooperation and Development, is the subject of an external research contract between the Vanuatu Agriculture Department and the Faculty of Medicine and Pharmacy of the University of Poitiers.

Information relating to the plant

I VEGETATIVE PART

I.1 General appearance
- 3 Erect
- 5 Semi-erect
- 7 Prostrate

I.2 Ramification of orthotropic stems
- 3 Little ramification
- 5 Moderate ramification
- 7 Highly ramified

I.3 Colouring of stem internodes
- 1 Pale green
- 2 Dark green
- 3 Green with purple shading
- 4 Purple
- 5 Black

I.4 Pigmentation of internodes (at 10th internode)
- 1 Uniform (Fig.12)
- 2 Mottled (Fig.13 and 14)
- 3 Speckled (Fig.15)
- 4 Striated and mottled (Fig. 18)

I.5 Maximum height of plant (in cm)
- 1 Age three years
- 2 Age five years

I.6 Average diameter (in mm) of 5 main stems measured at their base (below first node)

I.7 Maximum number of nodes on longest stem

I.8 Stem conformation (Fig. 17)
- C: *node diameter*
- Internode length

I.9 Direction of growth of stem branches (Fig. 13)
- 1 Levogyrate (clockwise)
- 2 Dextrogyrate (anticlockwise)

I.10 Scar sizes and shapes (Figs. 12, 13 and 14)
- 1 On petioles
- 2 On branches

I.11 Leaf shape (Figs. 20 and 21)
- L x B in terms of cm2
- B/L as a %
- O/L as a %

I.12 Ramification edges
- 1 Undulate (Fig. 22)
- 2 Raised (Fig. 23)
- 3 Drooping (Fig. 24)
- 4 Regular (Fig. 20)

I.13 Leaf colouring

1 Upper surface	1 Pale green
	2 Dark green
	3 Purple
2 Lower surface	1 Pale green
	2 Dark green
	3 Purple

I.14 Pubescence on lamina

1 Upper surface	0
	+
2 Lower surface	0
	+

I.15 Kavalactone content of leaves (%)

II. INFLORESCENCES

II.1 Position of inflorescences

1 Axillary
2 Opposite

II.2 Average length of 10 inflorescences (in mm when stamens mature)

III. RHIZOME

III.1 Rhizome weight

1 Fresh
2 After drying

III.2 Rhizome colour

1 White
2 Light yellow
3 Dark yellow

III.3 Total kavalactone content (%)

III.4 Presence of kavalactones

1 Dihydrokavain
2 Kavain
3 Dehydrokavain
4 Tetrahydroyangonin
5 Yangonin
6 Methoxy-yangonin
7 Dihydroyangonin
8 Diyhydromethysticin
9 Methysticin

IV. SUSCEPTIBILITY TO SOIL AND CLIMATE CONDITIONS

These observations are scored according to a scale from 1 to 9, for example:

3 Low susceptibility
5 Moderate susceptibility
7 High susceptibility

IV.1 Susceptibility to drought

IV.2 Susceptibility to high humidity

V. SUSCEPTIBILITY TO PESTS AND DISEASES

Susceptibility is scored on a scale from 1 to 9, as with IV; it is noted whether the observations were made in natural conditions or following artificial inoculations.

VI. CYTOLOGICAL CHARACTERISTICS

Basic chromosome number

VII. ENZYMATIC PROFILES

The traits to be used for description purposes cannot be restricted to those listed above, but it should be possible to evolve a dichotomic determination process (successive choices between two opposing characteristics) using the selected criteria. Making the list any longer would be pointless, as the code would lose clarity without gaining in accuracy or effectiveness.

The aim is to discover how many individuals are needed in the collection plot so as validly to represent the distribution area's total population and establish a watertight determination key.

3.1.4 Obstacles and limitations in distinguishing between cultivars

Many problems are encountered while studying *Piper methysticum* Forst.'s polymorphism and when systematically selecting its cultivars. They are, briefly, as follows:

The plant is highly heterozygous, resulting in a very great diversity of cultivars (see figures), and a very large number of hybrid individuals would have to be observed in order to list their distinguishing characters and establish how these traits are transmitted. For reasons stated earlier, studying variations produced by sexual reproduction, assuming these exist, would be less important.

Each cultivar within the species is descended from a single parent by asexual reproduction and therefore, theoretically, has the same genome. The task of describing and identifying the cultivars or horticultural varieties raises the following difficulties:

The cultivated forms were selected for the sole purpose of improving those characteristics which were useful to man, such as yield and earliness. There are therefore so many similarities between some varieties that it is extremely difficult to distinguish between them. Most of these varieties, moreover, appear genetically unstable and affected by gemmate mutations transmitted through vegetative propagation (1). The majority of morphological or physiological

(1) During surveys, farmers were often heard to state that some of their cultivars would 'change' when cuttings were planted.

changes brought about in this way are probably undesirable and should be eliminated by thorough selection.

Good gemmate mutations probably occur less frequently, but are essential for improving planting material. In fact, when an individual's progeny is considerably different from its parent, it constitutes the origin of a new clone and, thus, a fresh cultivar.

Today, these theories need to be tested. Present research consists of evaluating correlations between characteristics and their inheritability, by means of comparison trials, so as to devise an improvement programme based on clone selection.

It should be remembered that Vanuatu's current aim is rapidly to obtain quality material, or at least identify it from amongst the present diversity.

3.2 METHODS OF CULTIVATION

An empirical approach to overcoming agronomic difficulties has helped kava-growers evolve a number of techniques suited to the cultivation of the various clones.

The aim in this part is not to disrupt traditional cultivation methods, but rather to improve and rationalise them in such a way as to make intensified production a possibility. In the paragraphs that follow, the authors suggest a set of techniques that have been scrutinised in the field and station-tested and which are designed to assist in the development of this crop.

3.2.1 Ecology

1. Climatic requirements

Kava's natural habitat is dense rainforest with persistent foliage. It is a shade-loving species whose distribution is restricted to wet equatorial or sub-tropical climates. Its ecological area of cultivation therefore occurs between the northern and southern tropics (latitudes 25 degrees N and S). It can only be grown with rewarding results in high rainfall areas. Kava requires fairly high average temperatures, ranging from 20 to 35 deg. C, associated with a high humidity reading (70 to 100 per cent relative humidity). At altitudes of less than 400 m, the plant requires an average annual precipitation of over 2200 mm. At higher altitudes its minimum rainfall requirement would appear to be around 1800 mm annually, which does not preclude its cultivation in tropical climates with a very marked dry season (1) provided that the drought is not too extended. In such climates, it is important to plant at the start of the rainy season so that the plant can draw as much benefit as possible from the rain during the critical first six months of growth, when kava is at its most susceptible to a water deficit and when the crop can suffer serious losses if the dry period lasts too long.

2. Suitable soils

Kava's root system possesses only very limited tolerance to asphyxia. One essential quality of the soil it is grown in should therefore be good drainage and drying properties, to avoid bacterial or fungal diseases. Accordingly, the chosen site should offer soil with a physical structure conducive to the free movement of air and moisture and with a high humus content. Kava is a forest-habitat species requiring soils very rich in organic matter, which it craves and considerably impoverishes. Although kava can be grown in a very wide range of soils, it has a preference for deep, loose, fresh soils. Hillsides are often the sites best-suited to

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(1) Tonga, for example.

kava-growing, as drainage is much freer there than in valley-floor locations, where there are risks of waterlogging. The highest yields are apparently obtained on silica-clay soils with a PH of 5.5 to 6.5.

The soil's mineral element content and hence its fertility is an important additional factor but it is too early to determine to what extent any of these elements may act upon the biosynthesis of the kavalactones.

3. Choice of site

Selection of a suitable site is essential for the success of this crop. Due to kava's shade-loving nature, care should be taken that the young plant is able to develop properly, out of the way of the sun and the wind, which catalyse the evapo-transpiration process and dry out the plants. It is also necessary to choose a site facing in a suitable direction and sheltered to the south-east from the prevailing tradewinds, which buffet and damage stems and rhizome, thus making it easier for diseases to set in. In the traditional farming system, the ideal site is therefore the Melanesian garden, cut from the forest and shaded by the other crops, or hillside areas of dense forest from which all the undergrowth has been cleared.

In intensive field cultivation, artificial shade arrangements need to be made for the first 30 months of growth. Association with catch crops can also be rewarding since kava can be profitable and harvested after a 3 to 4 year growth cycle, which is the time-span needed for most perennial shrub crops to reach maturity.

3.2.2 Propagation

1. The planting material (Fig.25)

It is impossible to obtain seeds naturally. Propagation by seed-sowing would not be worthwhile in any case, as kava's probably sexual reproduction method would produce excessively heterogeneous progeny. Marcotting, on the other hand, is very straightforward with kava; as soon as a node on any of the runners touches the ground it puts out roots and turns itself into a natural marcot. The orthotropic branches are never used for propagation purposes.

The most common method of propagation is, however, by taking cuttings. With *Piper methysticum* Forst., as with many other species, the cambium, between the wood and the bark, contains cells of a particular kind known as rhizogenic cells, i.e. cells that produce roots. These cells occur at the point where the branches join the stems. When choosing between stem cuttings or shoots for planting purposes, growers favour the former. The shoots are young buds sprouting from the rootstock which can be taken from the second year of growth onwards.

Cuttings are taken when the plant is pulled up. They are selected with reference to two factors : their age and the type of nursery it is intended to set up.

The method consists of cutting already woody lengths from the base of the most mature stems, ranged around the outer part of the plant. It has been observed that the performance of two cuttings taken one after the other from the same stem depends not on their constitution but rather on their respective position, which also dictates their powers of regeneration. This polarity can be ascribed to physiological and not anatomical (1) factors. Unlignified cuttings tend to rot very quickly under frequent watering, whereas woody cuttings are a highly resistant

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(1) The basal parts of a stem contain more rhizogenic cells which, once the apical dominance has been supressed, produce the roots of the young plant.

and easily transportable planting material. When the cuttings are taken, it is very important to snip them close to a node and not halfway down an internode, because the micro-organisms which could rot the inside of the stem appear to have difficulty in penetrating this harder portion.

2. Planting in the nursery (at Tagabe Station)

The authors' study of varietal polymorphism has shown that some varieties are harder to propagate than others. Varieties with short internodes, for example, provide very hardy planting material for the reason referred to above, whereas cuttings from long-internode varieties are susceptible to rot. Dark-coloured varieties' meristems only develop very slowly.

Once the cuttings are ready and before planting them in the nursery, it is recommended to treat them by immersion in a solution of Benlate (Benomyl, a systemic fungicide), mixed at a rate of 100 g per 100 litres. The cuttings are then laid out on the ground to dry before planting. Two types of nursery are possible : beds dug in the soil planted with two-node cuttings or plastic bags containing four-node cuttings.

a) A bed dug in the soil, planted with two-node cuttings (Fig.26)

This technique avoids the purchase of very expensive polythene bags and is therefore popular with growers.

A bed, 15 centimetres deep, 2 metres in width and 4 metres long is dug, the bottom of which is covered with a 10 cm deep layer of soil, very rich in organic matter or compost. The treated and dried cuttings are then laid out lengthways, spaced approximately every 10 cm to make removal and replanting an easy task. Another layer of earth 3 cm deep is then put down loosely over the cuttings and abundantly watered. Although the cuttings have only two nodes, this technique produces a very high propagation ratio and the emerging plants measure 30 cm in height at 3 months and already boast a developed rhizome.

Nursery maintenance consists of:

- regular watering
- slight shading to prevent the buds and young plants drying out
- weeding to avoid the smothering effect of weeds.

b) Use of plastic bags and four-node cuttings

Two of the nodes are in the soil and two above. When a cutting begins to sprout, it produces leaves and branches at the distal extremity and roots at the proximal end. A pair of cuttings is planted in each bag ; the young plants are easy to maintain and handle when this method is used.

3.2.3 Planting and maintenance

1. Preparation of the soil

When grown in the traditional way, soil preparation is minimised and amounts to breaking up the ground rapidly with a planting stick. Kava is planted in association with root crops in subsistence gardens planted on cleared sites. Kava is cultivated for its root system but is not given the attention tubers normally receive i.e. reduction of the soil to a fine tilth. Farmers content themselves with earthing up the plant regularly, which encourages fresh shooting but

not the development of the rhizome itself. Recent station tests point to the advisability of planting on ridges 60 cm wide and 30 cm in height allowing good soil drainage and easy rooting of the stolons.

Under intensive cultivation, it is recommended to prepare the plots by mechanical means. This consists of:

- an initial ploughing: the soil is turned over to a depth of approx. 30 centimetres to provide favourable conditions for the rhizome to develop
- Second ploughing: 2 weeks after the first disc-harrowing
- Second disc-harrowing and rotavating one week later.

This process yields a very fine friable-textured soil, with a higher organic matter content through the ploughing-in of spontaneous vegetation.

2. Planting out

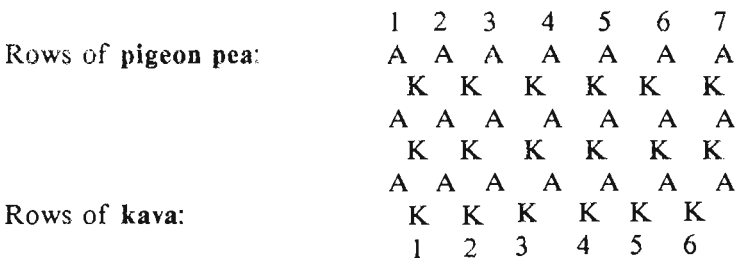
The young plants are ready for field planting when they measure 30 centimetres or so in height and are 3 months old. A hole 50 cm deep and the same in width is dug, in which are placed three young plants whose rhizomes will join together as they grow to form a single rootstock. If the soil is relatively poor, it is recommended to apply an NPK make-up manure of around 30 grams of NPK (12.12.20) per hole, and to mix it into the soil before putting in the plants.

When planting out, care should be taken to select healthy and vigorous plants from the nursery, leaving aside any frail specimens.

3. Spacing

Various cropping systems are possible, including single-cropping or inter-cropping in association with cash crops such as coffee, cocoa or coconuts. The minimum spacing would appear to be 2 metres by 2 in a square layout and should be used only for monocropping under artificial shade. Trials carried out show that some cultivars of pigeon pea *Cajanus cajan var. bicolor*, growing to a height of 2.5 to 3 m at maturity, are perfectly suited to such an association due to the density of their foliage, their posture and the fact that they belong to the legume family.

The diagram below gives an idea of how a plantation should be laid out (density: 2500 plants per ha.).

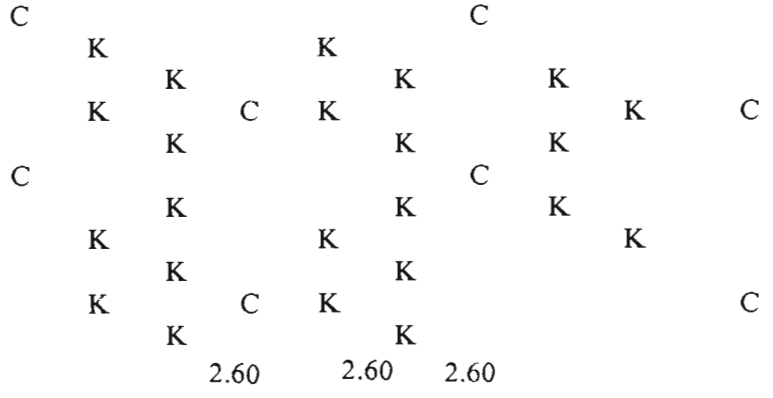


The pigeon pea is sown on the chosen site at the start of the rainy season. At the same time the cuttings are placed in plastic bags in the nursery to be transplanted 2 months later.

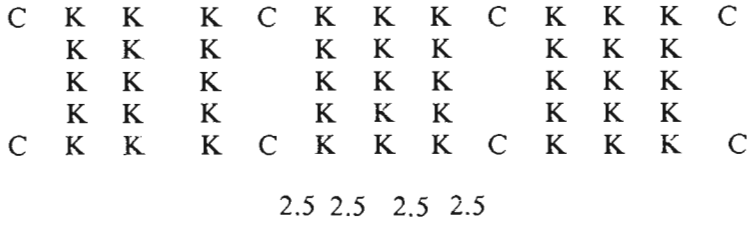
Where the coffee or cocoa crop is planted under artificial shade, the intercropping arrangement is the same: 2.5 m square for the coffee bushes and a 3 m triangular layout in the case of coconuts.

Planting under coconuts is also viable. The trees provide adequate shade and are not a hindrance to mechanised maintenance of the kava crop.

The layout is as follows: when the coconuts are planted in a 9 m triangular formation, the kavas are spaced every 2.6 m between the rows and every 1.5 m along the rows, in a triangular arrangement.



Up to 3 rows can be planted in an intercropping scheme if the coconuts are laid out in 10m squares:



Here the kavas are planted every 2.5m in a square formation between the rows.

4. Irrigation

Kava is very susceptible to water shortage and its wilting point, which is reached very easily, arrives in a spectacular manner. A persistent water deficit will kill a plant if it occurs during the first 6 months of growth. There should therefore be no hesitation about watering this crop liberally if the stems begin to wilt.

5. Weeding

There are two methods of weed control: manual and chemical.

The weeding hoe should not be used near the root collar or on the side of the ridge because it can cause serious damage to the upper and adventitious roots and to the young shoots. It is, however, very useful for weeding between the rows or ridges starting around 50 cm out from the collar. The use of herbicide is trickier and should be carried out during the first year of growth. The residual effect of the active substances on the root system in particular has not yet been investigated and caution should therefore be the order of the day. The ideal solution is to use Glyphosate herbicide or 2,4,5 T just before planting out, but this technique is too costly to be recommended. The proper dose is 2.2 to 3.3 kilos per hectare. It is effective against weeds for around three months but it is not advisable to use this treatment more than

twice per year. The method of application is the conventional one: by individual treatment, being careful that neither the spray nor the vapours touch the plants. A contact applicator is therefore advisable.

6. Manure

Humus or decomposing organic matter is kava's natural nutrient. It is therefore recommended to apply compost liberally or at least to mulch regularly. Under intensive cultivation, however, spot application of an NPK (12.12.20) fertilizer is still worthwhile:

- on planting: 30 grams of complete fertiliser per plant mixed in with the earth in the hole;

- 4 months after planting: a nitrogenous fertiliser consisting of 30 grams of urea with 46% nitrogen for the purpose of accelerating the plant's development;

- additional maintenance fertilisation may be applied during growth every 6 months depending on observable chlorosis, the doses to be estimated according to apparent deficiencies.

As the mineral elements which may influence kavalactones' biosynthesis have yet to be identified, it would be rash to recommend one specific formula as against another. Clearly this field of enquiry now has to be granted priority.

7. Crop care (1)

Each node on the runners pushes out adventitious roots on contact with the soil. This should be allowed to continue for at least the first 20 months of growth, at which time the stolons should be trimmed off just after the last node has rooted and a new shoot has sprouted. This rooting process improves resistance to lodging and encourages the development of the root system. It should be mentioned that some varieties with a very upright posture root with much more difficulty.

It is also advisable to thin out the shade as the kava grows so that the older plants are sure to receive sufficient light.

3.2.4 Pests and diseases

In the Melanesian garden, kava grows alongside other traditional crops, all of which are hosts for some form of pest or pathogen capable of affecting the plant's condition.

1. Insects

The phytophagous weevil, *Elytroteinus subtruncatus* (2), occurring in most Pacific islands, is capable of inflicting considerable damage on the crop if it is left to gain a foothold without control. This boring weevil completes its biological cycle within the plant's stem, where its

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(1) In Tanna, in times past and in some cases still today, the people had plots permanently used solely for kava-growing, which is contrary to the traditional garden principle of combining many different plants. These plots, called nawa, were chosen for their quality and location : it had been observed that they were especially propitious for kava and this crop was regularly replanted there. This shows kava's cultural importance: it was given special care and grown on the most agronomically favourable sites (Bonnemaison, pers. comm.).

(2) An insect featuring a head elongated into a fairly pronounced rostrum and bearing a pair of jointed antennae.

larva gnaws the pith. The adult insect is found in the rhizomes when they are harvested; it reduces their commercial value by boring cavities in them.

The action recommended for control of this pest is spraying the one-year old kava plants with a Diazinon or Furadan type insecticide.

2. Nematodes

The ubiquitous nematodes develop on the roots by forming nodules which may grow up to 1 cm in diameter. They are too small to be observed by the naked eye but behave in the characteristic manner: the adult female pierces the cell walls and absorbs the contents, disturbs the tissues and lays her eggs in them. As soon as they hatch out, the larvae move towards the healthy tissue to feed. When the nodules burst, a form of root rot sets in which can cause the death of the plant. If too many nematodes occur, the plant droops, stops rooting, wilts and dies. Plants which have been attacked are, moreover, very susceptible to lodging.

Various species have been identified and are present in most plots. The most common are *Rotylenchulus reniformis*, *Meloidogyne* spp. and *Radopholus similis*. These species also take some of the blame for afflictions in which bacteria and fungi are also active, causing diseases of complex etiology. Under such circumstances, treatment selection must remain an empirical process. A systemic insecticide-nematicide such as Furadan can therefore be applied, but its efficiency remains to be demonstrated .

3. Diseases of fungal origin

A number of species of fungi can cause extensive damage. When the crop is started on a freshly-cleared site, the remains of tree stumps and trunks can transmit mycoses living in the soil, which attack the root system. These live parasitically in the rhizome which they very quickly cause to decompose. These species remain unidentified for lack of resources, but even when their identity is known it is unlikely that a radical treatment will be found. In the meantime it is more productive to devote attention to site choice and maintenance.

Kava anthracnose: as for most mycotic diseases, the physical environment influences kava's resistance to parasites in two ways: directly on the fungus's development and indirectly by changing the host's receptivity. In this particular affliction's case, the role played by the environment is fundamental.

Symptomatology: the symptoms appear on the vegetative parts of the plant in two quite distinct forms: an acute version which kills off the plant in 3 weeks and a chronic state which causes the stems to wilt and new shoots to grow.

The characteristic signs of attack are brown patches on the stems and leaves which gradually rot. The infection then spreads through the crop.

Etiology: after the infestation and total destruction of Tagabe Agricultural Station's collection, Dr. McKenzie (1), a plant pathologist, identified *Glomerella cingulata* Stonem, a very common species, as being the vector of yam anthracnose. A simple inoculation technique was used to reproduce the symptoms observed in the collection. Once a culture of the fungus had been prepared, an inoculum consisting of powdered mycelium, containing spores, was made up and mixed with distilled water. A number of plants were then infected, some in plastic bags containing sterilised soil, and divided between hothouse and field locations. The effects took some time to appear, but within four months all the plants had died.

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(1) Department of Scientific and Industrial Research (DSIR), New Zealand.

Epidemiology and control methods: the anthracnoses produce single-cell spores disseminated by raindrops splashing onto the leaves. Sporulation is therefore a wet-weather event and the conidia are distributed by water. *Glomerella* is a highly polyphagous species.

It cannot however as yet be stated whether the pathogen identified at Tagabe is a specialised form or whether it belongs to this species. Since *Glomerella* is not capable of breaking through a sound epidermis, the infection enters the stems through splits in the stem of mechanical origin caused by friction between one stem and another as a result of wind action. Badly-drained soil and high temperatures and rainfall are all factors favouring this disease's development. Intensive cropping speeds up its spread, whereas low-density cultivation has the opposite effect (few cases of infection are reported with traditional cultivation methods).

Anthracnoses do not yield to cupric products, but are almost defenceless against dithiocarbonates (Mancozeb, Propineb) and systemic fungicides of the Benlate type (Benomyl). The latter is, however, ineffective in high-rainfall areas, where it would be washed away immediately after application. To minimise the ravages of disease, healthy cuttings, previously soaked in a fungicide, should be used and the site and planting density should be chosen with care. Susceptibility to this affliction varies from cultivar to cultivar - the most resistant varieties ought therefore to be identified (from those of commercial interest).

4. Bacteria

It has been observed in Fiji that a bacterium, identified as *Erwinia* sp., was present in plants that had died of wilting, but the relation between cause and effect has not been demonstrated. It is recommended to keep the soil at a high level of fertility to avoid attacks of bacteria.

3.2.5 Harvest and yield

Kava is usually harvested after 3 or 4 years but may also be left in the ground for more than 20 years. The older it grows the heavier its rhizome becomes and the higher the kavalactone content rises. As yet it is not known from what age the concentration stabilises. Soil type and genotype are here more determining factors than plant age.

On harvesting, the stems are cut above the first node. Care is then taken first to free the adventitious roots, then the lateral ones. The rhizome, depending on the variety, can reach 30 to 60 centimetres in depth and some creeping roots may measure over 3 metres in length. If the plant is being grown on a ridge, harvesting is straightforward. Otherwise, a deep hole will need to be dug around and under the rhizome because the roots are very fragile.

A three-year-old plant yields about 10 kg of fresh material, four-fifths of which is accounted for by the rhizome and the rest by radicles. After drying, the material is reduced to 20 per cent original weight. These figures are averages, significantly influenced by the genome and the relevant soil conditions.

3.3 PREPARATION, PROCESSING AND TECHNOLOGY

For export purposes, the freshly pulled rhizomes must be prepared in a way which protects them from any deterioration. They are carefully washed in water to remove all soil particles and then separated from the roots, which form a second grade commercial product. They can now be peeled, in which case the peelings become a third grade of commercial product. All these steps concern the fresh commodity. The rhizomes and roots are then cut into slices and laid out to dry in the sun in pieces small enough to dry quickly. This drying process

yields a high-quality product, but is not always possible in the Vanuatu climate. In cases such as this the use of a hot-air dryer of the copra-dryer kind is recommended. The dry product's moisture content must not exceed 12 per cent in order to avoid any risk of mould. The pieces of dry rhizome are then packed in 40 kg jute sacks, like cocoa sacks, which allow the contents to 'breathe'. Depending on the intended use, purchasers may prefer rhizome, roots or peelings. The active principle content of these different items is very different in each case.

At the present time in the South Pacific, this product is processed locally in a very simple way. It is ground into a very fine powder with which the drink can easily be prepared by maceration in fresh water followed by filtering. This method has proved very popular throughout the region. It also makes adulteration easy, as Duve (1981) has noted in Fiji. Recent developments in Vanuatu, such as the proliferation of nakamals, an increase in the number of kava drinkers and the importation of more powerful grinders, mean that the adulteration problem may arise in that country too, necessitating quality control on the powder being supplied for local consumption.

The pieces of dry rhizome exported in bulk to the French pharmaceutical market represent another form of kava commodity, used as the raw material for the preparation of a brown hydro-alcoholic extract which is highly hygroscopic and partially soluble in water and alcohol.

3.4 FUTURE PROSPECTS

It would make more economic sense to manufacture the extracts in the kava production area and therefore to think in terms of manufacturing total extracts locally. Unwanted elements could be eliminated locally and special extracts produced.

Extraction techniques vary according to the required end-product and the raw material used, whether dry or fresh leaves or roots:

1. Freeze-dried extract, obtained from a filtered macerate. An experiment showed that the extract obtained from root powder was highly hygroscopic (1)

2. Essential oil obtained by distilling leaves with water (drawing off with steam).

3. Extraction using volatile solvents chosen for their extracting power or special properties capable of producing the required elements; dihydrokavain, for example, can quite easily be extracted with hexane and crystallises on cooling, producing a cheap active ingredient. Several technical and economic factors need to be studied, particularly the solvent's selectivity and suitability in terms of its boiling point and of the kavalactones' thermal stability, availability (an important factor in the South Pacific), the cost price and recycling possibilities. As the extract is aimed at the pharmaceutical market, there should not be any solvent in the end product.

3.5 PROFITABILITY

Kava is an encouraging crop for farmers and has considerable cultural and sentimental value. Labour requirements are minimal, leaving time for the grower to attend to other work.

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(1) ORSTOM Centre, Noumea, New Caledonia.

Table A: Labour input

Man-days per ha and per year	Year 1	2	3	4	TOTAL
Bush clearance	50				
Fencing upkeep	25				
Earthing up and shading	28				
Nursery work	10				
Cuttings and planting	28				
Weeding	25	25	25		
Mulching and pruning	10	15	15		
Harvesting(1)				28	
TOTAL	176	40	40	28	284

(1) At a rate of 40 plants a day.

Supposing that the traditional planting density is 1000 plants per ha, that a yield of 10 kg of fresh roots per plant is obtained and that the producer in Vanuatu is paid 100 VT/kg (1), the net annual income per hectare would be broken down as in table B.

If the plantation is large, harvest drying costs should also be taken into account.

It is interesting to compare income obtained from kava with the new cash crops recommended to Vanuatu's farmers in the campaign to diversify exports. This traditional crop appears impressively competitive next to other plants, as shown in Table C (p.92).

(1) 1 US dollar in early 1985.

Table B: Income per hectare

Overall income: 1000 plants x 10 x 100 VT/kg		1,000,000 VT
Material and equipment costs:		
Barbed wire for fencing:	96,000	
Tools:	5,000	
Purchase of cuttings:	71,000	
TOTAL material and equipment costs:		172,000
Labour costs (400 VT/day's work) (70,400 + 16,000 + 16,000 + 11,200)		113,600
TOTAL costs:		285,600
Net income per hectare		714,400
Income per day's work		2,515
Net annual income per hectare		178,600 (1)

3.6 THE EXPORT MARKET

The European pharmaceuticals market consumes an average of 30 tonnes of dry roots annually (France and West Germany). It is very stable and should not fluctuate significantly as research and promotion costs for a new medicine would be prohibitive (5 to 10 million FF in France).

Fiji has been importing approximately 50 tonnes of dry roots annually for the last few years and Pacific Islanders living in New Zealand, Australia and the United States consume 10 tonnes a year, according to a recent market survey (2). It should be noted that trade with the United States is carried out on the black market as the Food and Drug Administration banned kava imports to the USA in 1958. USAID (3) is currently campaigning to have kava consumption legalised in the USA.

(1) In comparison, the net annual income per hectare in Fiji in 1980 was 10,140 Fiji dollars or 60 $F per day's work, according to Pittaway (S.F.) (1980 - Farm Management Budget Manual, Ministry of Agriculture and Fisheries, Fiji).

(2) Hassal and Associates Pty., Canberra.

(3) United States Agency for International Development.

Table C: Comparison with income from other cash crops

Species	Income per man-day (VT)	Net income per ha per ('000 VT)	Price per tonne FOB Port Vila ('000 VT)	Development potential for next decade ('000,000 VT)	Ease of inter-cropping	Crop proces-sing	Price fluc-tuation
	(1)	(2)		(3)	(4)	(5)	(6)
KAVA (Piper methysticum)	2,515	178	587	25	10	9	5
GARLIC (Allium sativum)	1,083	290	138	6.4	0	8	3
PEPPER (Piper nigrum)	903	161	279	18.3	7	9	7
CARDAMOM (Elettaria cardamonum)	1,137	203	972	0	6	7	4
VANILLA (Vanilla fragrans)	1,771	283	2,942	0	7	0	1
GINGER (Zingiber officinale)	688	315	160	-	6	7	2
COCOA (Theobroma cacao)	896	63	147	100	8	6	5
COFFEE (Coffea arabica)	800	75	267	35	7	6	3
COPRA (Cocos nucifera)	500	30	45	2,000	0	9	5

(1) Income per man-day is calculated by dividing the net income per ha by the number of man-days required over the full crop cycle (see table B).

(2) Net income per ha per yr. is calculated by dividing total net revenue by the number of years the crop has been grown.

(3) The development potential for the coming decade is the value of probable crop exports for that period.

(4) The species are graded on a 10-point scale according to their suitability for inter-cropping or crop association.

(5) The species are graded on a 10-point scale according to how difficult it is for growers to process their crop.

(6) The species are graded on a 10-point scale according to the risk of export price fluctuations.
(According to Hassal & Associates Pty. Ltd. Canberra, Australia).

The market with the greatest potential is South-East Asia, although several businessmen from that part of the world operating in the South Pacific say they are not sufficiently organised to satisfy the massive demand there. Admittedly, demand is for powder only, which would require grinding mills, but it appears that investment would nevertheless yield very high profits and a pilot plant should soon be set up in Port Vila. For the time being, other markets remain more accessible, particularly neighbouring Melanesian countries (New Caledonia, Solomon Islands and Papua New Guinea), where alcoholism is rife and whose governments would be only too glad to import a substitute.

PART FOUR

KAVA IN VANUATU: STATISTICAL SURVEY FINDINGS AND SOCIO-ECONOMIC INFORMATION

4.1 METHOD

A statistical survey was carried out to gather the necessary data for the Ministry of Agriculture to be able to guide kava development and the Vanuatu Commodities Marketing Board to devise a purchasing system for this commodity.

The method used was to conduct sample surveys and extrapolate the results to the population as a whole.

In mid-1983, an initial survey covering virtually the whole country was conducted as part of the agricultural census. The households surveyed were a randomly selected sample. The survey was concerned with the number of kava plants per household and per island with a view to evaluating the plant's distribution in Vanuatu. The fundings are summarised in Table 1.

According to these findings, 6 out of the 21 kava-growing islands supply 95 per cent of the country's total (extrapolated) yield. These are Ambae (Aoba), Maewo, Pentecost, Epi, Tongoa and Tanna. Pentecost and Tanna alone contribute over 63 per cent of the total.

On average, 6.3 per cent of households were surveyed. It might well be asked whether the sample was representative of households overall and therefore whether the extrapolations were significant. The resources deployed to survey 1,297 households, however, were considerable enough and it would be difficult to increase the sample's representativeness owing to major problems caused by remoteness, distance and the lack of infrastructure.

A second survey was conducted in September 1984 to assess the situation at grower level. While the previous survey sample was made up using a random list of households, this one was areolar in nature and based mainly on geographical areas. Sample units were selected from these regions, subdivided into basic areas, and consisted of villages chosen at random from the areas. Each village consisted of a certain number of households which were all surveyed, as far as possible. The sample's basic characteristics were therefore the same as the total population's in the area considered, but could not be extrapolated to other areas.

The survey covered 12 areas situated on Ambae, Maewo, Pentecost, Paama, Epi, Tongoa and Tanna.

4.2 THE QUESTIONNAIRE

The survey's centrepiece was the questionnaire, which was devised with the greatest care and designed to facilitate data gathering, checking and handling. It was prepared in such a way as to enable the Agriculture Department to issue precise instructions. It covered crop size, varieties, the importance of custom and marketing.

Fourteen Tagabe Agricultural School pupils were selected as interviewers, given prior training, made aware of possible difficulties and pitfalls and sent out to the different areas.

Table I: Number of kava plants per household per island (mid-1983 estimates)

Island	No of households		%	KAVA PLANTS		Kava plants per household	% total for Vanuatu (estimate)
	Total (a)	Sample (b)	bx110=p / a	Sample (c)	Estimate of island's total cx100 / p		
Ambae	1,781	100	5.6	2,863	51,125	29	3.96
Santo	2,608	144	5.5	1,402	25,491	10	
Maewo	423	30	7.1	6,627	93,338	221	7.23
Malo	531	45	11.8	28	237		
Mere Lava	222	10	4.2	0	0	0	
Mota	113	10	8.8	17	193	1.7	
Mota Lava	244	20	8.2	86	1,049	4.3	
Gaua	202	10	5.0	26	520	2.6	
Torres	82	0	0	0	0	0	
Ureparapara	53	0	0	0	0	0	
Vanua Lava	204	20	9.8	5	51		
Ambrym	1,334	80	6.0	485	8,083	6	
Malakula	3,465	219	6.3	14	222		
Paama	563	40	7.1	39	549	1	
Pentecost	2,173	150	6.9	20,451	296,391	136	22.98
Efate	1,555	79	5.1	371	7,274	4.7	
Emae	168	10	5.9	204	3,458	20	
Emau	141	10	7.1	244	3,437	24	
Epi	596	40	6.7	3,100	46,269	78	3.58
Nguna	226	20	8.8	26	295	1.3	
Tongariki	54	10	18.5	198	1,070	20	
Tongoa	658	30	4.6	9,719	211,282	324	16.38
Buninga	27	0	0	0	0	0	
Mataso	76	0	0	0	0	0	
Aneityum	107	8	7.5	0	0	0	
Aneiwa	74	10	13.5	0	0	0	
Erromango	234	20	88.5	1,276	15,011	64	
Futuna	66	10	15.2	0	0	0	
Tanna	3,385	210	6.2	32,508	524,323	155	40.65
VANUATU RURAL	21,315	1,335	6.3	79,689	1,289,668	61	94.78

From: 1983 Agricultural census

The original Bislama text of the questionnaire translates as follows:

Island: Village: Code:

Name: Household no:

1. Do you grow kava? YES NO

2. How many kava plants do you have in each age group and

   How many are ready to be uprooted?

	TOTAL PLANTS	READY FOR UPROOTING
Under 1 yr.		
1 yr.		
2 yr.		
3 yr.		
4 yr.		
5 yrs +		

3. How many plants of each variety do you have?

Name of variety	Number of plants

4. How many kava plants have you uprooted for your own use in the past 7 days?

5. How many kava plants have you given (1) to custom in the past 7 days?

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(1) 'Givimaot long kastom' could be more elegantly translated as 'set aside for traditional activities', and is not limited to the idea of 'customary gift'.

6. What varieties have you given to custom?

7. Have you sold any kava in the last twelve months? YES NO

8. How many plants have you sold?

9. How many plants did you sell when you last sold kava?
On what date did you sell it ? Where and to whom did you sell it?
What was the price per plant ? What was the total price?

10. Have you ever sold kava to the boat when it called at your island?

11. How many kava plants did you sell the last time the boat called?
What was the price per plant and overall?

Some questions overlapped each other so that answers could be cross-checked straight away and inaccuracies detected and corrected. Instructions accompanying the questionnaire provide for uncertainties and possible ambiguities.

4.3 THE FINDINGS

The care taken by the Statistics Bureau in carrying out the survey made it possible to avoid all procedural errors and the method chosen proved, with hindsight, to have been perfectly reliable. The following results are a summary of the tables drawn up by the Statistics Bureau after computer-processing of the data. These tables are appended and the reader may refer to them for more detailed information.

Table II shows the size and representativeness of the samples for each geographical area considered. 1,762 households were interviewed during the survey. They accounted for 18 per cent of the surveyed islands' households and the samples' representativeness in their area was, on average, very high : about 22 per cent.

Table II: Representativeness of the statistical samples

The figures are very satisfactory for this type of sample survey and yield relatively accurate extrapolations.

The risk of error arises from the sample survey technique itself, in which individual observation errors are a serious matter because the number of observations and observers is low.

It emerges, however, from reading the field samplers' reports, that estimates were only made in a very few cases, and that most data came from actual counting, measurements or other information provided by growers. The latter, on the other hand, deliberately underestimated the number of plants. Some may even have hidden whole gardens or undervalued the number of plants sold for fear of being taxed on this crop. The figures on crop size and marketing should therefore be considered as being on the low side.

Table II: Representativeness of the statistical samples

Geographical area	Number of house-holds on the island (a)	Number of house-holds in the area (b)	Number of house holds interviewed (samples) Total (c)	Without kava	With kava (%)	Representative-ness of sample in the area (%) (c x 100)/b	Representative-ness of area on on the island (%) (c x 100)/a
1. W. Ambae	1,821	820	166	105	61 (37)	20	15
2. E. Ambae		810	107	8	99 (93)	13	
3. N. Maewo	439	365	142	19	123 (87)	39	
4. S. Maewo		74	27	0	27 (100)	36	
5. N. Pentecost	2,234	775	190	16	174 (92)	25	38
6. C. Pentecost		1,082	305	75	230 (75)		
7. S. Pentecost		377	135	12	123 (91)	36	
8. Paama	569	569	95	18	77 (81)	17	17
9. Epi	609	609	110	8	102 (93)	18	18
10. Tongoa	671	671	173	30	143 (83)	26	26
11. M.B. Tanna	3,487	1,368	218	14	204 (94)	16	9
12. S.E. Tanna		345	94	17	77 (82)	27	
TOTAL	9,830	7,865	1,762	322	1,440 (82)	22	18
%	100	80	18	3	15		
% Total Vanuatu rural (22,000 house-holds)	45	36	8	1.46	6.54		

Consumption figures, on the other hand, should be read as overestimated, since kava is never drunk alone and the conviviality that surrounds its consumption brings together at least 3 or 4 drinkers. The figures therefore relate to both what the household has uprooted for its own consumption and its partaking in that of others (1).

1. *Crop details*

Table III: Number of kava plants by age category and by area

These results can be extrapolated according to each sample's representativeness, which depends on the number of households questioned and the quality of the results. For each area considered, the extrapolations were made either by the direct method proportionately to the number of households, or after amending the figure obtained by applying a factor calculated according to the field samplers' reports and their opinions on the results.

Thus, for East Ambae, we noted that no Seventh Day Adventist (SDA) village had been covered in the sampling even though there were many of them in this area; (this church strictly forbids its followers to drink or grow kava). The extrapolation was made using a basis of 80 per cent of the figure obtained. (See also footnote about Table V). The same situation prevails on Tongoa.

For Tanna, the two areas surveyed (Middle Bush and South-East) made it possible to estimate the other 2 areas' production (South-West and East Tanna).

(1) In Vanuatu, the term 'household' in most cases represents a number of drinkers.

Table III: Number of kava plants by age category and by area

Geographical area		< 1 yr	1 yr	2 yrs	3 yrs	4 yrs	5 yrs +	Total plants	House-holds	Plants per house-hold
1.	W. Ambae	2,720	964	350	193	52	71	4,350	61	71
2.	E. Ambae	10,818	10,288	7,539	5,115	1,830	1,306	36,896	99	373
3.	N. Maewo	5,744	3,077	2,319	1,774	1,072	594	14,580	123	119
4.	S. Maewo	5,244	1,882	3,153	1,393	339	303	12,314	27	456
5.	N. Pentecost	18,886	13,122	8,685	2,563	993	796	45,045	174	259
6.	C. Pentecost	30,351	36,842	25,181	20,822	14,254	18,613	146,063	230	635
7.	S. Pentecost	18,935	9,994	6,398	4,659	2,552	1,045	43,583	123	354
8.	Paama	1,761	1,527	1,081	1,013	1,437	795	7,614	77	99
9.	Epi	6,596	5,075	4,345	2,904	961	393	20,274	102	199
10.	Tongoa	15,309	19,043	12,098	4,534	2,390	1,087	54,461	143	381
11.	M.B. Tanna	27,752	27,133	19,297	9,467	3,156	970	87,775	204	430
12.	S.E. Tanna	13,171	8,391	4,600	2,306	1,954	699	31,121	77	404
TOTAL		157,287	137,338	95,046	56,743	30,990	26,672	504,076	1,440	350 ($\bar{X}$)
% (of total)		000,031	000,027	19	11	7	5	100		

Table IV: Extrapolations from Table III

Geographical area	Number of house-holds in area (a)	Number of house-holds on island (b)	Number of kava plants in sample	Number of house-holds in sample	Number of kava plants per house-hold in area (c)	Number of plants in area (a x c)	Number of plants on island (d)	Plants per house-hold on island (d/b)
1. W. Ambae	1,001		4,350	166	26	26,286		
		1,821					249,846	137
2. E. Ambae	810		36,896 (80%)	107	276	223,560		
3. N. Maewo	365		14,580	142	103	37,595		
		439					71,339	163
4. S. Maewo	74		12,314	27	456	33,744		
5. N. Pentecost	775		45,045	190	237	183,675		
6. C. Pentecost	1,082	2,234	146,063	305	479	518,278	823,724	369
7. S. Pentecost	377		43,583	135	323	121,771		
8. Paama	569	569	7,614	95	77	43,813	43,813	77
9. Epi	609	609	20,274	110	184	112,056	112,056	184
10. Tongoa	671	671	54,461 (80%)	173	252	169,092	169,092	252
11. M.B. Tanna	1,368		87,775	218	322	440,496		
S.W. Tanna	414		(1)		327	133,378		
							1,001,629	287
		3,487						
12. S.E. Tanna	865		31,121	94	331	286,315		
E. Tanna	840		(2)		166	139,440		
TOTAL	9,830			1,762			2,471,499	

(1) Average between Middle Bush (M.B) and South-East (S.E) Tanna.

(2) 50 per cent of East Tanna.

Table V: Number of kava plants ready for uprooting (by age category)

Geographical area	<1 yr	1 yr	2 yrs	3 yrs	4 yrs	5 yrs +	Total	%
1. W. Ambae	0	4	7	0	24	5	40	1
2. E. Ambae	0	299	4,096	3,178	835	637	9,045	26
3. N. Maewo	0	133	1,380	1,487	1,046	565	4,611	32
4. S. Maewo	0	0	138	1,293	339	302	2,072	17
5. N. Pentecost	0	136	5,214	2,325	929	786	9,390	21
6. C. Pentecost	0	20	120	11,184	11,698	17,001	40,023	27
7. S. Pentecost	0	1,462	6,263	4,659	2,552	1,044	15,980	37
8. Paama	0	0	0	111	1,077	795	1,983	26
9. Epi	0	40	326	870	617	277	2,130	11
10. Tongoa	0	0	3,558	3,020	1,798	1,021	9,397	17
11. M.B. Tanna	0	61	15,940	9,216	3,156	970	29,343	33
12. S.E. Tanna	0	41	3,687	2,256	1,954	699	8,637	28
TOTAL	0	2,196	40,729	39,599	26,025	24,102	132,651	26
% (of total per category of age)	0	2	43	70	84	90		

One quarter (26 per cent) of the total number of recorded kava plants was considered by growers to be ready for uprooting, which means that, in Vanuatu, rotation takes place over 4 years on average.

Very clear discrepancies were observed between areas with regard to what growers considered as kava ready for uprooting and therefore consumable. Certain factors of an ecological or genetic nature may influence the age at which plants reach maturity, but in this case the considerations were more likely to be very subjective and related to drinkers' tastes.

Only 1 per cent of plants were considered ready for pulling up in West Ambae whereas for the eastern part of that island the figure was 25 per cent. These figures reflect social pressures exerted by the churches in the West (1) and not differences in soil properties or climate.

Table VI: Crop size

	Size of areas planted (in terms of number of plants)				
	1-9	10-49	50-99	100 +	TOTAL
Number of households	31	196	239	974	1,400
(%)	2	13	17	68	100
Number of Kava plants	148	5,565	17,011	481,352	504,076
(%)	0	1	3	96	100
Average	5	28	71	494	350

(1) The Seventh Day Adventist Church is a minority group in West Ambae. The Church of Christ is the dominant movement. Until the 70's the latter were strongly opposed to kava, but some members have gone back over to it since, which explains why there is a not insignificant consumption of kava now recorded for NduiNdui. 10 years ago, however, no kava whatever was drunk there (Bonnemaison, pers.comm.).

2. Custom

Kava's importance within traditional society was estimated according to the number of plants uprooted for custom purposes per household. This figure represents the total number of kava plants given by a household at customary ceremonies (marriages, burials or promotion to higher rank) during the preceding twelve months.

Table VII: Number of kava plants uprooted for customary purposes

Geographical area	Number of house-holds (a)	Number of households having up-rooted kava (b)		Number of uprooted plants (c)	Number of kava plants per households (c/a)	Number of plants per house-holds having up-rooted kava (c/b)
W. Ambae	61	2	(3%)	7	-	4
E. Ambae	91	72	(73%)	3,946	40	55
N. Maewo	123	78	(53%)	575	5	7
S. Maewo	27	24	(89%)	2,613	97	109
N. Pentecost	174	128	(74%)	4,547	26	35
C. Pentecost	230	110	(48%)	1,240	5	11
S. Pentecost	123	26	(21%)	65	-	3
Paama	77	52	(68%)	402	5	8
Epi	102	54	(53%)	296	3	5
Tongoa	143	104	(73%)	1,264	9	12
M.B. Tanna	204	171	(84%)	2,878	14	15
S.E. Tana	77	53	(69%)	682	9	13
TOTAL	1,440	874	(61%)	18,515	13	21

Table VIII: Cultivars recorded (by geographical area)

The results obtained corroborate the information gathered in the ethno-botanical survey and the classification and ranking order of cultivars appears very clearly. On average, 2 cultivars per area stand out from the rest.

Table VIII: Recorded cultivars (by geographical area)

Cultivar	Number of households growing the clone (a)	Number of plants grown (b)		Number of plants per household (b/a)	% of households having having uprooted this cultivar for customary purposes
1. W. Ambae					
Melomelo	49	2,455	(56%)	50	3
Mavute	50	1,464	(34%)	29	-
Tari	2	113		57	-
Borogoru	5	31		6	-
Memea	12	135		11	-
Mindo	1	10		10	-
Rogorogopula	8	81		10	-
Tolu	3	60		20	-
Tariporo	1	1		1	-
2. E. Ambae					
Vambu	7	83		12	-
Ganono	10	96		10	-
Garaeto	3	205		68	2
Biswiboe	0	0		0	-
Biswiboe	4	464		116	1
Makaru	2	56		28	-
Tarivoravora	1	12		12	-
Taritamaevo	16	289		18	-
Borogoru	33	1,798	(5%)	54	-
Qoro	0	0		0	-
Ranriki	1	12		12	-
Melomelo	98	32,250	(87%)	329	71
Sulusulu	5	54		11	-
Valeiboe	1	11		11	-
Memea	7	110		14	-
Tarimavute	13	963		74	-
Mologugei	4	310		78	3
Mologumavute	1	8	-	8	-
Ngwangaru	1	175		175	1
3. N. Maewo					
Tariparaus	12	470		39	2
Daumangas	13	237		18	2
Hawerara	106	10,105	(69%)	95	85
Borogoru	22	582		26	11
Bumalotu	4	170		43	1
Buara	2	71		36	1

Cultivar	Number of households growing the clone (a)	Number of plants grown (b)		Number of plants per household (b/a)	% of households having having uprooted this cultivar for customary purposes
3. N. Maewo (contd)					
Tongo Lava	2	4		2	1
Malokai	25	1,570	(11%)	63	5
Resres	15	970		65	8
Raimelmelo	10	313		31	3
Rairairereg	1	22		22	-
Gumaito	0	0		0	-
Tumpuinakapmato	2	30		15	1
Bamboo	1	30		30	-
Tarihani	1	4		4	1
Tufagi	1	2		2	-
4. S. Maewo					
Sese	27	10,940	(89%)	405	89
Borogoru	24	763		32	37
Vabu	16	311		19	19
Mologubanga	4	234		59	4
Ronrovula	3	25		8	-
Melrnelo	1	9		9	-
Tarivarusi	1	27		27	-
Mologubanano	1	5		5	4
5. N. Pentecost					
Borogoru	159	27,285	(61%)	172	70
Borogoru maïta	9	277		31	1
Borogoru memea	7	148		21	-
Sese	108	9,555	(21%)	88	34
Fabulakalaka	5	104		21	-
Fabukhai	72	4,744	(11%)	66	9
Bukelita	14	718		51	-
Bogongo	1	10		10	-
Rara	9	430		48	-
Rongrongvula	1	60		60	-
Tarivarus	10	908		91	-
Sese jarakara	12	421		35	-
Jabualeva	0	0		0	-
Melmel	10	311		31	-
Baraeto	2	74		37	-

Cultivar	Number of households growing the clone (a)	Number of plants grown (b)		Number of plants per household (b/a)	% of households having having uprooted this cultivar for customary purposes
6. C. Pentecost					
Borogu	219	116,282	(80%)	531	45
Borogu temit	41	7,662		187	-
Borogu tememe	13	12,954	(9%)	996	2
Melmel	92	3,309		36	6
Lalahk	17	541		32	-
Abogae	43	1,325		31	-
Bukulit	5	88		18	-
Bogong	0	0		0	-
Rara	3	110		37	-
Rongrongwul	7	91		13	-
Take	4	205		51	-
Bo	0	0		0	-
Malmalbo	18	600		33	-
Tabal	7	2,784		398	-
Maga	5	110		22	-
Renkaru	1	2		2	-
7. S. Pentecost					
Gorogoro	42	14,291	(31%)	340	7
Gorogoro emtepal	25	4,235		169	3
Gorogoro entemet	70	17,019	(39%)	243	10
Laklak	68	4,434		65	1
Takare	8	494		62	1
Tarivarusi	2	895		448	-
Kerakra	32	1,149		36	-
Tamaevo	16	1,050		66	-
Kavik	2	13		7	-
Liap	0	0		0	-
Sese	1	3		3	-
8. Paama					
Toh	10	791		79	6
Meihyang	56	4,409	(58%)	79	39
Teiha	25	2,414	(32%)	97	30
9. Epi					
Bagavia 1	79	6,701	(33%)	85	41
Mage	87	7,558	(37%)	87	37
Vip 1	1	9		9	1
Vip 2	0	0		0	-

Cultivar	Number of households growing the clone (a)	Number of plants grown (b)		Number of plants per household (b/a)	% of households having having uprooted this cultivar for customary purposes
9. Epi (contd)					
Lo	0	0		0	-
Wari	18	1,350		75	3
Mitiptip	3	127		42	2
Vila	21	345		16	-
Bagavia 2	8	343		43	7
Tinbokai	14	1,302		93	1
Pakaewa	3	226		75	1
Purumuebwe	6	1,222		204	1
Meawalake	1	5		5	-
Kaviui	1	57		57	-
Meder	23	1,029		45	7
10. Tongoa					
Pualiu	139	19,482	(36%)	140	32
Puariki	141	29,536	(54%)	209	63
Nakasara	6	455		76	-
Metolei	25	2,592		104	1
Tali	7	119		17	-
Olaikaro	13	2,200		169	-
Ewo	4	073		18	-
Raro	0	0		0	-
Miel	1	4		4	-
11. M.B. Tanna					
Ahaouia	29	861		30	3
Aigen	119	33,496	(38%)	281	52
Apin	22	298		14	2
Fare	0	0		0	-
Leay	9	236		26	-
Kiskisnian	36	1,544		43	2
Pia	194	17,155	(20%)	88	58
Malamala	70	3,623		52	7
Mira	18	1,004		56	4
Paama	136	13,039	(15%)	96	25
Tikiskis	5	88		18	-
Vila	60	1,638		27	1
Rhowen	0	0		0	-
Yam	94	8,259		88	30
Yuan	43	919		21	4

Cultivar	Number of households growing the clone (a)	Number of plants grown (b)	Number of plants per household (b/a)	% of households having having uprooted this cultivar for customary purposes
11. M.B. Tanna (contd)				
Nik	46	2,104	46	8
Gnare	22	761	35	2
Keleiai	0	0	0	-
Awor	31	1,601	52	5
Kalwas	2	5	3	-
Pentecost	53	1,027	19	-
Tudei	3	10	3	-
Apol	2	23	12	-
Fiji	2	6	3	-
Awke	1	78	78	-
12. S.E. Tanna				
Pia	65	5,492 (18%)	84	64
Pentecost	4	514	129	-
Vila	22	963	44	4
Paama	13	872	67	4
Malamala	63	11,505 (37%)	183	78
Kowarwar	12	963	78	16
Kowariki	63	10,463 (34%)	166	77
Ring	3	376	125	1

3. Consumption

Table IX: Number of kava plants consumed the previous week per household

Geographical area	Number of households (a)	Number of households having consumed kava (b)		Number of plants consumed (c)	Number of plants per household (c/a)	Number of plants per household (c/b)
W. Ambae	61	14	(23%)	40	1	3
E. Ambae	99	69	(70%)	558	6	8
N. Maewo	123	70	(57%)	267	2	4
S. Maewo	27	19	(70%)	172	6	9
N. Pentecost	174	91	(53%)	514	3	6
C. Pentecost	230	192	(84%)	963	4	5
S. Pentecost	123	35	(29%)	81	1	2
Paama	77	17	(22%)	28	-	2
Epi	102	50	(49%)	123	1	2
Tongoa	143	97	(68%)	350	2	4
M.B. Tanna	204	94	(46%)	765	4	8
S.E. Tanna	77	52	(68%)	363	5	7
TOTAL	1,440	800	(56%)	4,224	3	5

N.B. Extrapolated on this basis, the annual consumption of the households interviewed is 219,648 plants or thereabouts. Also by extrapolation, the consumption of Vanuatu's rural households would be around 3,355,730 plants, or an annual consumption of 153 plants per household.

4. Sales

Table X: Number of households having sold kava last year (by number of plants sold)

Number of plants sold	1 to 9	10 to 49	50 to 99	100 +	TOTAL	% number of
W. Ambae	2	0	0	0	2	3
E. Ambae	18	20	6	6	50	51
N. Maewo	40	25	1	0	66	34
S. Maewo	3	1	5	4	13	48
N. Pentecost	21	32	17	4	74	43
C. Pentecost	55	38	5	3	101	44
S. Pentecost	32	5	0	0	37	30
Paama	23	4	0	0	27	35
Epi	48	6	0	0	54	53
Tongoa	8	20	14	13	55	38
M.B. Tanna	63	41	2	1	107	52
S.E. Tanna	17	9	1	3	30	39
TOTAL HOUSEHOLDS	330	201	51	34	616	43
%	53	33	8	6	100	
Estimated number of plants (1)	1,650	5,025	3,825	3,400	13,900	-

(1) The estimate of the number of plants sold was calculated by multiplying each category (5, 25, 75, 100) by the number of households having sold kava in this category.

These households' latest sales were divided into 3 sales periods (Table XI).

Table XI: Sales periods

	Less than 3 months ago	3 to 6 months ago	6 months ago	TOTAL
Number of households	309	160	47	616
%	50	26	24	100

Table XII: Number of households having sold kava (by place of last sale)

Geographical area	Same island	Vila or Santo	Ship	TOTAL
W. Ambae	2	0	0	2
E. Ambae	50	0	0	50
N. Maewo	38	28	0	66
S. Maewo	7	1	5	13
N. Pentecost	45	29	0	74
C. Pentecost	40	61	0	101
S. Pentecost	30	7	0	37
Paama	6	21	0	27
Epi	31	23	0	54
Tongoa	17	38	0	55
M.B. Tanna	78	29	0	107
S.E. Tanna	19	11	0	30
TOTAL	363	248	5	616
%	59	40	1	100

Table XIII: Number of households having sold kava (by purchaser at the time of last sale)

	Co-operative	Trader	Govern-ment	Market	Ship	Friend	Total
W. Ambae	0	0	0	0	0	2	2
E. Ambae	0	0	0	1	0	49	50
N. Maewo	0	26	34	0	0	6	66
S. Maewo	0	6	0	0	5	2	13
N. Pentecost	0	41	1	8	0	25	74
C. Pentecost	2	76	0	0	0	23	101
S. Pentecost	0	34	0	0	0	3	37
Paama	0	4	0	0	0	23	27
Epi	0	45	4	0	0	5	54
Tongoa	0	35	0	0	0	20	55
M.B. Tanna	0	15	0	1	0	91	107
S.E. Tanna	2	26	0	0	0	2	30
TOTAL	4	308	39	9	5	251	616
%	1	50	6	1	1	41	100

Table XIV: Value of last sale

Geographical area	Number of house-holds (a)	Number of plants sold (b)	Total value of plants (Vatu) (c)	Average value of one plant per house-hold (c/b)	Average no. of plants sold holds (b/a)	Average income per house- (Vatu) (c/a)
W. Ambae	2	3	1,400	467	2	700
E. Ambae	50	632	411,728	651	13	8,235
N. Maewo	66	700	426,250	609	11	6,458
S. Maewo	13	106	15,170	143	8	1,167
N. Pentecost	74	1,103	402,730	365	15	5,442
C. Pentecost	101	1,784	845,097	474	18	8,367
S. Pentecost	37	200	193,910	970	5	5,241
Paama	27	145	139,915	965	5	5,182
Epi	54	382	587,700	1,538	7	10,883
Tongoa	55	645	585,800	908	12	10,651
M. B. Tanna	107	1,279	878,810	687	12	8,213
S.E. Tanna	30	731	190,600	261	24	6,353
TOTAL	616	7,710	4,679,110	607	13	7,596

Table XV: Estimate of frequency of sales and annual income

Geographical area	Estimate of number of plants sold during year year (a)	Number of plants sold at the last sale (b)	Annual frequency (a/b = c)	Average income from last sale (Vatu) (d)	Average annual income (Vatu) (c x d)
W. Ambae	10	3	3.33	700	2,331
E. Ambae	1,640	632	2.59	8,235	21,329
N. Maewo	900	700	1.28	6,458	8,266
S. Maewo	815	106	7.68	1,167	8,963
N. Pentecost	2,580	1,103	2.33	5,442	12,680
C. Pentecost	1,900	1,784	1.06	8,367	8,869
S. Pentecost	285	200	1.42	5,241	7,442
Paama	215	145	1.48	5,182	7,669
Epi	390	382	1.02	10,883	11,101
Tongoa	2,890	645	4.48	10,651	47,716
M.B. Tanna	1,590	1,279	1.24	8,213	10,184
S.E. Tanna	685	731	0.93	6,353	5,908
TOTAL	13,900	7,710	1,80	7,596	13,673

Table XVI: Number of households having sold their kava to a trading ship in the past year

Geographical area	House-holds having sold kava (a)	House-holds having sold kava to a ship (b)	% $\frac{(b \times 100)}{a}$	Number of plants at last sale (c)	Total value at last sale (Vatu) (d)	Average value per plant (Vatu) (d/c)
W. Ambae	2	0	0	0	0	0
E. Ambae	50	1	2	3	3,000	1,000
N. Maewo	66	43	65	292	287,300	984
S. Maewo	13	13	100	125	35,200	282
N. Pentecost	74	2	3	22	4,300	195
C. Pentecost	101	17	17	141	84,809	602
S. Pentecost	37	0	0	0	0	0
Paama	27	1	4	2	2,000	1,000
Epi	54	1	2	1	532	532
Tongoa	55	3	6	9	4,200	467
M.B. Tanna	107	17	19	234	186,900	799
S.E. Tanna	30	0	0	0	0	
TOTAL	616	98	16	829	608,241	734

4.4 COMMENTS

After the survey carried out in mid-1983 as part of the agricultural census, the total number of kava plants in Vanuatu at that time was estimated to be approximately 1,300,000 (Table I).

The second survey boosted this estimate to somewhere in the region of 2,610,000 plants (Table IV). This discrepancy is due rather to procedural problems than an increase in production, for the data obtained in the agricultural census fell far short of reality, at least as far as kava is concerned. The questionnaire in fact referred to 'garden crops' and not kava specifically, which gave rise to some inaccuracies in the responses.

The statistical survey itself yielded figures that can be considered as being under-estimates which should be increased by 20 per cent. The use of this multiplier, calculated on the basis of interviewers' reports, would be more realistic, giving a total number of approx. 3,132,000 plants for Vanuatu in October 1984 for an area of 3,130 ha and a density of 1000 plants per ha.

Table III, however, shows that producers are increasing their crop size by about 15 per cent per year: 157,287 plants are under one year old as against 137,338 over this age. This production increase can be explained in two ways:

- for social and cultural reasons, kava consumption in the country is increasing and supply develops with demand.

- producers are responding to information given by the media about export markets and wish to sell part of their crop outside their village.

This increased production should create a marketable surplus, estimated according to the present number of plants (conservative estimate). It may be assumed that the figures concerning consumption, sales and customary gifts will only vary slightly from year to year and that new crops are planted in proportion to those harvested since every uprooted plant yields several cuttings. These surpluses can therefore be worked out as shown in Table XVII.

Table XVII shows Maewo as having a negative balance. In the area covered by the survey Maewo was the only island to have its production heavily drained in order to meet the first export contracts. Consumption on this island was very high, but balanced with the crop size there. Excessive demand directly affected this balance.

These surpluses were estimated in terms of numbers of plants and represent the tonnage that could have been exported in 1985 without affecting kava's social role throughout Vanuatu or local market prices.

Table XVII: Estimate of available surpluses by number of plants

Geographical area	Number of house-holds	Number of plants per house-hold (a)	Plants given to custom (b)	Plants consumed (c)	Plants sold (d)	Difference (e=a-(b+c+d)	Representa-tiveness of households within their area (f in %)	Surplus estimate by area - number of plants = $\frac{(e \times 100)}{f}$
W. Ambae	61	71	-	-	0	37	20.24	183
E. Ambae	99	373	40	293	16	24	13.21	182
N. Maewo	123	119	5	113	7	6	38.90	-14
S. Maewo	27	456	97	331	30	2	36.49	-4
N. Pentecost	174	259	26	153	15	65	24.52	261
C. Pentecost	230	635	5	218	8	405	28.19	1,433
S. Pentecost	123	354	-	34	2	319	35.81	888
Paama	77	99	5	19	3	72	17.70	407
Epi	102	199	3	62	4	130	18.06	714
Tongoa	143	381	9	127	20	225	25.78	873
M.B. Tanna	204	430	14	195	8	213	15.94	1,366
S.E. Tanna	77	404	9	245	9	141	27.25	517

The tonnage available for export was estimated by multiplying the number of plants available by ten, since the average weight of a plant is 10 kg. Eighty per cent this weight is lost in the drying process. The formula therefore becomes n x 10 x 0.20. The export commodity is the dry matter.

Quantity available for export	kg of dry kava
W. Ambae	996
E. Ambae	392
N. Pentecost	580
C. Pentecost	3,812
S. Pentecost	1,950
Paama	1,064
Epi	1,554
Tongoa	2,640
Tanna M.B.	2,858
S.E. Tanna	1,264
TOTAL	17,110

Local kava trading channels are shown in Tables XII and XIII. Like all traditional produce it passes through many transactions involving numerous middlemen. Ninety per cent of producers sell their kava to traders or friends. Only one per cent of households selling kava deal with the ships carrying outer island cocoa or copra to Vila or Santo.

Table XIV gives an idea of prices prevailing in the islands. They vary from 1 to 10 according to the island of origin, weight variations between plants from different islands and the local price for kava, as determined by its purely subjective value, which does not necessarily follow the normal relationship between supply and demand. The average value of a plant in the areas covered by the survey is 607 VT for an average fresh weight of 10 kilos per plant. The price paid for a kilo of fresh kava is 61 VT on average, which gives a price of 305 VT per kilo of dry kava.

Table XV shows that kava is an important annual source of income, probably the main one, on an island such as Tongoa. As Tongoa is densely populated, only crops with a high unit value can be planted, since most arable land is devoted to subsistence agriculture.

Kava thus emerges as the main cash crop and the most profitable one available to Vanuatu's farmers, whose production unit is the traditional garden, unlike the large-scale plantation crops, copra, cocoa and coffee, which demand substantially higher cultivation areas and capital outlay (1).

(1) In many areas of Tanna in particular, but also on other islands, coconuts do not grow well because of the altitude factor, which is the case in Middle Bush, for example.

4.5 PROPOSALS

The information gleaned from these surveys about kava's importance for Vanuatu (production, consumption and sales) contributes to our knowledge of this traditional crop and is such as to guide agricultural policy and research on this species' potential.

This survey's methodology is easy to reproduce and apply in the field but should be improved by a more accurate calculation of the weight of the crop. Kava lends itself singularly well to surveys of this kind, since the plant is considered individually by the grower who refers to 'kava plants' and not 'kava gardens', as he would for taro, for example. In addition, kava is a perennial and becomes an asset on planting which gradually accumulates value over the years, being left in the soil and uprooted only when needed. A balance is thus established between harvesting and planting. Some growers have surpluses which can be explained by the sentimental value they attach to kava, which is sometimes over-planted for the pleasure of owning more kava. The temptation to speculate and earn more money can, however, also be considered as an incentive for farmers to grow a surplus , but their traditional suspicion will prevent them from planting large areas until they have seen for themselves that a significant market exists and that kava is considered an export crop on the same footing as copra, cocoa or coffee.

Consequently, it is important to propose a scheme for organising the purchasing and marketing of kava, conceived in such a way as to give growers an income proportionate to their labour input without, however, upsetting the plant's social role within the country.

In Vanuatu, agricultural produce is exported through the Commodities Marketing Board which is in a better position than traders to negotiate export contracts, as payment is made on production of documents such as letters of credit. For kava, a medicinal plant, there are no fixed rates or organised international market and each contract is a 'one-off job'. In present circumstances, it would be more advisable for the board to have responsibility for such exports and essential for it to have close control over all marketing transactions, draw up the delivery schedule on the basis of orders received, organise sales, set minimum prices paid to producers and also play its part as a stabilisation fund.

To maintain the delicate balance between crop size and consumption, a collection and purchasing system should be set up for each area, on the basis of the available surplus at first and eventually in proportion to the number of planters per region. It would be advisable for exports to rise in proportion to the crop size increase. Overproduction risks remain low insofar as unsold kava stays in the soil and continues to grow, representing not so much a loss as a shortfall needing to be made up. Growers with too many plants should slow down their planting rate voluntarily. Moreover, the labour needed to plant a new crop is minimal. The disappointment of the farmer who does not manage to sell his plants can only be proportional to the work he put in. It is therefore slight, all the more so since a kava field is always something to be proud of and an asset.

The number of kava planters in Vanuatu can be estimated at 8,480 (Table II: extrapolations on the basis of 1,440 (82 per cent) kava-growing households in the areas studied, which account for about 95 per cent of planters in Vanuatu). Table X, however, shows that only 43 per cent of the households surveyed sell their kava. Over the country as a whole, therefore, 3,650 planters should be considered as being prepared to sell their kava to meet export contracts. This figure is likely to increase as the crop develops.

In order to supply the present export market, estimated at 90 tonnes of dry matter per year (1), growers would have to harvest 12 extra plants each (2), whereas their sales are at present limited to 13 plants per household per year (Table XIV). In addition, this market should expand if the country acquires a processing plant so as to be able to export ready-to-drink powder rather than dry roots. The same applies to the pharmaceutical market. Market potential is therefore great, but planters have not really become involved owing to the lack of clear directives.

The information gathered from the survey can be summarised as follows:

(a) The data gathered confirm the conclusions drawn from the ethnobotanical surveys in all respects.

(b) In Vanuatu, kava presently accounts for 3,132,000 plants, 3,130 hectares and 8,480 planters (3,700 m2 per planter) (3).

(c) Exportable surpluses for the areas considered are estimated at 13.5 tonnes or about 6,750 plants.

(d) The average price paid per kg of fresh kava is 61 vatu and corresponds to 305 vatu for a kg of dry kava.

(e) Coastal trading vessels which traditionally deal in agricultural produce account for only one per cent of buyers.

Since Independence, kava consumption in Vanuatu has risen steadily. This social trend translates a desire to assert the Melanesian cultural identity, but also reflects the realities of day-to-day living.

The churches and the women's associations encourage the proliferation of this habit as a weapon in the fight against alcoholism, which is a scourge in other South Pacific countries.

The price of a serving of kava (half a coconut shell) is now VT 100 (4), more than a beer (VT 80). As the effect is felt by the drinker after the first glass, however, kava emerges as offering better value for money. At the same time, the Government is encouraging an increase in the number of nakamals, the 'bars' where kava is served, by waiving business licence fees for such establishments, of which there are presently 38 in Port Vila, some occasionally running out of stock because demand is so high (240 tonnes per year) and supply so tricky. A kilo of fresh roots makes six good servings of kava. At this rate, 4,000 cups are consumed every day in the capital alone, representing 144 million vatu in expenditure each year by these customers. Vanuatu's annual consumption has reached 8,000 tonnes of fresh material. This figure is unlikely to shrink because the number of women, young people and expatriates consuming kava is expanding steadily.

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(1) For comparison purposes, the Samoas exported 34.35 tonnes in 1908 and 16.3 tonnes in 1919, according to Lewin (1927). The buyer was probably the German pharmaceutical industry. According to Degener (1940), around 1885 Hawaii sold to Germany quantities of kava whose value 'never exceeded $4000 per yr'.

(2) Calculated on the basis of those farmers interested in speculation, Table X.

(3) In 1978, 2,463 hectares were planted to kava in Fiji (according to Rothfield, and Kumar 1980, Report on the Census of Agriculture, 1978, Parliament of Fiji, Parliamentary Paper 28), generating income estimated at 27 million Fiji dollars. In 1980, according to Pittaway op.cit., kava covered 4,000 hectares and yield was approx. 2.25 tonnes of dry kava per hectare.

(4) = $US1 (approx.).

CONCLUSION

Kava is an interesting plant in many respects:

- Sexual determinism (dioecious with inequality between the sexes: very few female flowers, no fertilisation);

- Variability of the different cultivars;

- Cultivation (methods, associations and viability);

- Use of the rhizome to prepare a beverage or to extract the active principles used in pharmacy.

Kava is a dioecious species with an entirely vegetative reproduction method, which is a guarantee of a high degree of cultivar polymorphism. The asexual reproduction process is imposed by the characteristics of its inflorescences, unisexual and very unbalanced between the sexes, with female inflorescences and specimens being uncommon. To be more precise, botanists are unanimous in saying that the latter are hard to observe but make no attempt to explain the situation. As, in addition, cases of mistaken identity are frequent with the *Piper* genus, it is difficult to discern between what can be attributed to poor observation and what is a genuine absence of female flowers.

Plants of either sex cannot be distinguished by their vegetative characteristics. The flowers are very small and observation of the stamens, for example, is only possible on maturity. If female flowers were, however, in fact more common than is thought, they are still apparently sterile. Pollination would appear to have to be anemophilous: the sexes are separate, the size of the pollen grains means they can be wind-borne and they occur in abundant numbers. Consequently, if two individuals of opposite sex occur close to each other, fertilisation should take place, unless there is some kind of physiological incompatibility. No fruits were observed on any individual during the authors' field surveys in Vanuatu. The same is true of the 102 specimens of varying origins examined in 1984 by one of the authors (1) at the Bishop Museum Herbarium in Honolulu. Propagation by the generative method is therefore difficult and would in fact appear out of the question. The field of enquiry remains very wide.

This state of affairs causes kava to die out if its cultivation is abandoned, as can be observed in most parts of Polynesia. Even within its likely area of origin, the Melanesian arc, lies an area, the Solomon Islands, where *Piper methysticum* no longer exists because its consumption has been given up in favour of betel nut. A very clear boundary running through the Santa Cruz islands separates, in this region, one area where the species has disappeared and another area where great diversification has taken place, Vanuatu. Very few plant species can ever have undergone such a process in their very area of origin.

Although not properly measured, the very high degree of polymorphism in Vanuatu kavas would appear to be explicable. The variability was studied using extensive sampling, which was in all likelihood representative, and it can be assumed that Melanesia is the original home of a species which shows a higher degree of variability there than in Polynesia. It is therefore reasonable to conclude that the majority of existing cultivars are preserved in Vanuatu (and Papua New Guinea), whereas only a limited number of clones have been dispersed elsewhere.

The variability concerns the plants' height, leaf form and pilosity, plus the colouring of the various organs and their active ingredient contents, all of which characters are highly sensitive

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(1) P.C.

ecological factors. No research has been done on the genetics of kava. Such fundamental work, i.e. genetics and effects of ecological conditions, needs to be taken further.

The basic issue is to find out what this polymorphism stems from, or to be more precise, to determine the part played by reproduction methods in the inception and maintenance of such variability of characteristics in kava.

The heterogeneity of the descendants of dioecious allogamous plants is well known, but in this species' case, as fertilisation would seem difficult if not impossible, a study of the somatic mutations might prove more rewarding. As *Piper methysticum* is a plant for which vegetative propagation is achieved with ease, the study should concentrate on the potential for variation by this process.

A systematic chemical analysis of Vanuatu's cultivars is in its early stages (1). All analysis so far performed has related to samples from other sources and, for practical reasons, to dry roots. Reservations should therefore be expressed as to their value, since the drying process can alter the chemical composition. It is assumed for the purposes of this document that for the chemical variability there is a corresponding genetic variability. Analysis carried out recently by J.Levesque (2) at the University of Poitiers Pharmacognosy Laboratory partially proves this hypothesis : different cultivars from the same pedoclimatic environment yield total kavalactone contents varying from 4 to 18 per cent, while the relative compositions also differ significantly. Such a chimio-taxonomic approach is a way of supplementing traditional techniques for assessing polymorphism. It is an essential one for the study of a medicinal plant.

The Pacific islanders have been cultivating kava for centuries, but although it enjoys great cultural standing, this plant does not receive the tender care growers lavish on other traditional crops. This is largely due to its hardiness and the fact that its value increases the longer it is left to grow. This shade-loving species is particulary well-suited for association with the various other crops grown, providing that the development of pathogens is not encouraged. It is grown primarily to fulfil a social role, but is rapidly becoming a highly motivating cash crop, especially in zones where the coconut cannot fructify.

In the western world, the fashion is for natural products. Both Europeans and Americans are using more and more tranquillisers and anxiety-relievers to fight the permanent aggression surrounding them in their way of life. The odds are good that they would turn to kava instead of their daily soporifics if they had the chance.

Here the Pacific has a possible substitute with comparable properties to offer.

Stimulants, coffee and tea in particular, are the world's best-selling beverages. There is no reason why there should not be some room on the market for a relaxant with acknowledged therapeutic properties. Kava has a vastly smaller effect on the central nervous system than alcohol and could become a substitute for it in future if the legislation in importing countries was favourable. As regards its export potential, therefore, kava rates both as a drink and as a medicinal plant.

As a new natural product on the market, kava should be very successful, especially in the South-East Asian countries where phytotherapy has been in vogue since living memory. This

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(1) With the assistance of the South Pacific Commission, the French Ministry of Cooperation and Development and Poitiers University, France.

(2) Levesque. J. - 1984 - A preliminary report on the chemical composition of specimens of kava (P.methysticum) selected by Tagabe Agriculture Station, Republic of Vanuatu (pers.comm.).

market, which consists of many million consumers and is highly promising, demands efficaceous and high-quality products.

Kava opens up new research avenues. Few plants can attract such a wide range of interests : for the linguist, kava helps trace the migrations of Oceanic peoples; for the sociologist, it is the catalyst for a convivial event of impressive scale and potential. For the anthropologist, there are the numerous rites, magic acts, stories and legends associated with kava to be studied. Botanists cannot fail to be intrigued by the problem of its origin and how to define the species, while for geneticians the interest lies in the morphological variability, the plant's inability to reproduce by the sexual method and its dependence on man. The agronomist will see in kava an under-utilised crop but one which is perfectly suited to the traditional agricultural systems of the Pacific islanders, as kava's high unit value makes it profitable, even if only grown in small quantities.

For development staff kava-growing is a way of generating cash surpluses, difficult to find in a country where the only advantage of being a group of islands is to attract tourism.

New cash crops can be introduced to raise farmers' revenues, but the success of such an operation is dependent on a number of factors. The plant must be suited to the terrain and accepted by the people; it must not overwhelm available land thus depriving the populace of their food-crop gardens. Lastly, the market for the new product must be open, offering consistently attractive prices.

Another answer is to harness the potential of existing flora, as some species are already well integrated into the outer island lifestyle. This is the case for kava: development of this crop meets all the preconditions for success. It is easy to propagate, needs little space, requires only limited attention, does not disrupt food-crop production, into which it can be introduced smoothly, and provides a drink and medicines.

In conclusion, it is amusing to see a plant grown in the garden yield higher man-day income than all the other crops commonly referred to as cash crops. This plant is kava, an essential or indeed the central element in Vanuatu custom. It is very unusual for a species of such importance in an area's traditions to offer so much hope and such good prospects for development.

Fig. 1a: Piper methysticum, general appearance of the plant

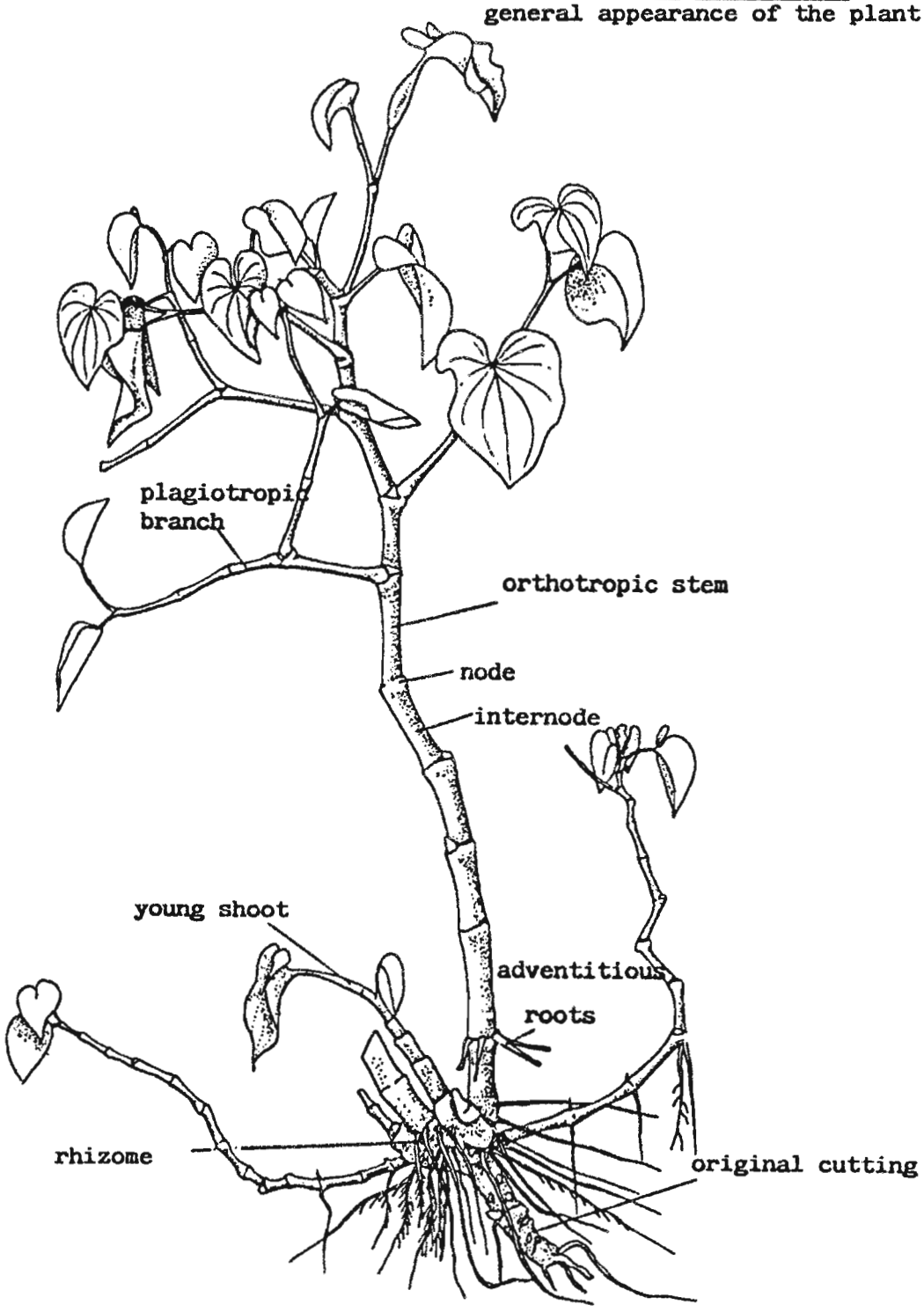


Fig. 1b: Piper methysticum, appearance of a stem root

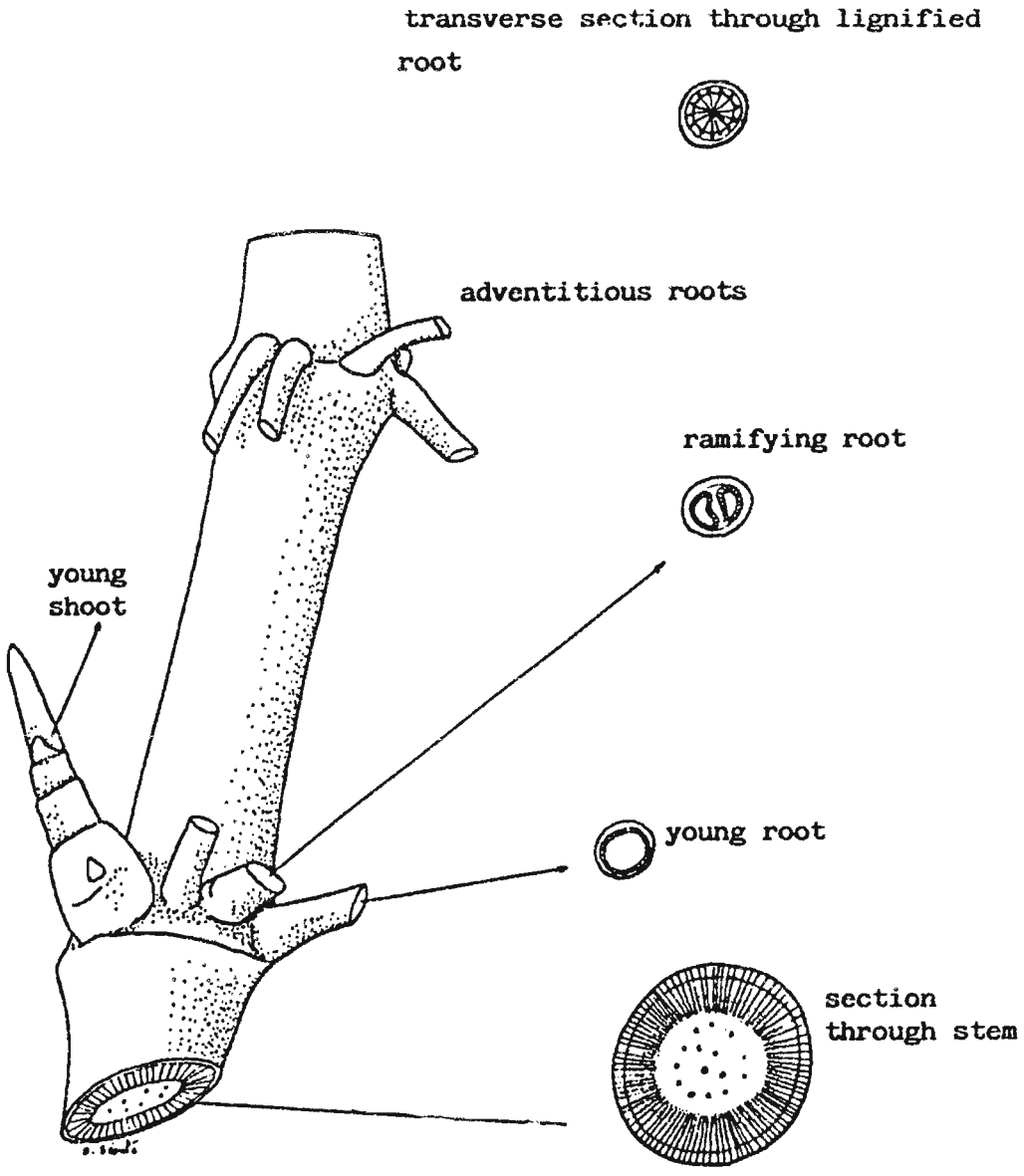


Fig. 2: Piper methysticum,
appearance of vegetative parts

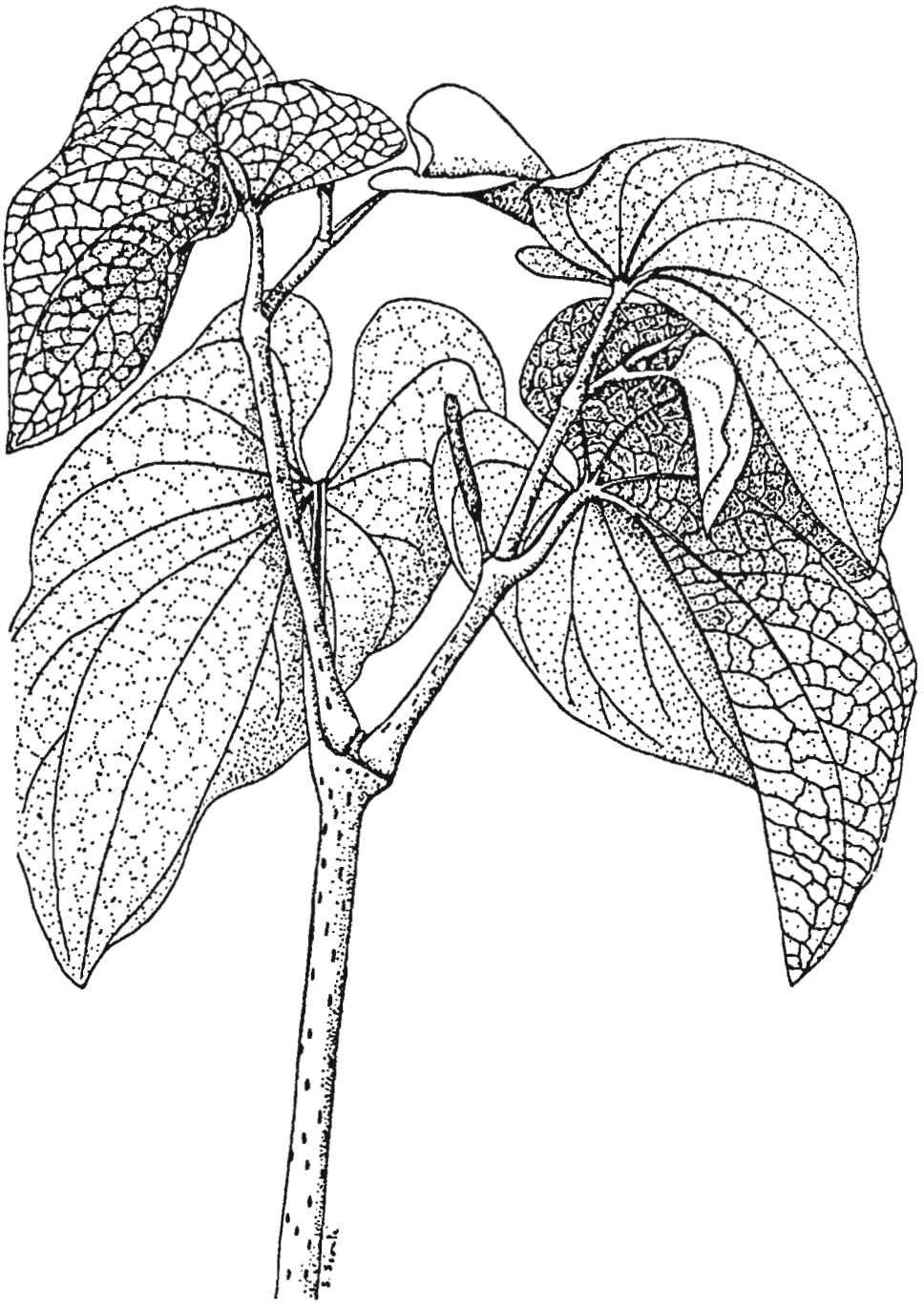


Fig. 3: Piper methysticum, appearance of inflorescences

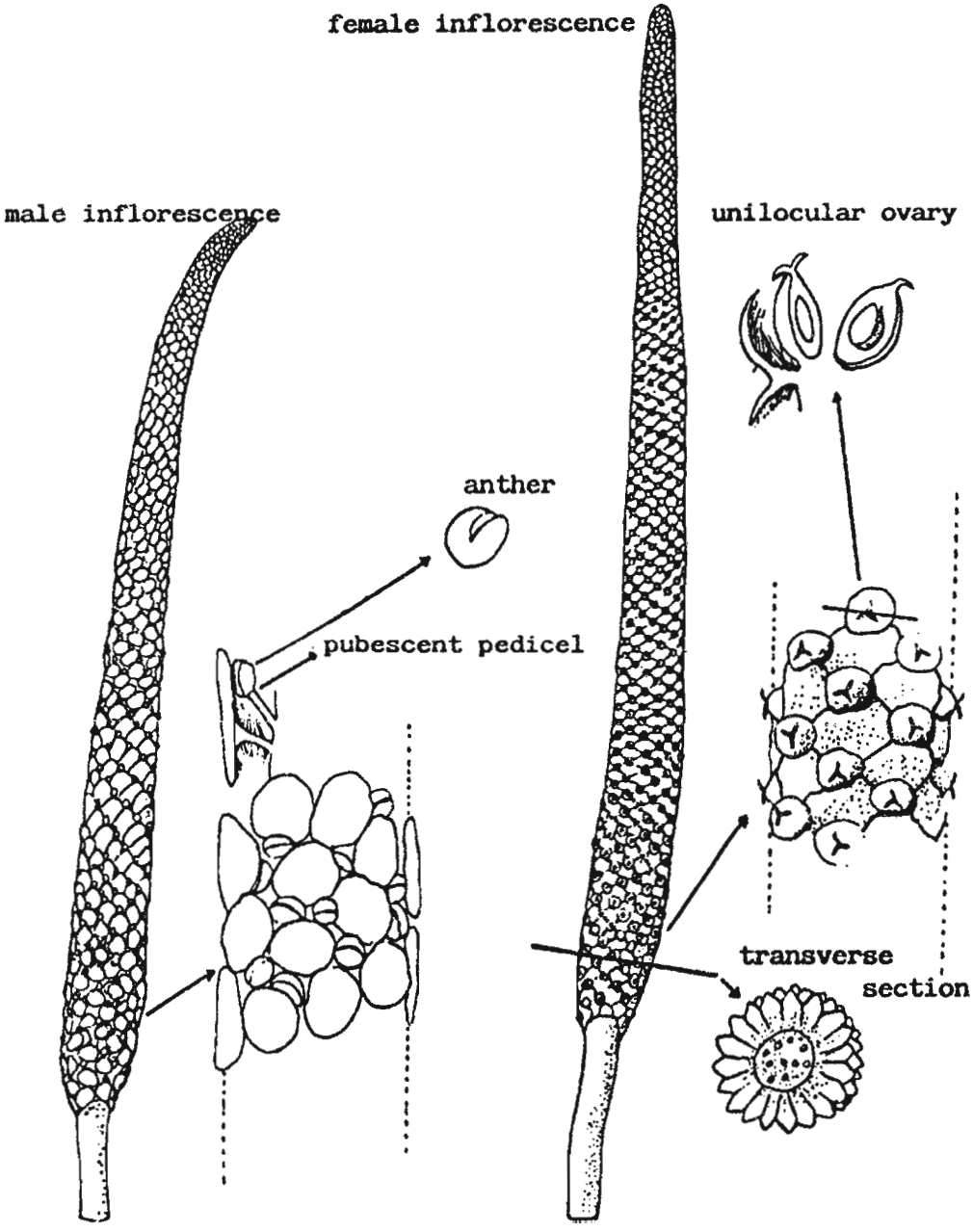
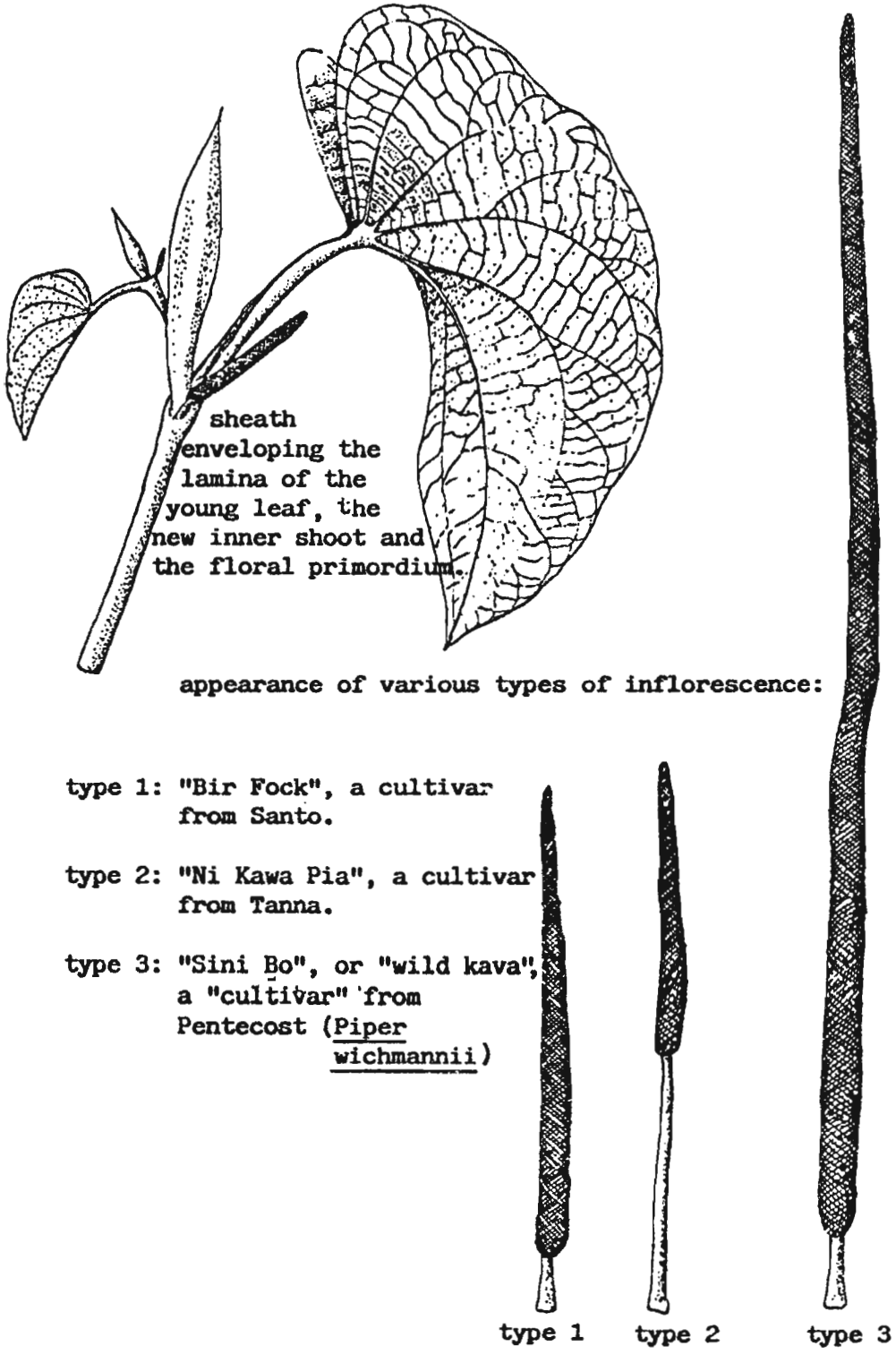


Fig. 4: Piper methysticum, arrangement of inflorescences on branches



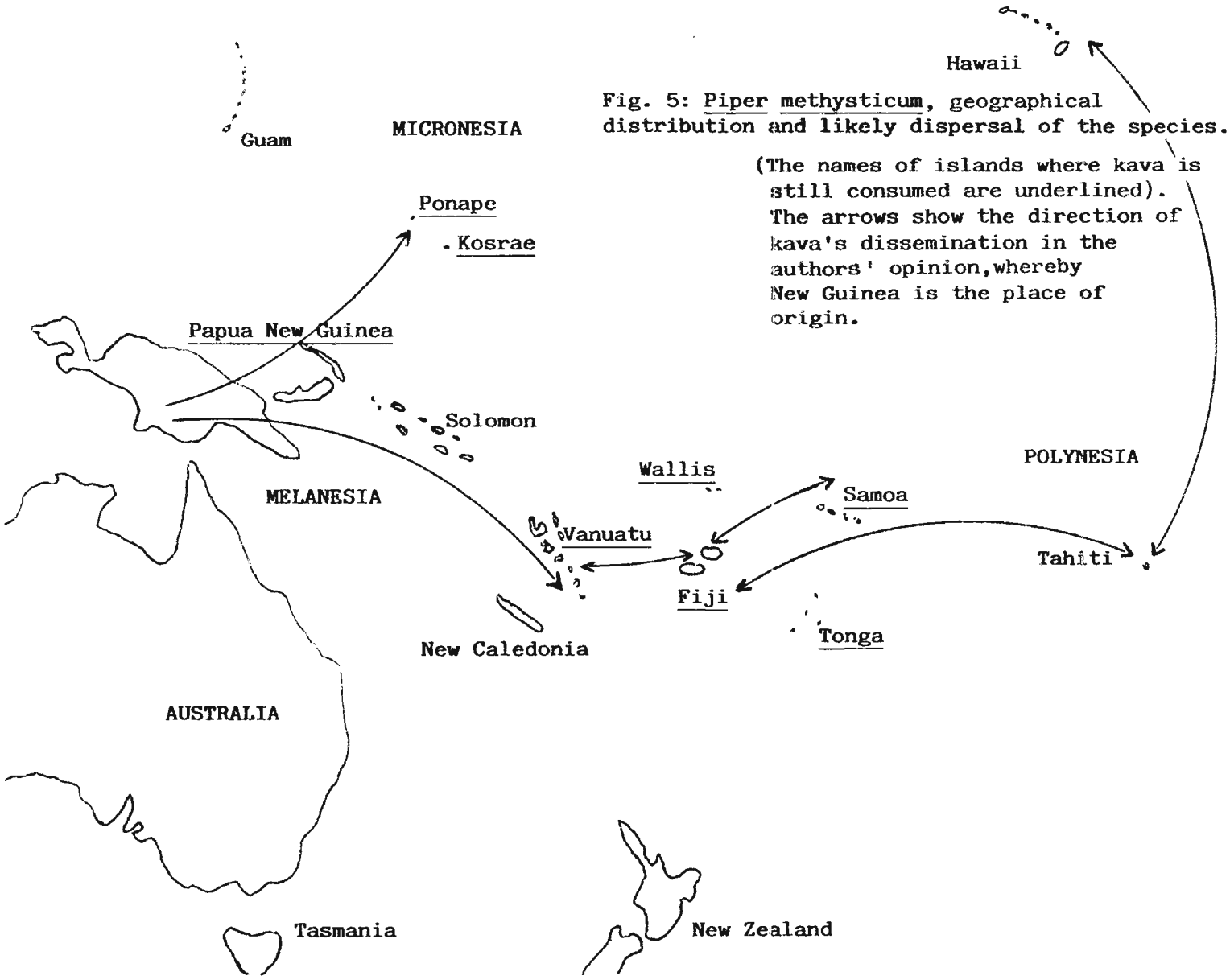


Fig. 5: Piper methysticum, geographical distribution and likely dispersal of the species.

(The names of islands where kava is still consumed are underlined). The arrows show the direction of kava's dissemination in the authors' opinion, whereby New Guinea is the place of origin.

Fig. 6: Macropiper latifolium Forster

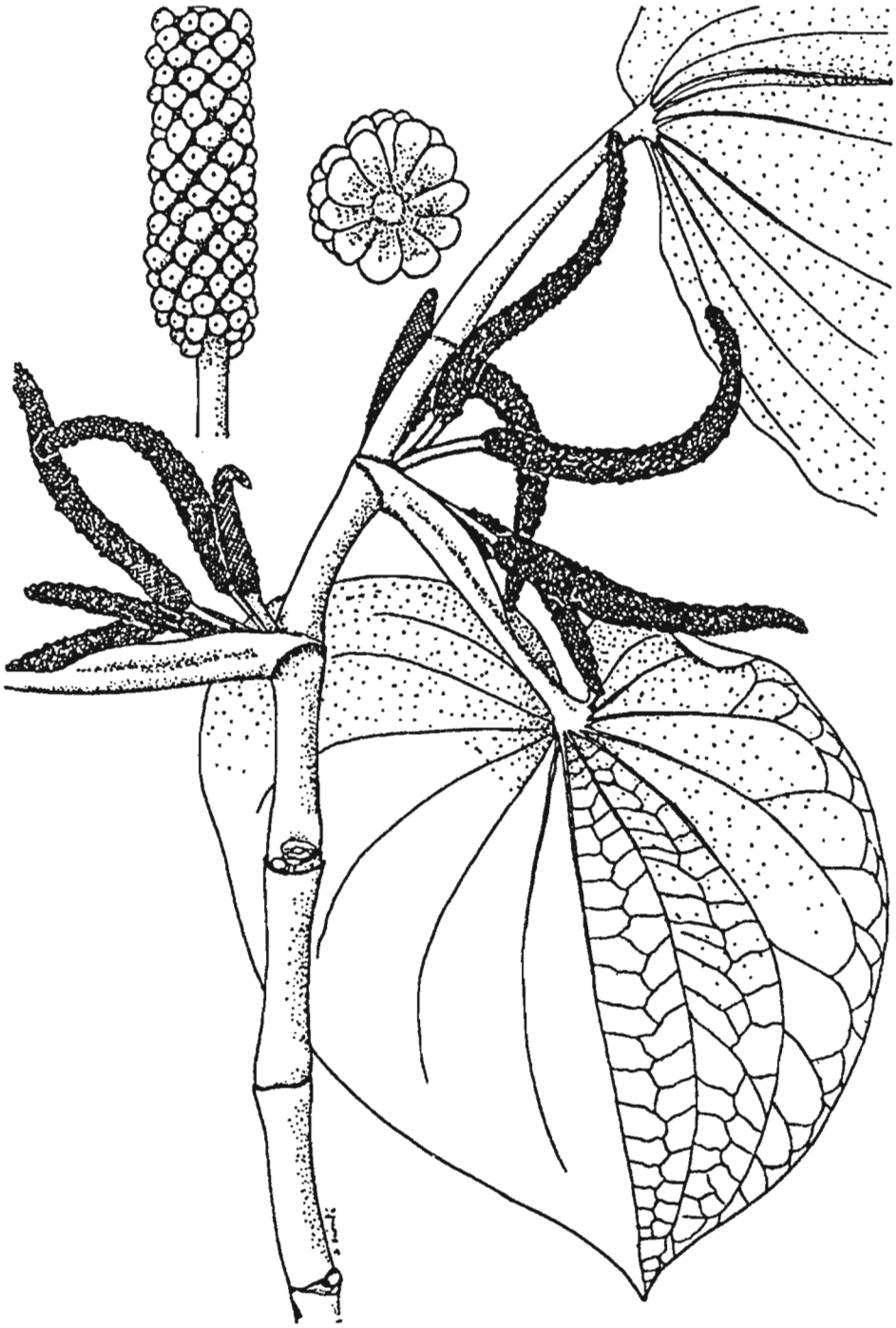
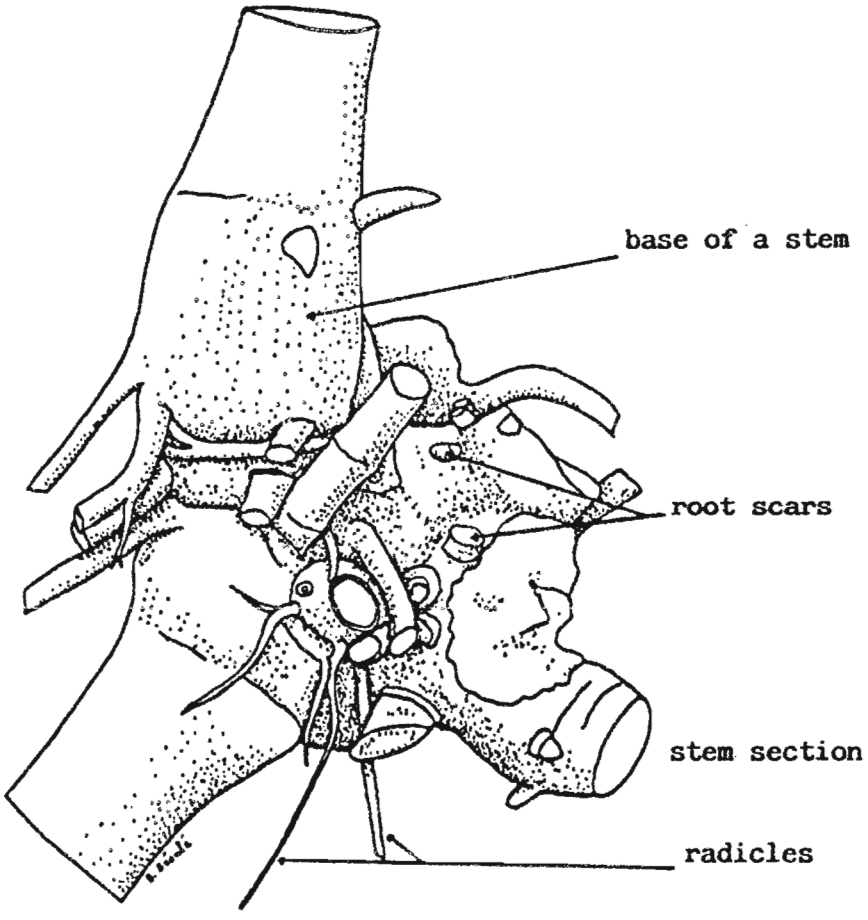


Fig. 7: Piper methysticum, portion of a dry rhizome as commercially traded



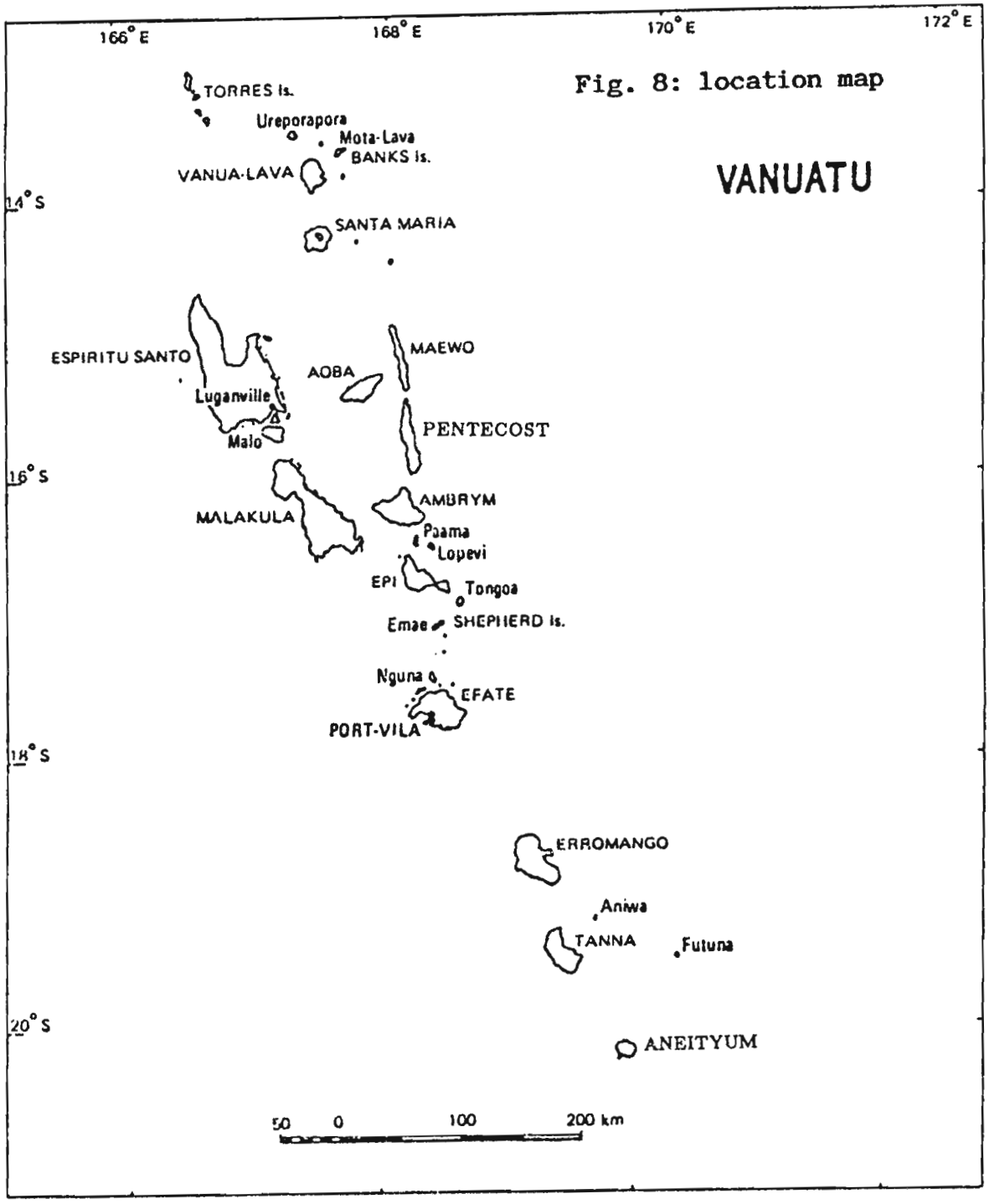


Fig. 8: location map

VANUATU

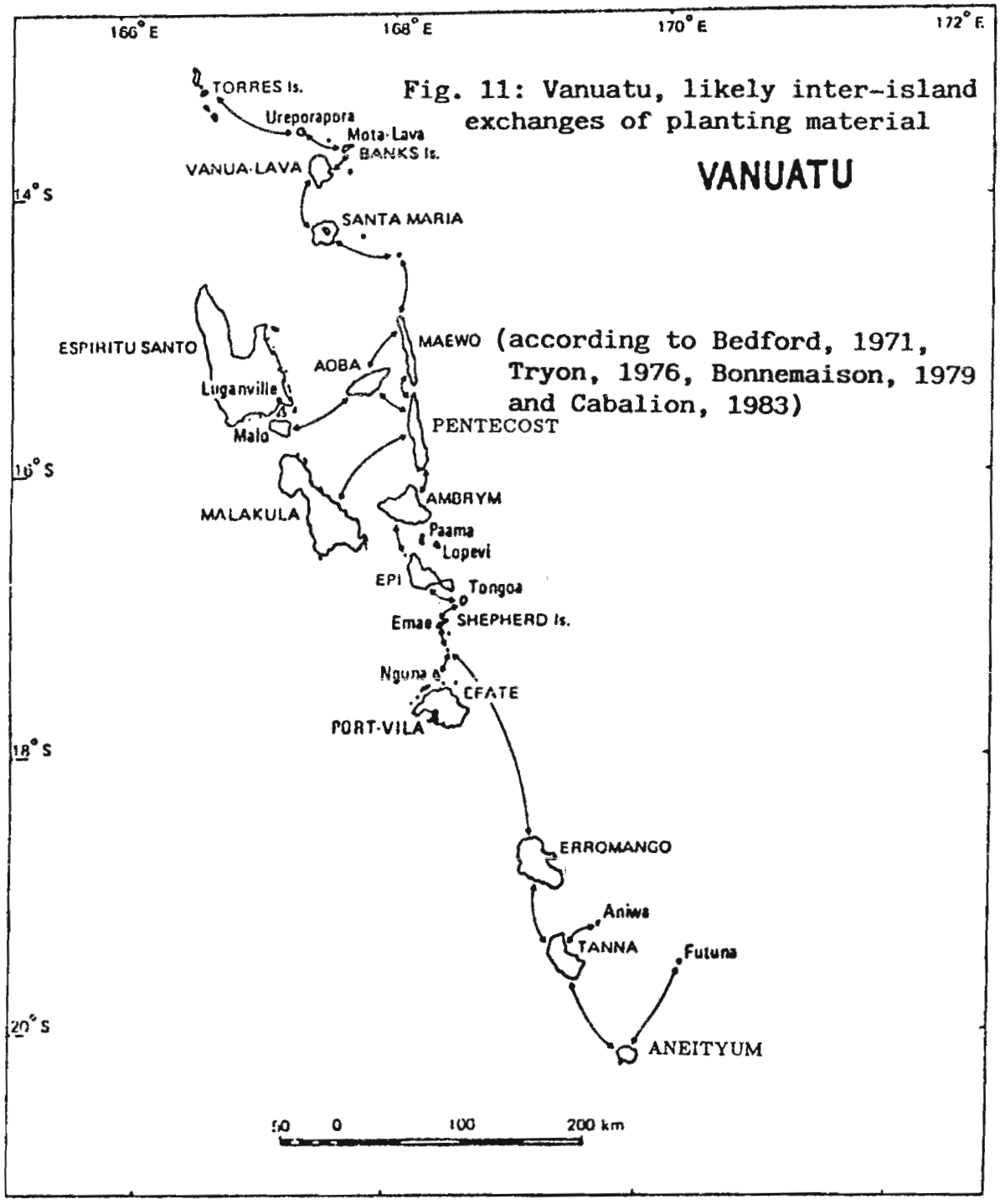


Fig. 11: Vanuatu, likely inter-island exchanges of planting material (according to Bedford, 1971, Tryon, 1976, Bonnemaison, 1979 and Cabalion, 1983)

Fig. 12: SAN/2, "Fock"

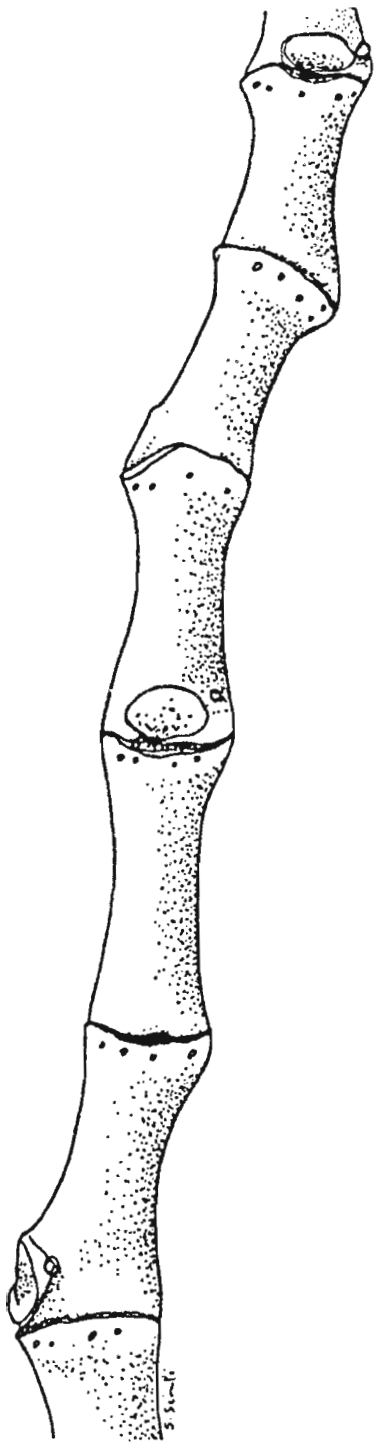


Fig. 13: EMA/7, "Miela"

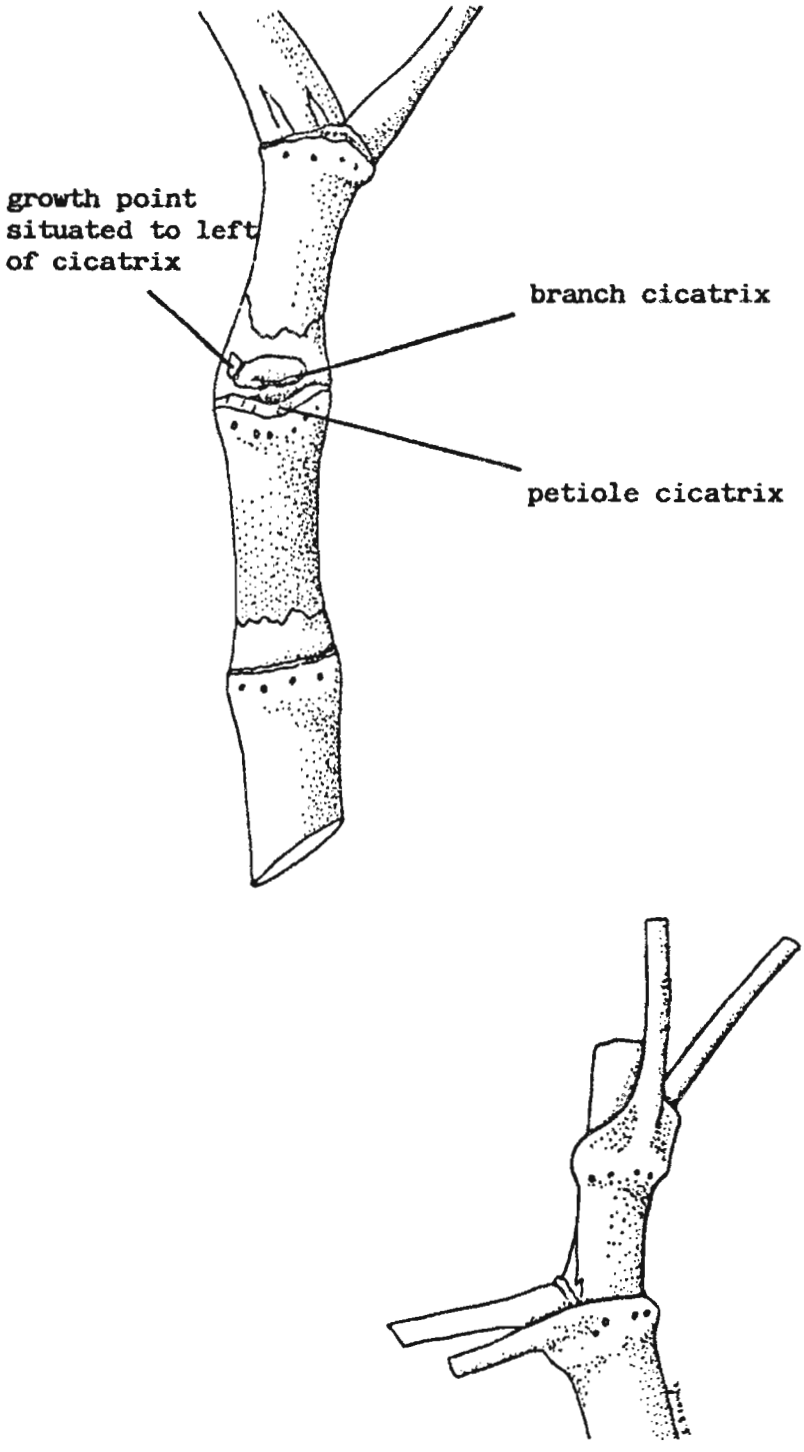


Fig. 14: EMA/7, "Miela"

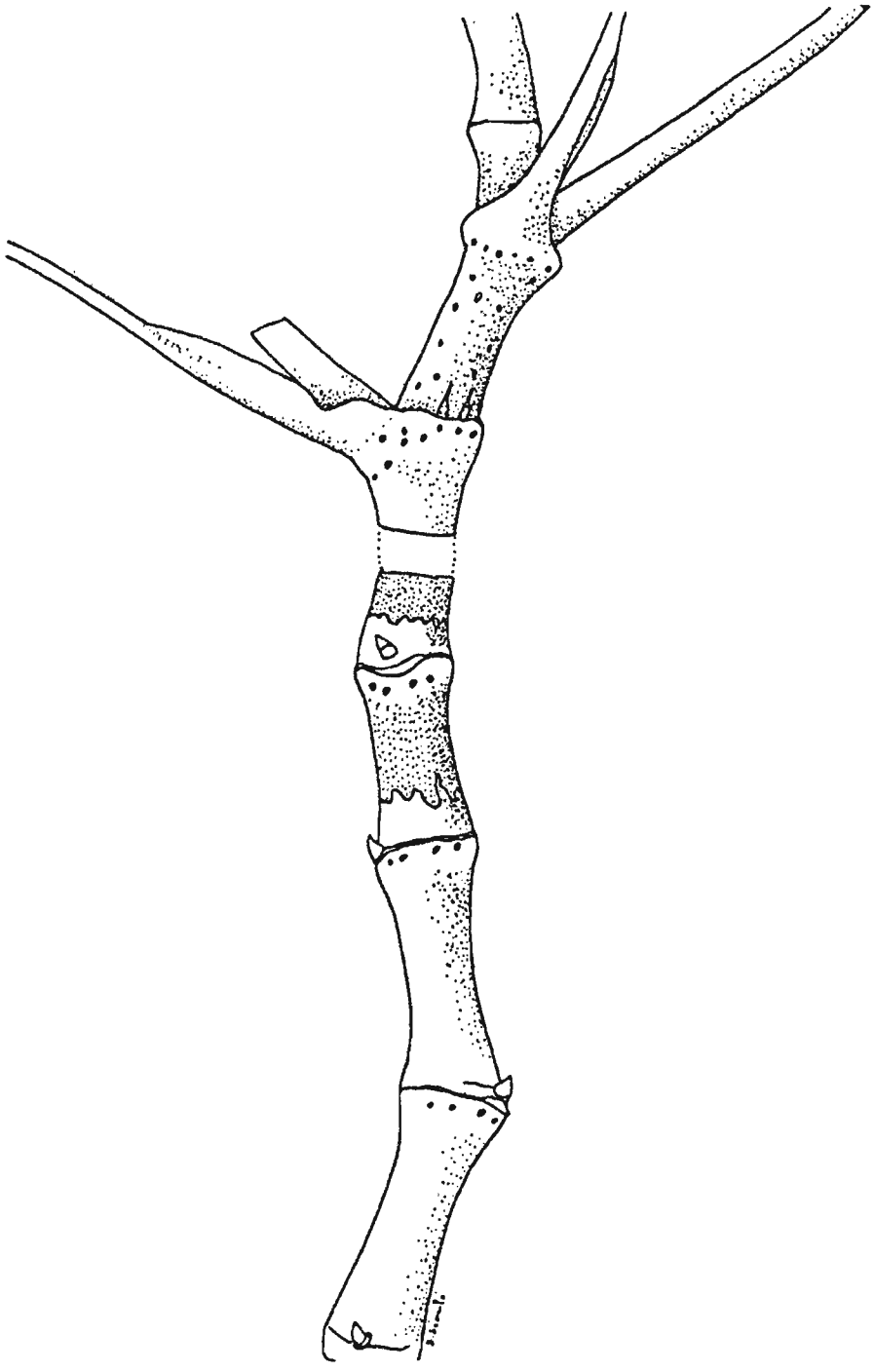


Fig. 15: VAN/2, "Bambu"

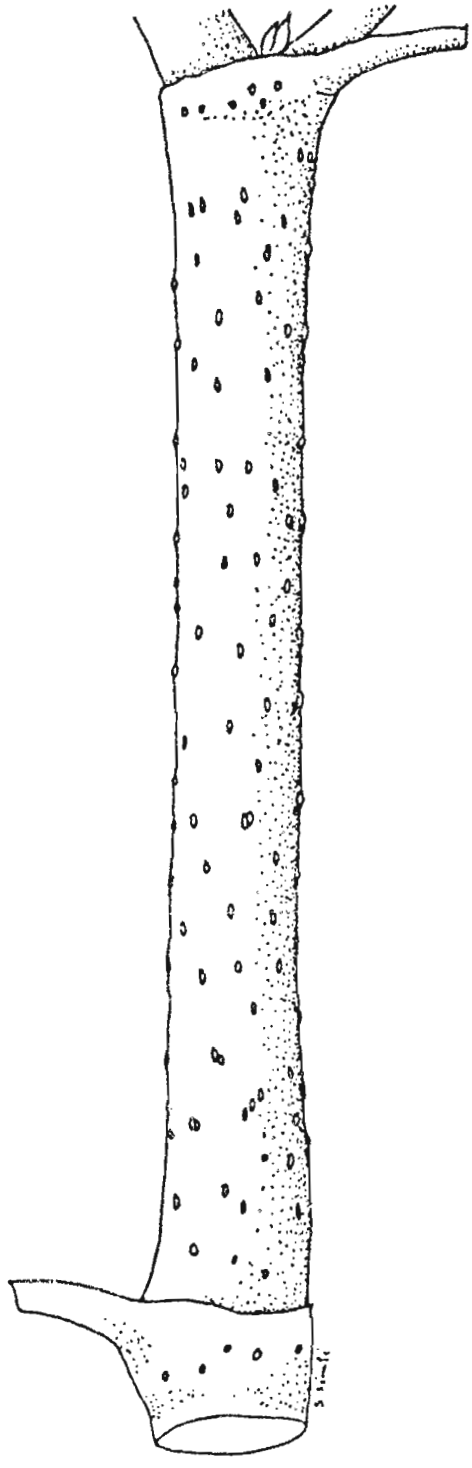


Fig. 16: VAN/2, "Bambu"

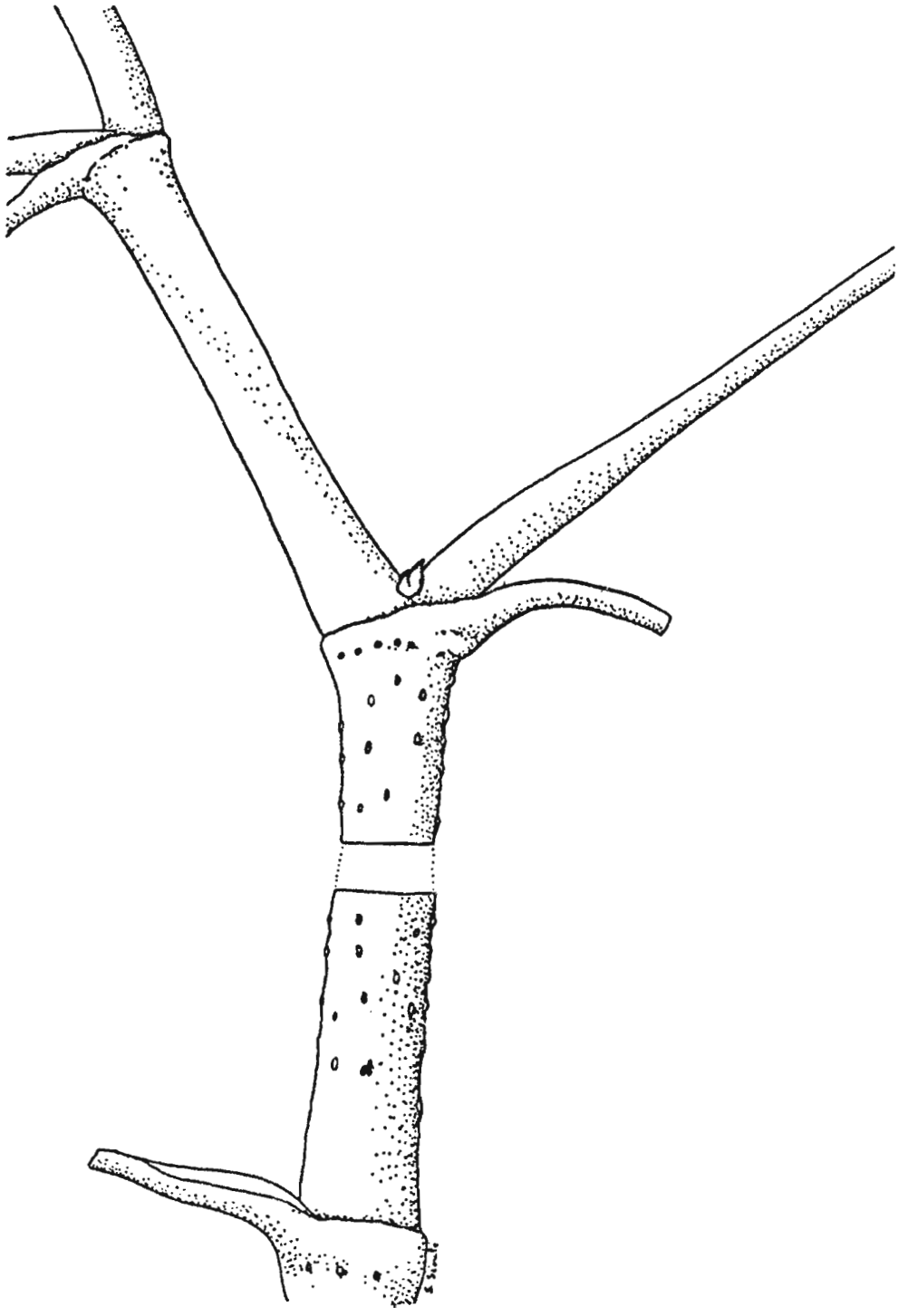


Fig. 17: PEN/24, "Rong Rong Wul"

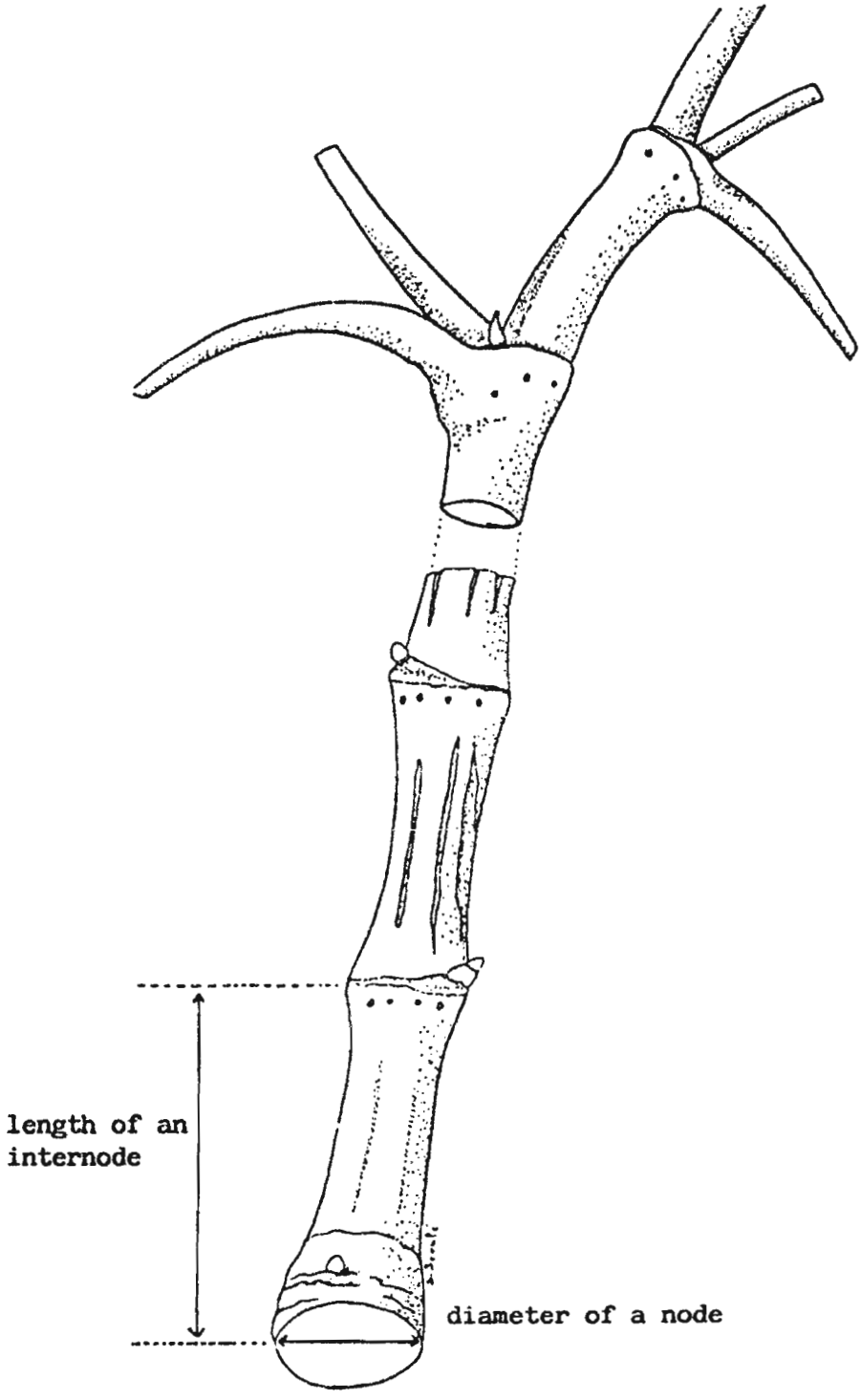


Fig. 18: TAN/7, "Pia"

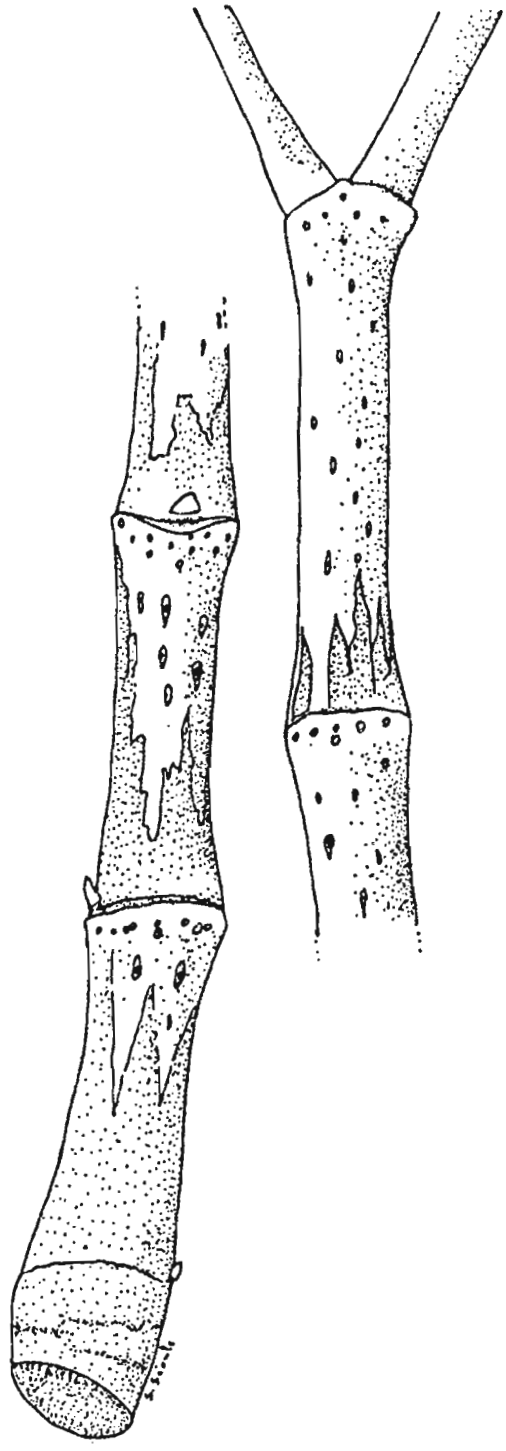


Fig. 19: SAN/2, "Fock"

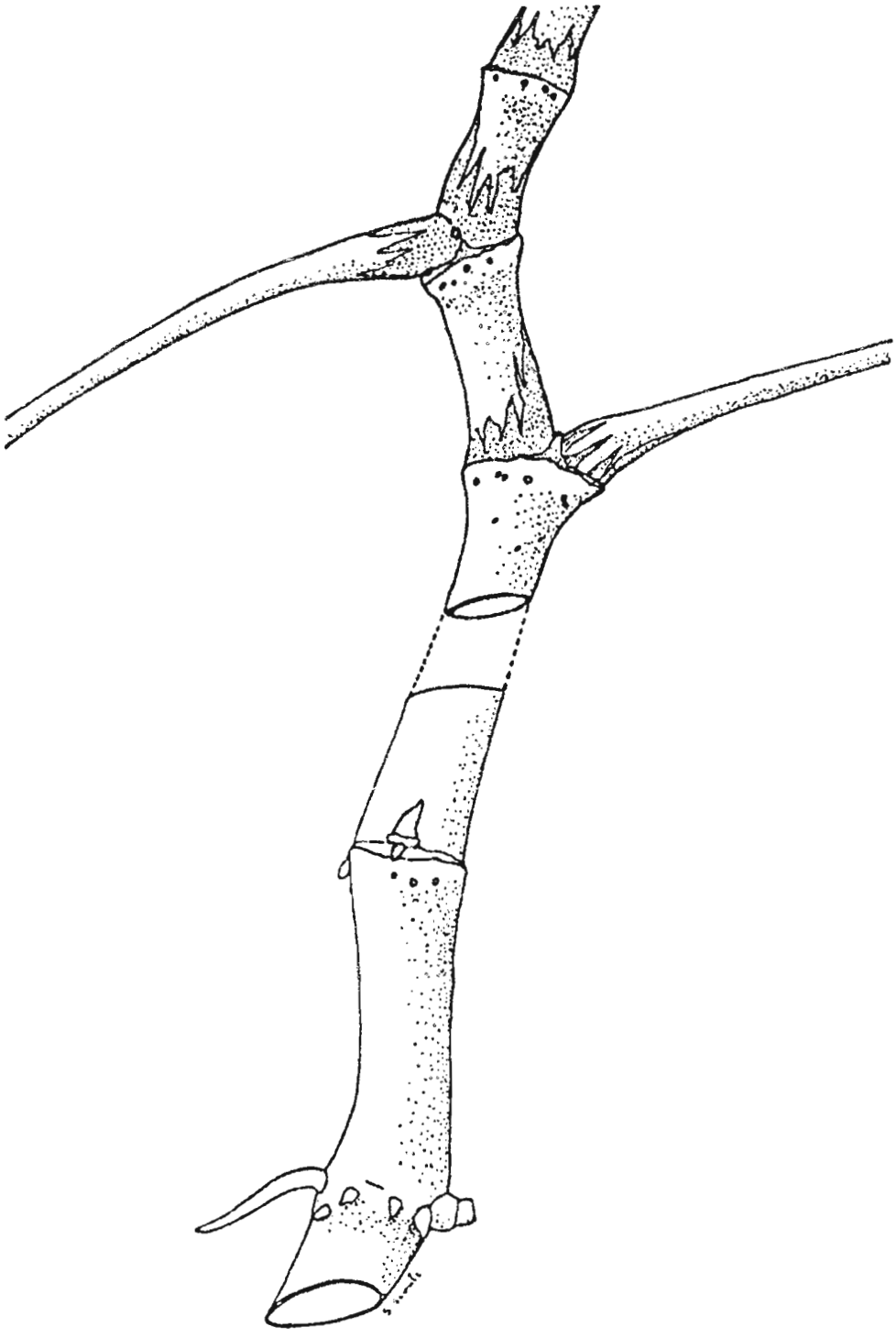


Fig. 20: PEN/24, "Rong Rong Wul"

B and O are expressed as a percentage of L. Where a cultivar has a lamina of 111 %, B is 1.11 times greater than L.

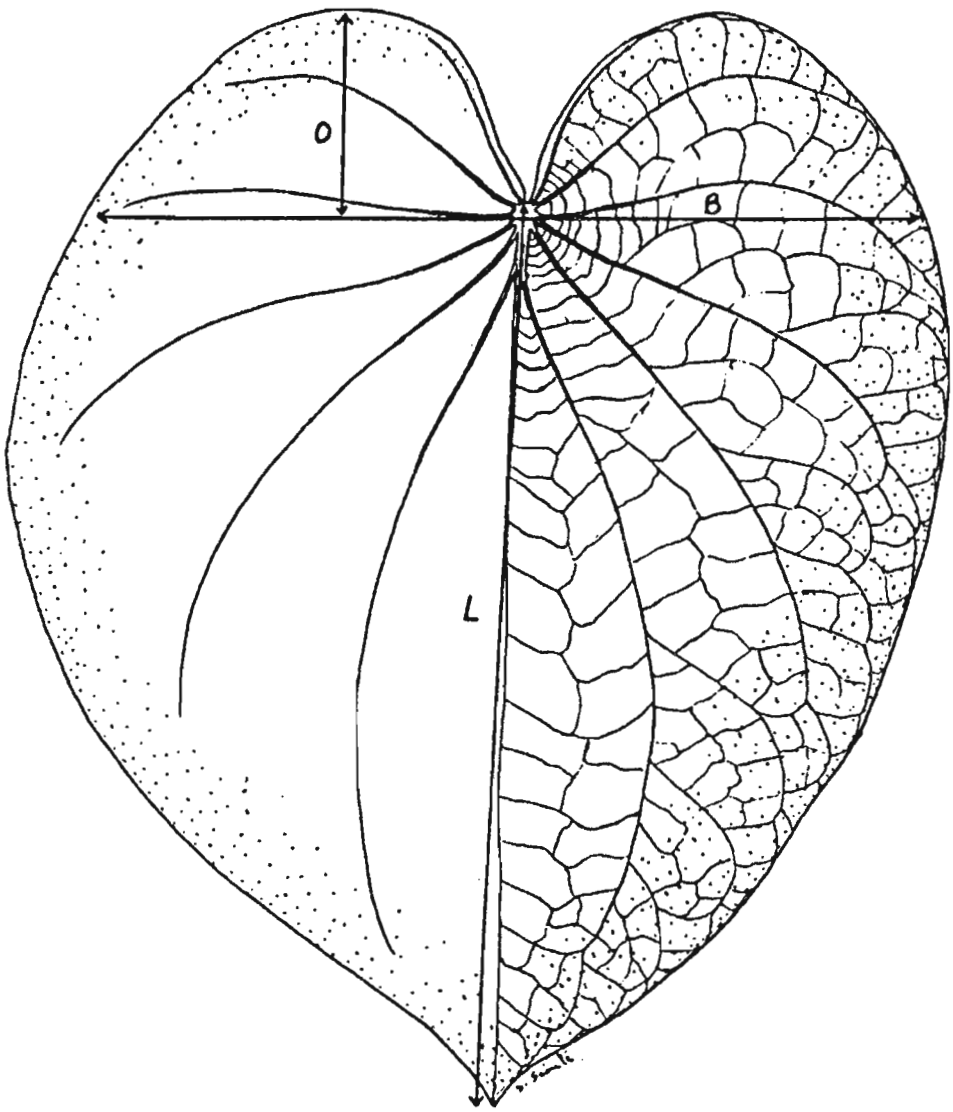


Fig. 21: TAN/7, "Pia"

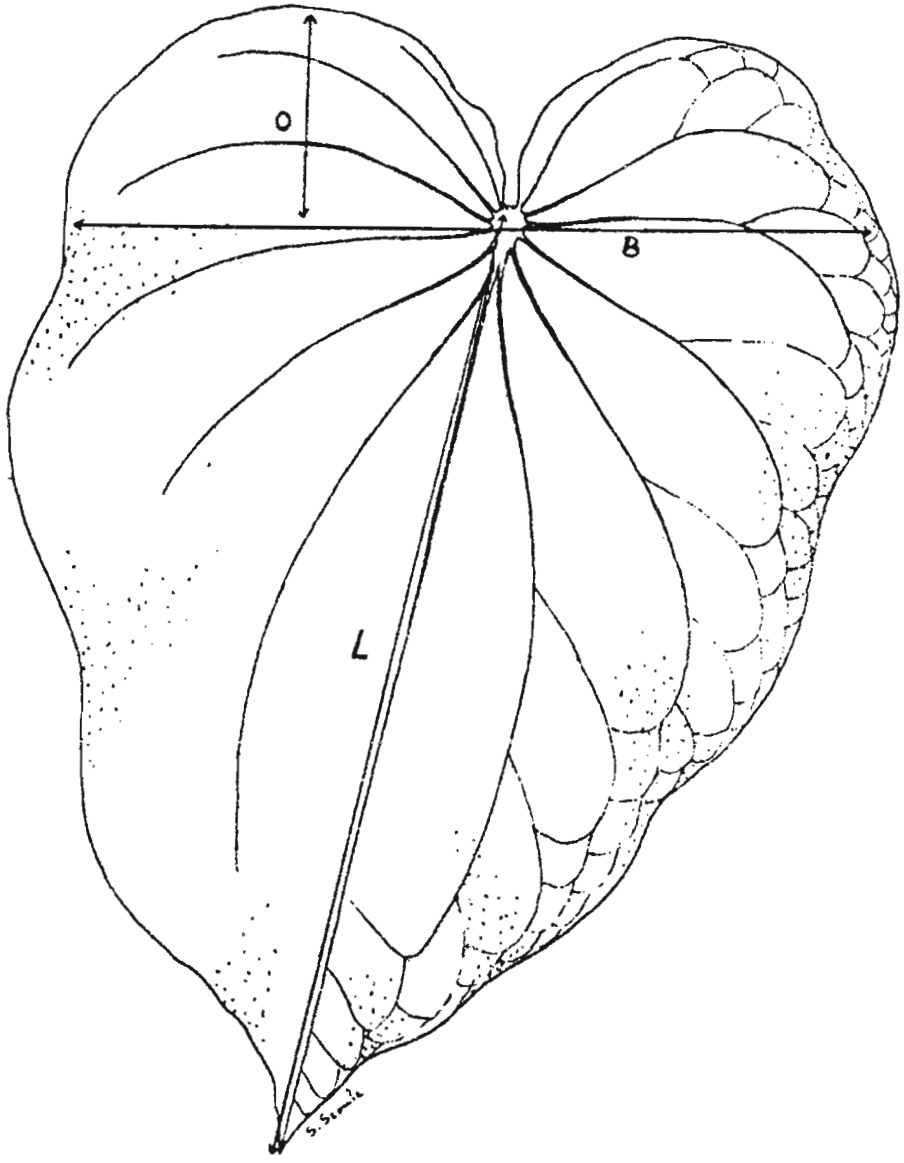


Fig. 22: SAN/2, "Fock"

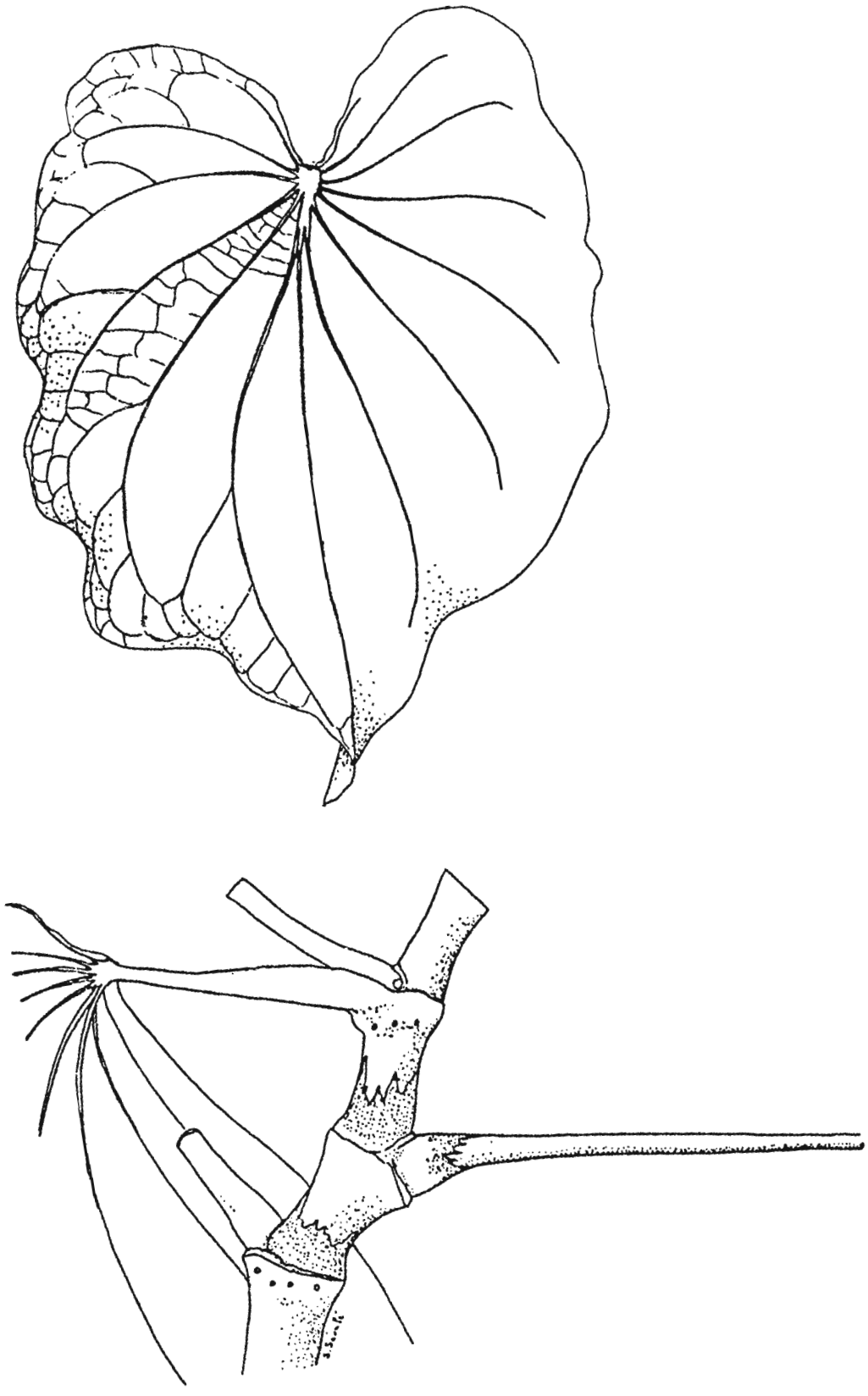


Fig. 23: VAN/2, "Bambu"

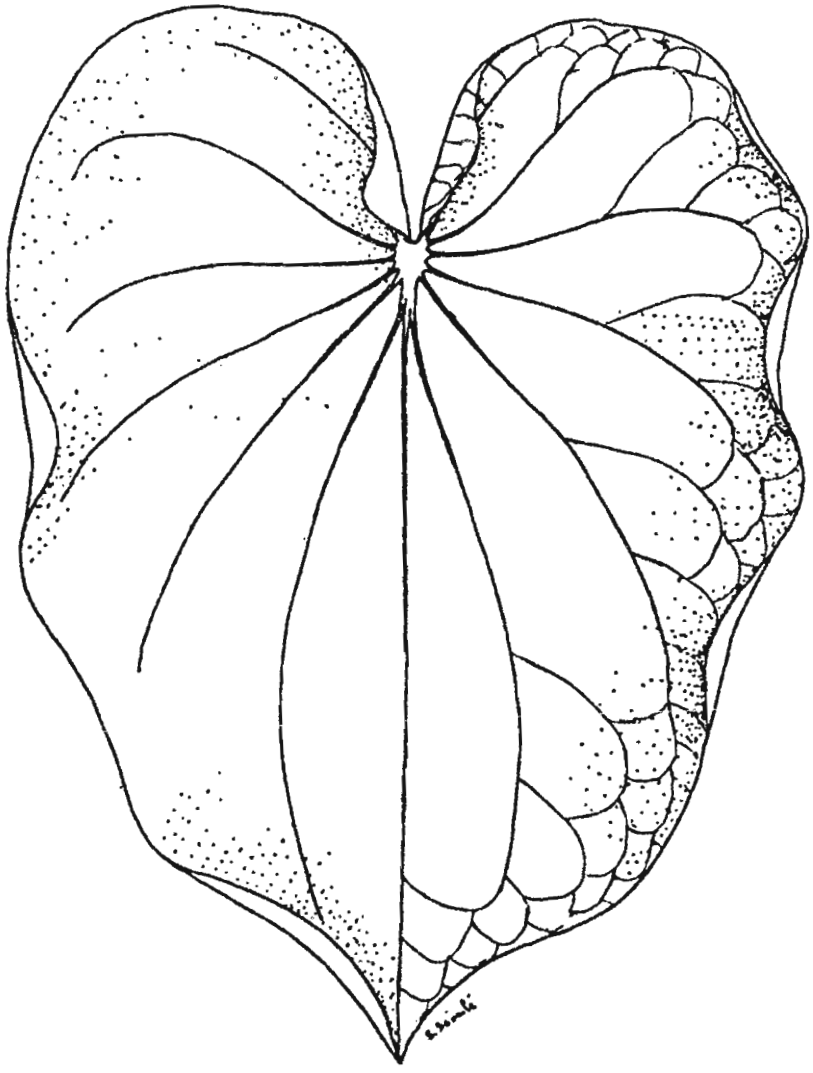


Fig. 24: EMA/7, "Miela"

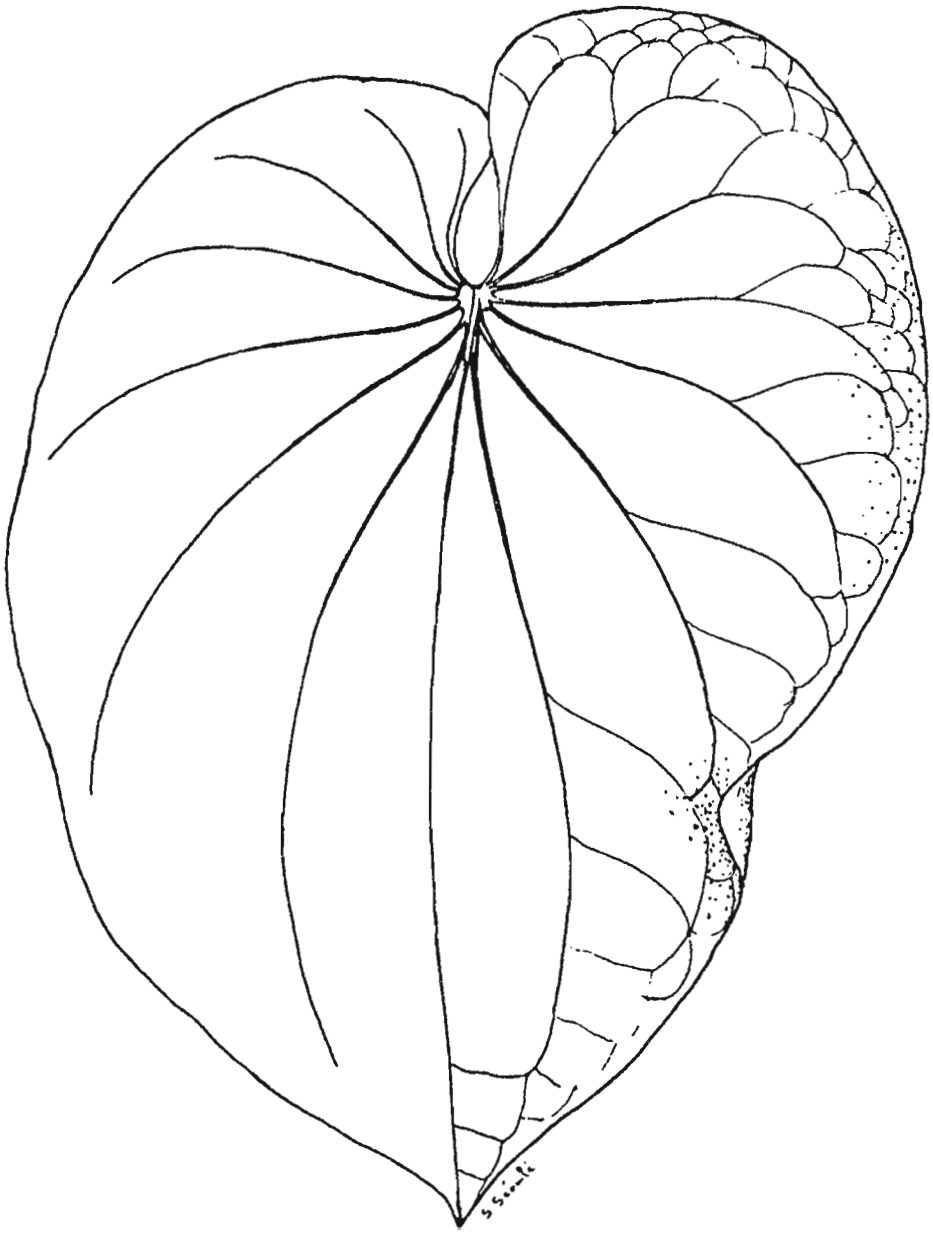
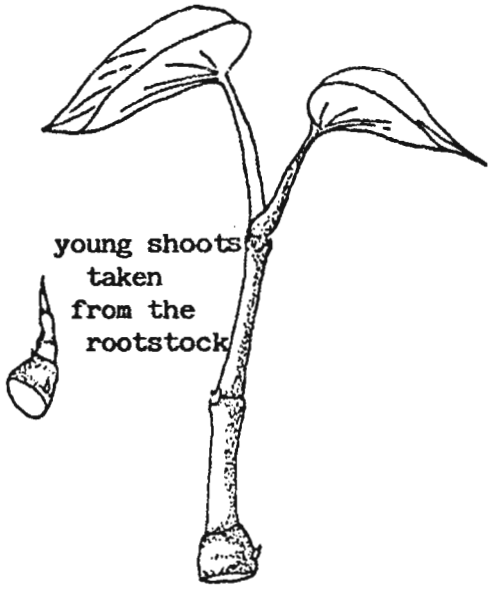


Fig. 25: Nursery cuttings



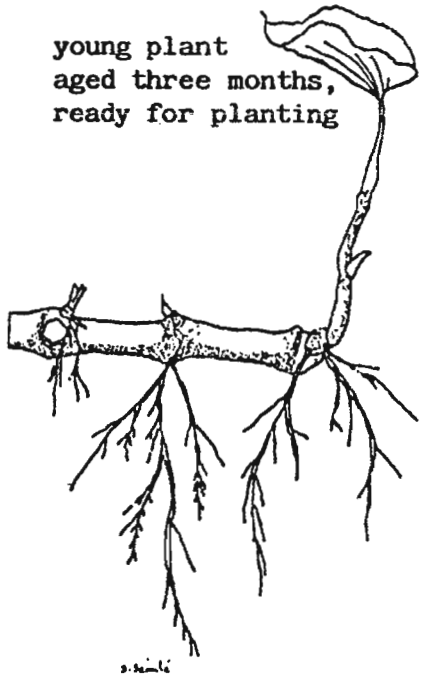
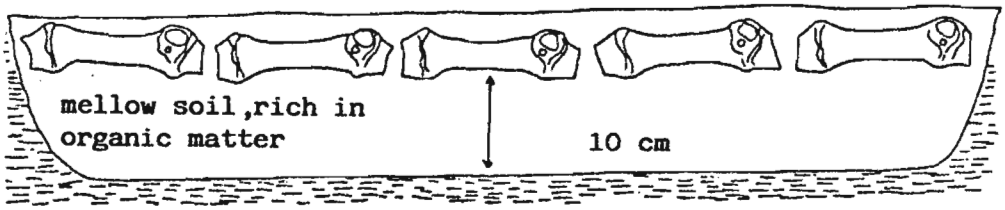
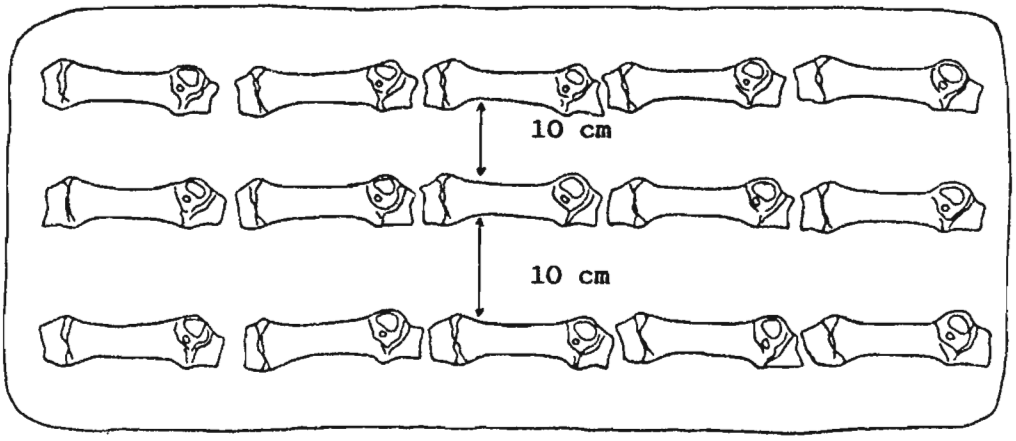


Fig. 26: Nursery

side view



view from above



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4. Agronomy or market research

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