appear cognate with *kau* on Baluan. However, it is currently n.)ssible to determine whether the plant was initially introduced to the Admiralty Islands from Kosrae and Pohnpei or vice versa. Whatever the direction of diffusion, Vanuatu would have been the ultimate source.

Significantly, linguistic research indicates affinities between the languages of northern Vanuatu and those of Nuclear Micronesia. Tryon (1984) suggests that around 3500 B.P. "a set of migrations apparently began in the northern/central Vanuatu region, one moving north, spreading the Austronesian languages throughout Micronesia . . . another moving southeast to the Fiji group." Pawley and Green (1984) also recognize these linguistic affinities and cluster together Vanuatu and Nuclear Micronesian languages in their subgroupings of the Oceanic languages. These linkages corroborate the observation that linguistic relations "indicate a movement from the New Hebrides [Vanuatu] to Micronesia" (Grace 1964). In addition to linguistic affinities, ongoing isozyme studies on cultivars of taro (*C. esculenta*; Lebot 1992) and on breadfruit (Ragone 1991) also indicate a movement of plant clones from Vanuatu to the eastern Carolines. Taro, breadfruit, and kava all share this route of dispersal.

As we will see in following chapters, the linguistic, botanical, and genetic evidence that suggests a northern Vanuatu origin for *P. methysticum* is supported by island mythologies, similarities in drug preparation techniques, and cultivar chemistry. The history of kava is about the human dispersal of planting material throughout the Pacific. It is about kava adoption, rather than kava abandonment, by island societies. Today, in spite of 150 years of religious and governmental prohibitions on its cultivation and consumption, kava and its use are still spreading.

3. Chemistry
Active Principles and Their Effects

Numerous chemical and pharmacological studies of kava have been published over the past 140 years, producing a wealth of data. However, the results of these efforts have often been tentative, fragmentary, and contradictory. This chemical research has had a dual aim: (1) to identify the active principles responsible for kava's psychoactive effects and (2) to analyze the physiological activity of those ingredients. In this chapter we first describe the psychoactive effects of kava drinking and then present a chronological review of scientific research focusing on the chemistry of *P. methysticum*. We do not discuss the neurological mechanisms that underlie kava's psychoactive effects on human emotions. Significant research into kava's alteration of brain chemistry has yet to be undertaken.

Physiological Effects of Kava

Fresh kava rootstock, when prepared by mastication, pounding, or grinding, yields a greenish milky potion that is considerably stronger than the grayer mixture obtained from dry roots. Before L. Lewin began his scientific research on the plant in Germany during the nineteenth century, it was generally believed that the method of preparation was the only factor that determined the strength and kind of kava's physiological effects. It was assumed that saliva, mixed in during the mastication process, converted starches contained in kava rootstock into sugar, which produced alcohol when fermented. Lewin (1886a) concluded more than a century ago that "this theory is incorrect in every respect."

Steinmetz (1960) was the first to point out that the main factor determining the psychoactive impact of kava is the degree of separation in water of the resinous active ingredients. Van Veen (1939) had noted that for kava to be most effective, rootstock must be emulsified very finely in water, saliva, lecithin, or oil to disperse the active ingredients. Mastication transforms rootstock mass into tiny particles, releasing the resin stored in the cell tissues. The active substances in this resin, insoluble in water, become available to the drinker after emulsification. This, rather than the action of saliva, explains why kava drink prepared by grinding or pounding rootstock often has less physiological effect than that produced from finely chewed, emulsified rootstock.

Infused kava is an emulsion of lipidlike compounds suspended in water. The resinous compounds present in each cell of the rootstock as microscopic drops are dispersed when the root tissues are macerated and infused. When the beverage is ingested, thousands of these microscopic particles transit rapidly through the stomach membrane to the bloodstream. If the emulsion is rich in active resinous compounds, this will induce a rapid and pronounced psychoactive effect.

Of all the scientists who have studied the physiological effects experienced by kava drinkers, Lewin has provided some of the most eloquent descriptions. In 1886 he noted that "a well-prepared kava potion drunk in small quantities produces only pleasant changes in behavior. It is therefore a slightly stimulating drink which helps relieve great fatigue. It relaxes the body after strenuous efforts, clarifies the mind and sharpens the mental faculties. If a certain quantity of these active elements is absorbed they produce special narcotic effects" (Lewin 1886a). A later publication (Lewin 1927) offers a more detailed description of kava's effects on the human mind and body:

> 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. (Translation by R. M. Benyon in Lebot and Cabalion 1988)

A more recent but equally graphic description of kava's effects is provided by Gregory, who writes from his own experience with the drug:

> Kava seizes one's mind. This is not a literal seizure, but something does change in the processes by which information enters, is retrieved, or leads to actions as a result. Thinking is certainly affected by the kava experience, but not in the same ways as are found from caffeine, nicotine, alcohol, or marijuana. I would personally characterize the changes I experienced as going from lineal processing of information to a greater sense of "being" and contentment with being. Memory seemed to be enhanced, whereas restriction of data inputs was strongly desired, especially with regard to disturbances of light, movements, noise and so on. Peace and quiet were very important to maintain the inner sense of serenity. My senses seemed to be unusually sharpened, so that even whispers seemed to be loud while loud noises were extremely unpleasant. (Gregory and Cawte 1988)

To explain the potency and action of the drug, Steinmetz (1960) suggested that kava affects the nervous system through a reduction of spinal (rather than cerebral) activity followed by muscular stimulation and then paralysis that particularly affects the lower limbs. It reduces the cardiac rhythm, and first stimulates and then slows down respiration. Unlike alcohol, kava does not influence drinkers' capacity to think clearly before they are overcome by sleep. Some drinkers, like Gregory, even claim that kava consumption can help clarify their thought processes.

As is often reported, kava drinking also causes pupil dilation and reduced light reflexes if an excessively strong dose is absorbed. Immoderate drinkers sometime suffer from photophobia. Cases of diplopia (double vision) are also known, manifesting temporary oculomotor paralysis (Frater 1952). Garner and Klinger (1985) conducted an experiment on a thirty-year-old male who had not previously ingested kava. The beverage increased his pupil diameter and disturbed his oculomotor balance. The mechanisms responsible for these symptoms were difficult to pinpoint, but Garner and Klinger concluded that the disturbance of oculomotor balance must be caused by the general effects of kava on the central nervous system.

Half a coconut shell (approximately 100–150 ml) of certain varieties of kava is strong enough to put a drinker into a deep, dreamless sleep within 30 minutes. On average, such an emulsion contains 1.0–1.5 g of psychoactive resin (Lebot 1988). This is excellent performance for a soporific drug. The next day the drinker awakens having fully recovered normal physical and mental capacities. Kava produces no aftereffects comparable to those of alcohol when reasonable quantities of the drug are consumed. Contrary to Lewin's claims (1886a) that "from the point of view of its moral influence on the individual this passion is like alcoholism, morphine-addiction and other yearnings," obvious chemical addiction to kava does not occur (Lebot, personal observation, 1981–87; Lindstrom, personal observation, 1978–89).

Although Lewin believed kava was addictive, he denied that it was "responsible for the skin diseases of the Pacific Islanders, especially a state of scaly exfoliation giving the skin a shrivelled appearance" (Lewin 1886a). This affliction is in fact one documented side effect of chronic kava consumption. Very heavy drinking may cause skin lesions and drying of the skin, producing an advanced exanthema of itchy urticarial patches (Lebot, field observations, 1985).

Kava drinkers are thus sometimes recognizable by their bloodshot eyes and ulcerous skin. These symptoms occasionally are wrongly diagnosed as ichthyosarcotoxism, or ciguatera (fish poisoning), which is an occasional health problem in the South Pacific. Such reactions are only found in heavy drinkers and can be attributed to the properties of kava's active constituents, lactones. The lactones in kava are related to sesquiterpenical lactones—"allergens capable of causing severe eczemas . . . what provokes the aggressiveness of these substances is the presence of an alpha-methylene-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" (Benezra and Dupuis 1983). Skin lesions, called *kani kani* in Fiji (Frater 1952), disappear if kava consumption is reduced. Kani kani seems to affect only those drinkers who are susceptible to the allergens.

A second side effect of heavy kava consumption is an occasional state of apathy that reportedly affects some drinkers, preventing them from eating adequately. In areas where kava is prepared by grinding dried rootstock rather than masticating fresh rootstock, these side effects are less common because grinding dried rootstock yields a drink with weaker physiological potency. Furthermore, if kava—chewed or pounded, fresh or dried—is drunk in moderation, it has no toxic consequences or other deleterious side effects.

Identification of the Active Principles

Analysis of the composition of kava rootstock indicates that fresh material on average is 80% water. When dried, rootstock consists of approximately 43.0% starch, 20.0% fibers, 12.0% water, 3.2% sugars, 3.6% proteins, 3.2% minerals, and 15.0% kavalactones, although the kavalactone component can vary between 3% and 20% of rootstock dry weight depending on the age of the plant and the cultivar (Lebot and Lévesque 1989; see table 3.1). Those who have attempted to isolate the active principles have taken two approaches: some have studied water-soluble fractions of kava rootstock, whereas others have analyzed fractions of kava resin extracted by organic solvents. Although research remains to be done regarding the chemistry of water-soluble fractions, it is now clear that the active principles

Table 3.1. Sugar, protein, and mineral composition of kava stump and roots (percentage of dry matter)

Sugars		Proteins (amino acids)		Minerals	
Saccharose	0.50	Aspartic acid	0.28	Potassium	2.237
Maltose	0.10	Threonine	0.08	Calcium	0.372
Fructose	1.75	Serine	0.11	Magnesium	0.179
Glucose	0.85	Glutamic acid	0.26	Sodium	0.111
Total	3.20	Glycine	0.11	Aluminum	0.150
		Phenylalanine	0.07	Iron	0.106
		Histidine	0.05	Silica	0.090
		Lysine	0.10	Total	3.245
		Arginine	0.08		
		Alanine	0.16		
		Valine	0.11		
		Methionine	0.02		
		Isoleucine	0.07		
		Leucine	0.14		
		Tyrosine	0.06		
		others	1.87		
		Total	3.57		

Source: Lebot and Cabalion 1986.

of kava are mostly, if not entirely, contained in its resin. These molecules are a series of lactones—that is, organic compounds containing oxygen, with similar structures. These are alpha-pyrones bearing a methoxyl group at carbon 4 and an aromatic styryl moiety at carbon 6 (Hänsel 1968).

Kava resin has been investigated using several analytical techniques, including thin-layer chromatography, gas chromatography, and high-performance liquid chromatography (Lebot and Lévesque 1989). Some methods of extraction, isolation, and analysis can encourage the formation of artifacts, or substances that are naturally absent from the plant; the composition of a lipid extract thus may vary according to the type of extraction process used, distorting observed activity. If the drink or extract is prepared by infusion or decoction in hot water, for example, enzymes may be destroyed, whereas if an extract is prepared by maceration in cold water, enzymes may be preserved.

The emergence of information about kava chemistry over the past 100 years has been laborious and contentious. During the last half of the nineteenth century, controversy surrounded the issue of who first isolated and described the inebriating substance of kava and the basis of its psychoactivity. On 10 April 1857, while serving as a pharmacist in the French navy, Cuzent isolated an apparently pure crystalline substance he named "kavahine . . . , to perpetuate the name of kava given to *P. methysticum* by the Polynesians" (Cuzent 1857). [Mea]nwhile, Gobley had obtained what he labeled "methysticin" from a sample sup[pli]ed by Cuzent to O'Rorke, another pharmacist who had just traveled around the world via Polynesia (Cuzent 1857 [10 May]). Gobley (1860) proposed the name methysticin for "the inebriating substance in the drink." He analyzed the composition of hot-air-dried kava rootstock as 26% cellulose, 1% crystalline methysticin, 49% starch, 2% resin combined with an essential oil (lemon yellow in color), 15% water, and 7% substances of lesser importance (including 1% potassium chloride and 3% calcium carbonate combined as ash).

Various authors have suggested that the two compounds isolated by Cuzent and Gobley—kavahine and methysticin—are the same and correspond to methysticin as it is known today (see figure 3.1). However, the percentage analysis of carbon (C), hydrogen (H), and oxygen (O) given by Cuzent (1861a) for kavahine (65.85% C, 5.64% H, and 28.51% O) is closer to the composition of dihydromethysticin (65.21% C, 5.84% H, 28.95% O) than to that of methysticin (65.69% C, 5.15% H, 29.17% O, calculated in Lebot and Cabalion 1986). The melting point of kavahine, 120°–130° C, is also nearer to that of dihydromethysticin (116°–118° C, Winzheimer 1908; 117°–118° C, Borsche and Bodenstein 1929; 118° C, Jössang and Molho 1970) than to that of methysticin (132°–135° C, Saüer and Hänsel 1967; 136°–137° C, Rasmussen et al. 1979; 139°–140° C, Borsche and Peitzsch 1929a; see also Duve 1981). The differences observed between these figures would be easy to explain if Cuzent had actually obtained and analyzed pure syncrystals, but the 10° C variation in the melting point of his kavahine indicates that the substance he analyzed was contaminated. Our best guess is that Cuzent's kavahine was a mixture of dihydromethysticin and methysticin.

The so-called methysticin isolated by Gobley contained 1.12% nitrogen (Cuzent 1983) and therefore was probably also impure, though of different composition from Cuzent's kavahine. Seemann (1868), probably quoting Gobley, also wrongly cited 1.12% as the nitrogen content of the "chemical constituents" of kava, suggesting that methysticin represented 1% of the dry weight.

When Lewin published his monograph on kava in 1886, he claimed to have been the first to isolate the active components of kava, but he was overlooking the earlier work of Cuzent (1861b), Gobley (1860), O'Rorke (1856), and Nölting and Kopp (1874), who had already isolated yangonin in 1874. Lewin isolated yangonin and also methysticin, concluding correctly, as had Gobley, that kava's active substance was in its resin. This he broke down into alpha resin and beta resin using a process that involved the use of fat solvents, such as petroleum ether, chloroform, and benzene (Lewin 1886a).

Although Lewin did not find any new active ingredients (kavalactones) in 1886,

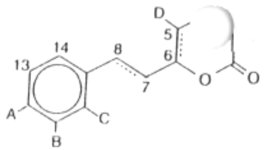
his pharmacologic[al res]earch and the favorable publicity he gave *P. methysticum* encouraged many sc[ie]ntific teams, especially in Germany, to investigate the drug from both chemical and pharmacological viewpoints. Major chemical substances were isolated from kava rootstock and their structures determined, but a detailed picture of the main active ingredients remained elusive for years. Borsche 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" (Borsche and Lewinsohn 1933). However, the foundation for discovery of kava's psychoactive principles was laid by chemists working with Borsche, who, between 1913 and 1933, isolated a series of compounds they called kavalactones—including kavain, methysticin, dihydrokavain, and dihydromethysticin.

Methysticin was first obtained in a pure state by Pomeranz in 1889 after its original isolation by Gobley, Cuzent, and Nölting and Kopp. It was found to yield methysticic acid ($C_{15}H_{12}O_5$; Pomerang 1889). A second kavalactone, yangonin, was isolated by Reidel in 1904 and a third, dihydromethysticin, by Winzheimer in 1908. Borsche and Gerhard (1914) determined the formulas of these kavalactones: methysticin, $C_{15}H_{14}O_5$; yangonin, $C_{15}H_{14}O_4$; and dihydromethysticin, $C_{15}H_{16}O_5$.

Borsche isolated an additional kavalactone, kavain ($C_{14}H_{14}O_3$), and converted it into kavaic acid by alkaline treatment and to dihydrokavain by hydrogenation. He attempted unsuccessfully to confirm the structure of kavain by synthesis and concluded wrongly that none of the substances he isolated possessed an identifiable physiological activity. He thus failed to recognize the important psychoactive role of kavalactones, especially dihydrokavain. Still, the meticulous and methodical research carried out by Borsche's team produced 14 dissertations that helped clarify the chemistry of kava (see Bibliography).

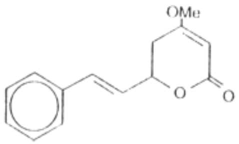
Not until 1938, when Van Veen applied the adsorption column technique, was a kavalactone readily isolated in crystalline form by combining the extraction method with chromatographic analysis. Van Veen named this crystallizable substance marindinin ($C_{14}H_{16}O_3$) after the Marind-anim people of southeastern Irian Jaya, where the kava sample he analyzed was collected. He claimed incorrectly that marindinin (which is actually dihydrokavain) is the only substance in kava that affects the nervous system (Van Veen 1939).

Other research efforts have been directed toward chemical synthesis to address issues of availability and quality of experimental material, variations in natural composition, and purity of active substances. Steinmetz (1960) reported that kavain and dihydrokavain were synthesized for the first time in 1942. Borsche and Peitzsch (1929a, 1929b) synthesized d,l-dihydromethysticin in 1929, and Klohs,

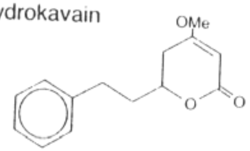


	A	B	C	D	C5-C6	C7-C8
1. Kavain					–	=
2. 7,8-Dihydrokavain					–	–
3. 5,6-Dehydrokavain					=	=
4. Yangonin	OMe				=	=
5. 5,6,7,8-Tetrahydroyangonin	OMe				–	–
6. Methysticin	$O\text{-}CH_2\text{-}O$				–	=
7. Dihydromethysticin	$O\text{-}CH_2\text{-}O$				–	–
8. 5,6-Dehydromethysticin	$O\text{-}CH_2\text{-}O$				=	=
9. 5,6-Dihydroyangonin	OMe				–	=
10. 7,8-Dihydroyangonin	OMe				=	–
11. 10-Methoxy-yangonin	OMe		OMe		=	=
12. 11-Methoxy-yangonin	OMe	OMe			=	=
13. 11-Hydroxy-yangonin	OMe	HO			=	=
14. Hydroxykavain				OH	–	=
15. 11-Methoxy-12-hydroxy-dehydrokavain	OH	OMe			=	=

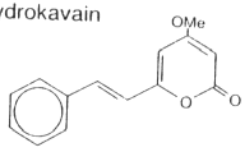
1. Kavain



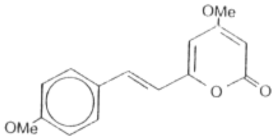
2. 7,8-Dihydrokavain



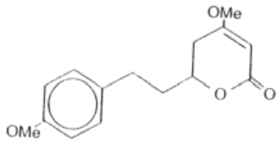
3. 5,6-Dehydrokavain



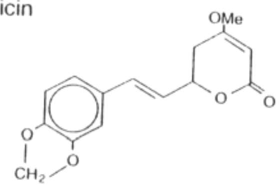
4. Yangonin



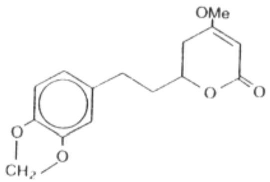
5. 5,6,7,8-Tetrahydroyangonin



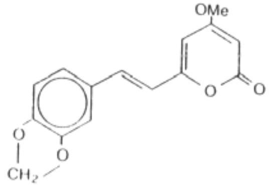
6. Methysticin



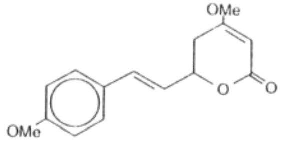
7. Dihydromethysticin



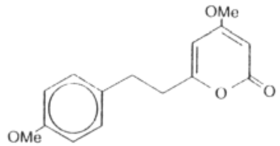
8. 5,6-Dehydromethysticin



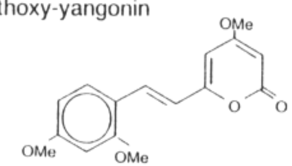
9. 5,6-Dihydroyangonin



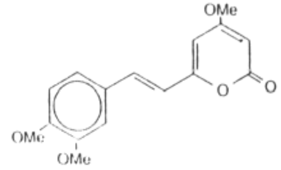
10. 7,8-Dihydroyangonin



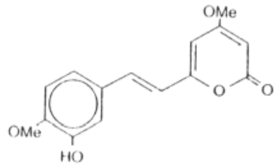
11. 10-Methoxy-yangonin



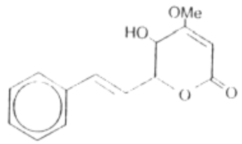
12. 11-Methoxy-yangonin



13. 11-Hydroxy-yangonin



14. Hydroxykavain



15. 11-Methoxy-12-hydroxy-dehydrokavain

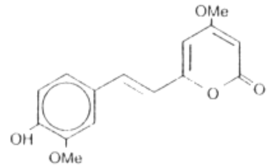


Figure 3.1. Chemical structure of kavalactones (from Lebot and Cabalion 1986).

Keller, and Williams (1959) were the first to synthesize d,l-[illegible]hysticin. After Klohs's work (1967), the Riker laboratories in Northridge, Califo[illegible]a, registered a patent protecting the synthesis of d,l-methysticin and d,l-dihydromethysticin. Hänsel, Saüer, and Rimpler (1966) have added four new kavalactone compounds to the alpha-pyrone series with the isolation of 5,6-dehydromethysticin, demethoxy-yangonin, 11-methoxy-yangonin, and 11-methoxynoryangonin. The structures of these compounds have been confirmed by synthesis.

Although such kavalactones as kavain and methysticin can now be synthesized, these synthetics do not induce the same physiological effects as the natural raw extract. The efficacy of kava evidently does not stem from a single active substance but rather from a mixture—a blending of several kavalactones that results in a synergistic physiological effect. Some kava constituents may be of secondary importance but are nonetheless required to induce the whole suite of psychoactive effects. Each kavalactone so depends on the presence of the others that unaltered extracts produce more potent psychoactive results than does any single isolated substance (Steinmetz 1960).

Molecular Structures of Isolated Compounds

Alkaloids

A number of scientists claim to have found alkaloids among the substances extracted from kava root. Some of the physiological effects of kava are close enough to those produced by alkaloids (e.g., the anesthetic effect of cocaine and the muscle relaxation caused by papaverine) that the temptation to seek alkaloid structures is understandable. However, nitrogen, an alkaloidal constituent, is absent from chemical products obtained from kava resin. Some authors have claimed that the presence of alkaloid compounds in kava is demonstrated by reactions in thin-layer chromatography; but Hänsel (1968) has challenged these claims, arguing that the reagents used in chromatographic analysis are not specific to alkaloids. He also recognized that lactones, which are nitrogen-free compounds, can react like alkaloids when analyzed chromatographically (Farnsworth, Pilewski, and Draus 1962).

Achenbach and Karl (1970a), using more sophisticated methods of analysis, succeeded in isolating two alkaloids from kava rootstock. However, these alkaloids are not part of the resinous extract responsible for kava's physiological effect. R. M. Smith (1979) identified in kava leaves a third alkaloid, specific to *P. methysticum,* which he named pipermethystin.

Lactones

The skeletons of the lactonic molecules isolated from kava rootstock are generally 4-methoxy-2-pyrones with phenyl or styryl substituents at the 6- position (figure 3.1). They consist of thirteen carbon atoms, six of which form a benzene ring attached by a double bond to an unsaturated lactone. Fifteen lactones have been isolated from kava rootstock (Hänsel 1968), nine of which have been fully identified. The following six compounds are present in the highest concentrations: yangonin, methysticin, dihydromethysticin (synonym pseudomethysticin), kavain, dihydrokavain (synonym lewinin), and demethoxy-yangonin. Nine other compounds are of minor importance in the rootstock: dehydrokavain, cis-5-hydroxy-kavain, 7,8-dihydroyangonin, 5,6-dihydroyangonin, 5,6-dehydro-methysticin, 11-methoxy-yangonin, 11-hydroxy-yangonin, 11-methoxy-12-hydroxy-dehydrokavain, and 10-methoxy-yangonin (Duve 1981).

Some researchers have tried to classify kavalactones by reference to common characteristics. The simplest method of grouping is one suggested by Hänsel (1968), which sorts the molecules according to the presence or absence of double bonds at the 5,6 and 7,8 positions and divides them into two major groups: the enolides, with one double bond, and the dienolides, with two double bonds. This system recognizes that primary chemical differences among the kavalactones involve the presence or absence of these double bonds as well as the presence or absence of substituent groups in the phenyl ring.

It has been established that biogenetic activity is essentially similar in the various parts of kava's vegetative system but produces different chemical compositions in the stump, roots, and leaves (R. M. Smith 1983). After Hänsel (1968), Jössang and Molho (1970) attempted to explain the formation of kavalactones by two biosynthetic processes: one starting from cinnamic acid and resulting in styrylpyrones like dehydrokavain; and the other beginning with the alcohol corresponding to a given styrylpyrone, which develops into styryldihydropyrones like kavain. Kavain is notably absent from the leaves of the kava plant; this is explained by the immediate reduction of one double bond (7,8) by ascorbic acid. Yangonin and dehydrokavain are found in the leaves, but only in traces. Both major and minor kavalactones are present in variable concentrations in different parts of the plant. For example, Duve (1981) determined that together they compose 10.44% of the lateral roots and 5.28% of the rootstock (average of six samples). Concentrations of kavalactones are typically highest in the lateral roots and decrease progressively toward the aerial parts of the plant. In studies of kava from Vanuatu, Lebot (1988) found that when the kavalactone concentration was near 15% in the roots, it decreased to approximately 10% in the stump and 5% in the basal stems. These concentrations varied according to the cultivar (Lebot and Lévesque 1989).

Flavokavins and Other Compounds

Three flavokavins, labeled A, B, and C, have been identified in kava rootstock (Duve 1976; Hänsel, Ranft, and Baehr 1963; Dutta et al. 1973, 1976; for structures of flavokavins A and B see figure 3.2). Flavokavin C structure and synthesis were analyzed by an Indian team in 1976 (Dutta et al. 1976). Other substances

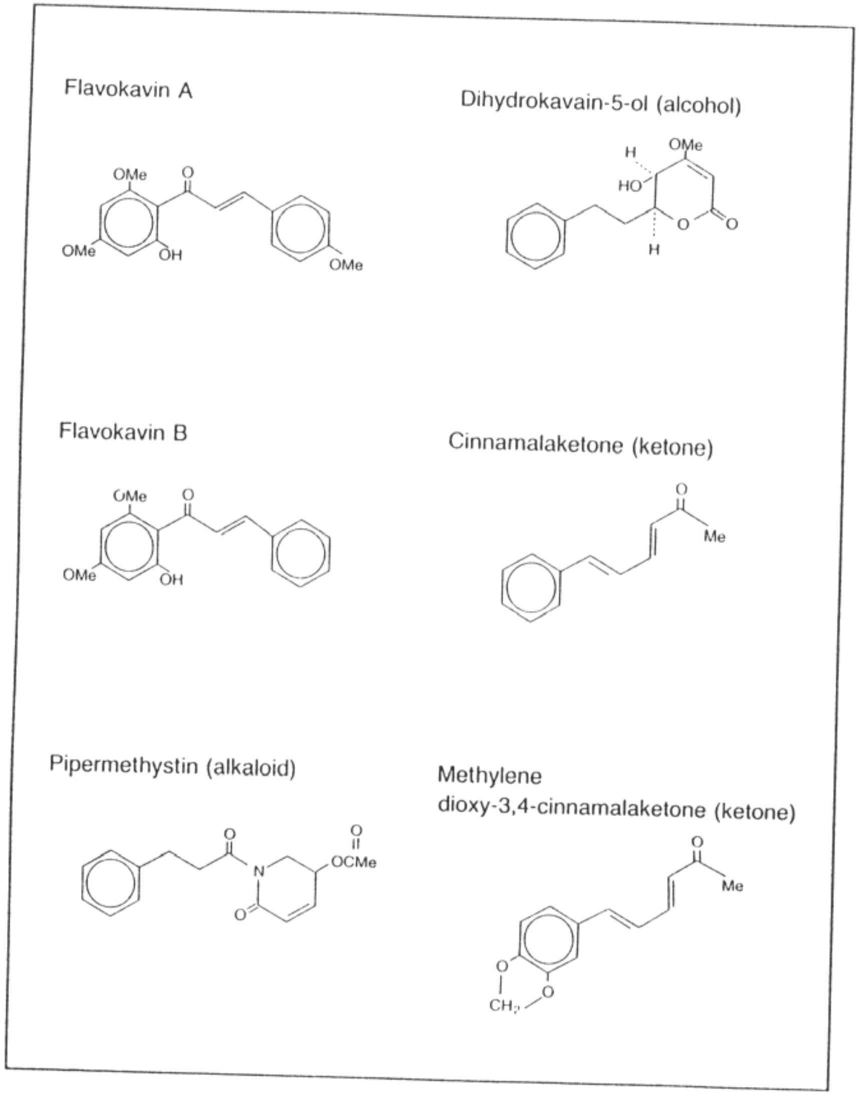


Figure 3.2. Chemical structure of flavokavins A and B and alkaloids (from Lebot and Cabalion 1986).

isolated from the kava t include an alcohol (Achenbach and Wittman 1970), ketones (Jössang and Molho 1967), a phytosterol (Jössang and Molho 1970), and organic acids (Achenbach and Karl 1970a).

Physiological Activity of Kavalactones

A team of scientists from the Freiburg University Institute of Pharmacology in Germany, led by H. J. Meyer, conducted the first comprehensive study of the physiological activity of the various kavalactones during the 1950s and 1960s. This research determined that the main properties of kavalactones are (1) potentiation of barbituric narcosis (Klohs et al. 1959; Meyer 1962), (2) analgesic effect (Brüggemann and Meyer 1963), (3) local anesthesia (Meyer 1964; Kretzschmar and Meyer 1965), (4) muscular relaxation (Meyer 1965), and (5) antimycotic activity (Hänsel, Weiss, and Schmidt 1966).

Meyer also attempted to account for the central nervous system and peripheral effects experienced by humans who consume kava. His Freiburg team was the first to document variation in the physiological effects of the major kavalactones. Absorption of kavain and dihydrokavain in the gastrointestinal tract, for example, was remarkably rapid. Methysticin and dihydromethysticin, in contrast, have a longer induction period and a more lengthy duration of action. Although Hänsel (1968) states that in animal experiments dienolides, kavalactones of the yangonin type, are pharmacodynamically inert compared with enolides, kavalactones of the kavain type, Meyer and his team had demonstrated earlier that all kavalactones are physiologically active. Their experiments showed that the six major kavalactones (kavain, dihydrokavain, yangonin, demethoxy-yangonin, methysticin, and dihydromethysticin) are pharmacologically effective and that differences in their action are quantitative as well as qualitative. These findings help explain why different chemical compositions of crude kava extracts have different physiological effects on human subjects both in the laboratory and in the field.

Potentiation of Barbituric Narcosis

Hänsel (1968), quoting Meyer (1962), noted that among the kavalactones, dihydromethysticin (DHM) has the greatest potentiating effect on barbituric narcosis. He cited an experiment in which Meyer injected white mice with 150 mg/kg of hexobarbital sodium, causing the animals to sleep for an average of 2 hours. Meyer then repeated the experiment, adding 240 mg/kg of DHM to the same dose of hexobarbital sodium, and observed that the animals slept for 27 hours. Hänsel concluded that the potentiating activity of DHM on barbituric narcosis is particularly pronounced. Furthermore, he demonstrated that 50–200 mg/kg of dihydrokavain (DHK) or DHM administered to the stomach mouse to sleep in 20 minutes. He noted that DHK, which is not soluble in water, is 95 percent soluble in ground-nut oil at 37° C and in gastric juices. Like Van Veen (1939), Hänsel concluded that DHK and DHM are the most active elements of kava.

Klohs et al. (1959) confirmed that DHK and DHM are the kavalactones with the most active potential, and Meyer and Kretzschmar (1966, 1969) ascertained that potentiation by these two lactones is similar to the narcotic effect of nitrogen protoxide and ether. Notably, traditional forms of potentiation occur in various kava-consuming societies. For example, on Pentecost, Vanuatu, to overinebriate a pretentious kava drinker, a lichen (*Usnea* sp.) is mixed with the rootstock before grinding. The potent effects of this drink may be explained as a synergy between the kavalactones and certain lactonic acids contained in the lichen (Molho, personal communication, 1984).

Analgesic Effect

Brüggemann and Meyer (1963) performed comparative tests to measure the analgesic effect of kava's two most powerful, and therefore therapeutically promising, lactones: DHK and DHM. The results of these tests are summarized in table 3.2.

Table 3.2. Relative effect of analgesics

Analgesic	Dosage required for equivalent effect (mg/kg)
Morphine	002.5
Dimethylaminophenazone	100.0
Dihydrokavain (DHK)	120.0
Dihydromethysticin (DHM)	120.0
Acetylsalicylic acid (aspirin)	200.0

Source: After Hänsel 1968, condensed from Brüggemann and Meyer 1963.

Local Anesthesia

When fresh kava is prepared by mastication, kavalactones produce local anesthesia of the chewer's mouth. Van Veen (1939) observed this phenomenon, but Meyer provided the most detailed scientific description of the effect. He noted that, of the many kavalactones that induce anesthesia, kavain is particularly effective in surface anesthesia and that the superficial anesthesia effects of kavain are equivalent to

and last as long as of cocaine. Meyer reported that the kavalactones are particularly interesting as superficial anesthetics because they manifest no toxicity in the tissues.

Baldi (1980) observed that a subcutaneous injection of an alcoholic kavain solution induces a local anesthesia for several hours and sometimes for several days. He found, however, that if the injected dose was high enough it caused paralysis of the peripheral nerves, and concluded that kavain is unsuitable as a local anesthetic, except perhaps in very moderate doses.

Anticonvulsive and Muscle-Relaxant Action

Meyer's Freiburg team demonstrated that DHM and DHK inhibit nervous and muscular contractions. Meyer and Kretzschmar (1966) observed that the length and intensity of effect of these compounds are comparable to those of the best synthetic products of phenobarbital, pyrimidin, and diphenyhydantoin in current use (Hänsel 1968; Jössang and Molho 1970). Kretzschmar (1970) described the "excellent psychopharmacological activity" of kavain, which produces "emotional and muscular relaxation, stabilization of the feelings and stimulation of the ability to think and act." Klohs et al. (1959) noted that kavalactones inhibit convulsions caused by strychnine and are a more effective countermeasure than mephenesin, the conventional antidote. Furthermore, a clinical test found antiepileptic action in DHM, which might also be used to treat schizophrenia (Klohs and Keller 1963). Jössang and Molho (1970), drawing on Meyer and Kretzschmar (1965), pointed out that DHM and DHK are muscular relaxants superior to substances normally used for such purposes (e.g., propanediol, benzazoles, and benzodiazepines).

According to Singh (1983), kavalactones act less by inhibition of neuromuscular transmission than by a direct effect on muscular contractibility:the postsynaptic depression is similar to that caused by lignocain and other local anesthetics. Hänsel (1968) observed that the effects of DHM and DHK on muscles are similar to those of papaverine. After experimenting on frogs, Singh suggested that kava acts on the ionic mechanisms that produce muscular contractions. It may be that kava also acts on the control of muscle relaxation by the central nervous system, as do barbiturates and tranquilizers (Bruce Morton, University of Hawaii, personal communication, 1990).

Antimycotic Activity

Hänsel (1968) took a special interest in the antimycotic activity of kava when he realized he had never observed kava extracts attacked by yeasts, bacteria, or fungi. Any regular visitor to the urban *nakamals* (kava bars) of Vanuatu will observe the same phenomenon in kava prepared several days in advance. I [illegible] Weiss, and Schmidt (1966) have suggested that although kavalactones poss[illegible] remarkable antimycotic properties, they can not be classified as bactericides. However, according to Steinmetz (1960), Marpmann had demonstrated much earlier that kavain does possess bactericidal properties, especially against gonococcus, the specific pathogenic agent of gonorrhea, and against colon bacillus and blennorrhea. Flavokavin C has been reported to have antibacterial activity against *Salmonella typhi*.

Hänsel (1968) added that although the number of known bactericides is high, substances capable of stopping the growth of dermatophytic mycoses are rare. He quoted as an example the case of griseofulvine, a substance commonly used to treat dermatophytic mycoses. Griseofulvine has no effect on strains of *Aspergillus niger*, but DHK is the perfect remedy because it completely inhibits the growth of *A. niger*. Hänsel believed that kava extracts could be used to prepare orally consumed antimycotics and suggested that clinical tests be carried out on pathogenic fungal strains affecting humans. Duve (1976) has proposed that the potential of these extracts as food preservatives be studied, for most alternative agents can be used only in limited concentrations because of their toxic effects.

Absorption and Metabolism of Kava Extracts

Researchers have attempted to elucidate the absorption and metabolism of kavalactones in animals. Rasmussen et al. (1979), for example, studied the metabolism of dihydrokavain, methysticin, yangonin, and 7,8-dihydroyangonin, administered orally and peritoneally, in rats. The metabolites were identified by gas chromatography, mass spectrography, and the two techniques combined. The researchers found melting points of the metabolites to be much higher than the norm for kavain (145°–146° C instead of 106°–107° C) and DHK (71°–73° C instead of 55°–57° C). The team also found that lipophilic kavalactones have extremely low solubility in water, which probably reduces their oral absorption rates and may be responsible for the variable and often low observed metabolism.

Duffield et al. (1986) detected the presence of kava compounds in the urine of kava drinkers. They analyzed the urine of 80 Aboriginal people from the Northern Territory of Australia and found that individuals who had recently drunk kava had markedly higher concentrations of kavalactones in their urine than those who had not consumed the beverage for some time. When 40 mg/kg of DHK was orally administered, 50 percent was found in the urine within 48 hours in the form of hydroxylated (approximately 67 percent) and other derivatives. The fact that only 50 percent was found in the urine after 48 hours results from the opening of the 5,6-dihydro-alpha-pyrone ring, which produces nine metabolites, including hip-

puric acid. Methystici[illegible]s not seem to undergo any modification of its pyrone ring, providing only hydr[illegible]ated derivatives. Dihydrokavain has its hydroxyl in the meta position of the benzene ring and dihydroxydihydrokavain has it in the para position. The same studies have identified 10 metabolites resulting from oral kavain consumption. Yangonin and 7,8-dihydroyangonin each yield two O-demethylated derivatives in the para position.

Although Rasmussen et al. (1979) found only a very small amount of DHK in feces, they reported large concentrations of kavain and methysticin. According to these authors, unsaturated 7,8 kavalactones, like kavain, methysticin, and yangonin, are not absorbed and metabolized as well as the saturated compounds at the same position. Only the last are modified in their alpha-pyrone cycle.

Keledjian et al. (1988) measured the quantitative uptake of four kavalactones into mouse brains—kavain, dihydrokavain, demethoxy-yangonin, and yangonin—after intraperitoneal injection of 120 mg/kg. Their research established that kavain and dihydrokavain attain their maximal brain concentration within five minutes, whereas the other two compounds enter the brain more slowly and achieve lower peak concentrations. When an extract containing several kavalactones was used, the peak concentrations of kavain and yangonin were markedly higher than when isolated kavalactones were injected—supporting evidence for the greater strength of natural kava extracts. In one experiment (Keledjian et al. 1988), the administered extract was designed to resemble natural kava drink as much as possible. Unfortunately, the relative concentrations of kavain and dihydrokavain were not determined, and the "kava" content was expressed only in terms of mass of powder per unit of solution.

According to Keledjian et al. (1988), the synergistic effect observed in brain tissue penetration suggests that ingestion of other drugs like alcohol may affect the concentration of kavalactones in the brain. Kavain and dihydrokavain are the two kavalactones that pass the blood-brain barrier the most easily. Identification of the neuron receptors affected by kavalactones will be essential in understanding the pharmacology of kava.

Less research has been carried out on aqueous extracts of kava. This is not surprising, given that traditional aqueous infusions of plant rootstock are really emulsions of suspended kava resin in water. Furgiule et al. (1965) studied the physiological properties of a steam distillate of kava. They observed that their extract depressed motor activity and reduced irritability in rats. Notably, however, some of their distillate fractions contained kavalactones with known physiological effects (DHK and DHM). It is therefore difficult to conclude that aqueous (as opposed to lipid) kava extracts contain, in addition to kavalactones, unidentified compounds with significant physiological properties.

Duffield and Lidgard (1986) compared pharmacological activity in rats given aqueous kava extracts with and without kavalactones and four that the kavalactone extract had a much wider range of activity. A dose of 250 m of the extract without kavalactones did, however, cause some loss of spontaneous activity in rats without a reduction in muscle tone and produced some analgesic action and a very light anticonvulsant effect without hypnosis. Duffield and Lidgard concluded that although there are substances with pharmacological effects in aqueous kava extracts, their effects are insignificant when compared with those of resin fractions. The psychoactivity of kava, as prepared for human consumption, is clearly due to the insoluble resin components, the kavalactones.

Chemotypes

Keller and Klohs, in their review of the chemistry and pharmacology of kava (1963), observed that "no systematic scientific survey appears to have been made as to the relative potency of extracts from the various forms of *Piper methysticum*. The published studies generally have been carried out upon samples of plant material identified only as being the dried root of *Piper methysticum* and, since all of the growth forms would most likely not be thought worthy of recognition as separate taxa by plant taxonomists, this area remains one for possible future study and clarification." In 1966 Young et al. also stated that the morphological and chemical relationships of kava needed additional study. Jössang and Molho (1970) noted that variation in the composition of kava extracts from Fiji needed clarification, and Duve and Prasad (1981) concluded their qualitative evaluation of the drug by stating that variation in the active constituents of *P. methysticum* as these relate to a plant's age, cultivar type, and environmental parameters needs to be studied before chemical standards for kava can be formulated.

The comparative chemistry of the various kava cultivars is still largely unknown. Smith (1983) did compare two kava cultivars from Fiji, which he called white and black, in which the alkaloid pipermethystin (absent from the rootstock) was the main active ingredient isolated from the leaves. Smith identified DHK and DHM as the major lactones in the rootstock, along with minor amounts of tetrahydroyangonin, yangonin, demethoxy-yangonin, and kavain. The last two compounds were present in small quantities in the black cultivar but only as traces in the white cultivar. Cultivar chromatograms were quite similar, and analyses carried out at different times of the year showed no seasonal changes in active substance content in either cultivar.

Still, considerable variation between organs on the same plant was observed. The significant differences in chemical composition between the vegetative and root systems prompted a decision to divide the stalk into several segments from the base to the apex in order to study the segments separately. Kavain and demethoxy-

yangonin were found the major constituents of the rootstock, whereas DHK and DHM were foun. o predominate in the stalks and leaves. The chemical composition of Fijian kava leaves has also been studied by Jössang and Molho (1970) and Smith (1983). The main elements they found in the leaves were dihydromethysticin and dihydrokavain, along with traces of yangonin and dehydrokavain, beta-sitosterol, and flavokavins A and B; kavain and methysticin were absent. Flavokavin C was found in the rootstock of Fijian kava at concentrations of 0.07 g/kg by Dutta et al. (1976).

In 1984 Lebot and Lévesque initiated a research program to address two questions about the chemistry of kava. First, are the chemical composition and total kavalactone content of a plant dependent on the cultivar, the age of the plant, specific environmental factors, or a combination of these variables? And second, when a sport of a cultivar presents a new, desirable chemical composition, is it possible to preserve this composition by cloning? Lebot and Lévesque's identification of a number of kava chemotype groups also provides additional insight into the prehistory of distribution of the plant. Their findings showed that chemotypes are genetically controlled and therefore constitute a genetic fingerprint for each cultivar, and that species domestication involved preservation of selected chemotypes by cloning.

Lebot and Lévesque (1989) divided the active ingredients of kava into two main groups—major kavalactones and minor kavalactones—and demonstrated that the former account for approximately 96 percent of the lipid extract. They therefore numbered and used only the major kavalactones (1 = demethoxy-yangonin, DMY; 2 = dihydrokavain, DHK; 3 = yangonin, Y; 4 = kavain, K; 5 = dihydromethysticin, DHM; and 6 = methysticin M) to define cultivar chemotypes. These six active substances comprise a natural kava "cocktail" that induces different physiological effects according to the particular kavalactone mixture. To identify the different mixtures offered by various cultivars, chemical compositions were coded by listing in decreasing order of proportion the six major kavalactones in the extract; this coded description is called a chemotype. For example, if the chemotype of a cultivar is 521364, this indicates that kavalactone number 5 (dihydromethysticin) has the highest content of the six lactones in that cultivar, kavalactone number 2 (dihydrokavain) has the second highest content, and so on. Chemotype 521634 produces distinct physiological effects that differ from those of other chemotypes. The first three kavalactones in the code usually represent over 70 percent of the total. These three, therefore, are typically the most important for characterizing chemotype. In some cultivars, the percentage of each of the three major kavalactones is about the same (e.g., 25 percent, 23 percent, and 22 percent).

Cultivar chemotypes from throughout Oceania were grouped by multivariate analysis. Two statistical techniques (principal components analysis and clustering using Euclidean distance) were used, and both confirmed the groupings. Both techniques took into consideration the exact proportion of each kavalactone present in the extract rather than the relative proportion indicated by chemotype coding, and the two approaches yielded concordant clusters (see appendix E and Lebot and Lévesque 1989).

The genealogy of kava clones, from the wild species to today's cultivars, is primarily a lineage of chemotypes (figure 3.3). Although the production of secondary metabolites (e.g., alkaloids and kavalactones) in many plants has been linked to protection against herbivores, mammalian herbivores (apart from fruit bats) were introduced to the noncontinental Pacific islands by humans. As has been noted, rats, pigs, and insects are not repelled by kavalactones. The evolution of kava's diverse chemotypes appears to have resulted not from natural selection but from human efforts to mold the plant's psychoactive characteristics. Distinct relationships exist between specific chemotypes and their traditional uses. Because a selection is made each time a farmer uproots an individual plant and experiments with its physiological effect, the kava domestication process can be described as a progression of clone selections.

Chemotype Variability

Sixty-seven cultivars from the kava germplasm collection of Vanuatu were analyzed to determine their chemotypes (Lebot and Lévesque 1989; Lebot 1989). Kavalactone coding allowed the identification of convars, or groups of cultivar morphotypes, that have similar chemotypes. The results indicate that kava in Vanuatu is represented by six main chemotype groups (A, E, F, G, H, and I; see appendix E). Within each convar, cultivars are not significantly different chemotypically. When these results are compared with those obtained from ethnobotanical analysis, a clear correlation is observed between the traditional uses and the chemotype of a cultivar. For example, the convars typified by chemotypes 521634 and 526341 represent cultivars that are rarely consumed. The former group includes *P. wichmannii* cultivars *kau, vambu, buara,* and *bo*, whereas the latter group, which is used only for ritual purposes, comprises *P. methysticum* cultivars *tangurlava* and *tabal*. Drinkers report that the physiological effects of plants from these two chemotypes are too severe to allow daily consumption. When ingested, plants of these chemotypes produce an unpleasant nausea owing to their very high proportion of DHM (5) and DHK (2), the most potent kavalactones (Hänsel 1968; Lebot and Cabalion 1986). The same is true for chemotype 256431, which comprises a group of cultivars famous for their intense physiological effects. These are known in Bislama, the Pidgin English of Vanuatu, as *tudei* ("two days") because a drinker feels drunk for two days.

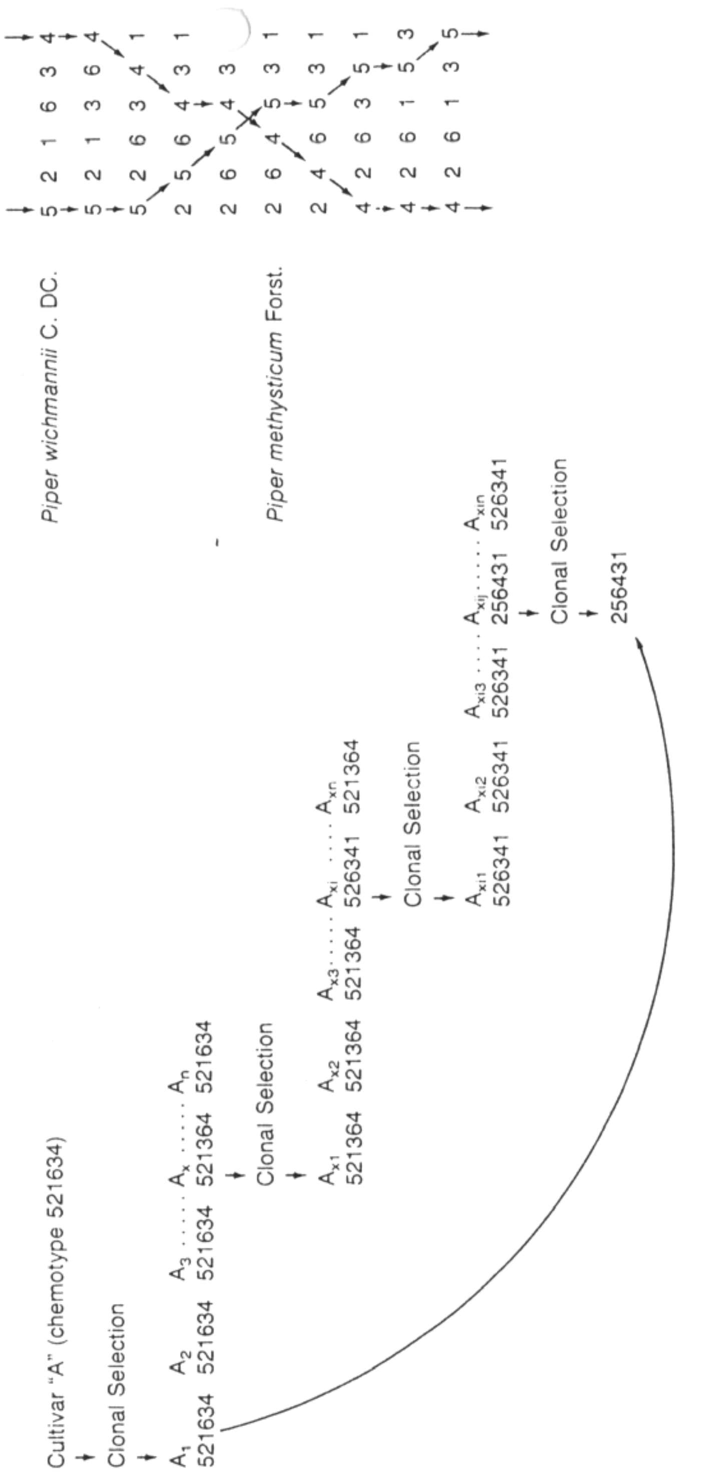


Figure 3.3. Domestication of chemotypes. Selection has been conducted from a chemotype rich in dihydrokavain and poor in kavain (*Piper wichmannii*) to one rich in kavain and poor in dihydrokavain (from Lebot and Lévesque 1989).

The convar typified by chemotype 265431 includes kava cu ys traditionally used for medicinal and exchange purposes. The largest convar, typified by chemotype 246531, comprises cultivars used for daily drinking. Chemotype 426135 (which includes cultivar *kelaï* from Epi) is famous throughout Vanuatu for its very pleasant effects. Drinkers in this archipelago generally do not appreciate the effects of cultivars containing high percentages of DHK and DHM; chemotypes with a high percentage of kavain and a low percentage of DHM induce the most desirable psychoactive effects. This can be explained by the fast absorption of kavain, which causes a sudden high, compared to the much slower absorption of dihydromethysticin, a major component of the tudei kavas that frequently produce nausea.

Kava cultivars from Fiji have a higher percentage of methysticin (6) than those from Vanuatu. Significantly, the high-prestige white cultivars (*vula*) from Fiji exhibit chemotypes beginning with 462 (group I), and group II cultivars, which are much appreciated in Vanuatu, have chemotypes beginning with 426 and 246. The less socially valued black cultivars (*loa*) of Fiji produce chemotypes based on kavalactones 643. One can easily understand farmers' appreciation of white cultivars that have a high proportion of kavain.

Interactions among Environment, Age, and Chemotype

Lebot and Lévesque (1989) evaluated the scope of chemotype variation within cultivars from Vanuatu. Several specimens of the same cultivar growing in different soils and under different climatic environments were harvested and analyzed; in addition, different plants of the same clone grown under the same conditions were harvested at different ages in order to study chemical variation in relation to ontogeny. All these tests indicated that variability in chemical composition and kavalactone content is more strongly related to genotype than to environmental factors. When different cultivars are planted on the same day in the same plot, they produce different chemotypes. This research confirmed farmers' reports that different cultivars uprooted from the same garden on the same day produce different physiological effects. Clones of cultivars *vila* and *small leaf*, for example, were planted on the same day and harvested exactly two years later. Kavalactone content and chemotype remained homogeneous among clones of each cultivar. In other words, farmers have a high probability of preserving chemical content and associated physiological qualities when cloning a mother plant.

Results of several trials conducted on two islands suggest that kavalactone chemotypes are unrelated to the age of an individual clone (Lebot and Lévesque 1989). Kavalactone content is highest after 18 months on average, and this content remains stable during subsequent growth of the plant, although the rootstock biomass continues to increase over time. Clones from different cultivars were planted in a row on the same day. One plant of each cultivar was harvested every five months. Plants grown for the trials on Santo Island (elevation 140 m; average annual precipitation; 3200 mm) were compared with control plants selected from local village gardens, when available, and also with the same cultivar from the germplasm collection on Efate (elevation 40 m; average annual precipitation, 2400 mm). The results indicate that kavalactone content is not related to ontogeny but rather to genotype.

Techniques similar to those used in Vanuatu to identify convars of kava were used to survey the entire geographic range of kava cultivation in the Pacific. The aims of this extensive research were to demonstrate the utility of the common-garden approach for standardizing chemotypes and to identify the chemotaxonomic signatures of all kava cultivars existing in the Pacific. Rootstock samples of local cultivars were collected throughout the Pacific and their chemical composition analyzed (Lebot and Lévesque 1989). Because of the large numbers of islands to be visited and the quantity of cultivars to be collected in a short six months, it was not possible to undertake diachronic trials. Nevertheless, germplasm collections were established in each island group surveyed, and in the future it will be possible to conduct such research. Confirming the results of the Vanuatu study, analysis of kavalactone chemotypes by Lebot and Lévesque demonstrated that when different kava cultivars (both *P. wichmannii* and *P. methysticum*) are planted in an homogeneous environment, they produce a range of chemotypes. When a cultivar is cloned, the resultant plants possess chemotypes and kavalactone content very similar to the mother plant.

In Fiji, for example, samples of the same cultivars were gathered from different islands. The cultivars included *loa kasa balavu* from Vanua Levu and Viti Levu, *vula kasa balavu* from Taveuni and Viti Levu, and *loa kasa leka* from southern Taveuni at sea level and northern Taveuni at 400 m above sea level. Individuals of each cultivar presented very similar chemotypes in spite of their different environmental origins.

Although field trials suggest that cultivar chemotype is determined by genotype, chemotypes do not usually correspond to the morphological characters of cultivars, which are surprisingly variable. In some cases, plants with similar morphotypes also have similar chemotypes, but exceptions are numerous. This absence of consistent correlation between chemotype and morphotype is probably due to the fact that growers' attention is focused more on the chemical than on the morphological characteristics of their kava cultivars. This focus on chemical properties probably also accounts in part for the retention of the morphological similarity of *P. methysticum* to *P. wichmannii*, its wild progenitor.

Distribution of Chemotypes

Throughout the Pacific, all kava morphotypes belong chemotypically to one of nine convars, A–I. Chemotypes in groups A, B, C, and D (see appendix E), all exclusive to Melanesia, are forms of *P. wichmannii* typified by a very low kavain content. Of these, *vambu, buara, bo, kau,* and *kau kupwe* are cultivated in Vanuatu and Baluan. Chemotypes in group A have high proportions of dihydromethysticin and dihydrokavain (38%–58%). These two kavalactones together account for 64%–75% of the total; the proportion of kavain is low (less than 3% in chemotype 521634). Chemotypes in group B (165234 or 156234) have a high proportion of demethoxy-yangonin (25%–35%) and a low proportion of kavain. Chemotype C is represented by only one wild form of *P. wichmannii* from the Madang area in Papua New Guinea and is typified by high concentrations of dihydrokavain and dihydromethysticin. Chemotype D has roughly equal proportions of dihydrokavain, dihydromethysticin, and methysticin (31%, 30%, and 27%) and little kavain (1%).

The morphological forms associated with these chemotypes differ, although all are erect. Forms from Baluan, Morobe, and Guadalcanal are nearly identical (chemotype B, 165324 and 156234), even though the one from Baluan is cultivated and the other two grow wild. A wild form from Karkar Island, off New Guinea's northern coast, presents a chemotype (D, 215634) very similar to one (521634) widespread in the Banks and Shepherds island groups in Vanuatu. In Vanuatu, *P. wichmannii* produces chemotypes (e.g., A, 521634) that are closer to those of *P. methysticum* (e.g., E, 526431 for the *tabal* and *tangurlava* cultivars) than to those of the wild forms of *P. wichmannii* occurring in other Melanesian islands

The chemotypes in groups E, F, G, H, and I occur only in cultivars of *P. methysticum*. These chemotypes are found in Melanesia (Vanuatu and New Guinea), Polynesia (e.g., Tonga, Wallis, Fatu Hiva, and O'ahu), and Micronesia (Pohnpei). The chemotypes in group E (e.g., 526431 and 526341), located in Vanuatu, Wallis and Futuna, Hawai'i, Tonga, Marquesas, and the Carolines, produce beverages with strong physiological effects resulting from very high proportions of dihydrokavain and dihydromethysticin.

Chemotypes in group F are distributed exclusively in Papua New Guinea and Vanuatu. All kava cultivars in Papua New Guinea exhibit this unique group of chemotypes. This supports previous conclusions about the extremely narrow genetic base of *P. methysticum* in Papua New Guinea and about a Vanuatu origin for the species (see chapter 2). Group F chemotypes are rich in DHK and DHM and do not produce the most favored psychoactive effects. Cultivars of this group are not used for daily consumption. Chemotypes in groups G, H, and I, well distributed throughout Polynesia, Fiji, and Vanuatu, are rich in kavain and are the most popular kavalactone blends.

It is possible to li[illegible] differentiate cultivars by chemotypic affinity even when great distances separate them. For example, although Fijian cultivars *honolulu* and *business* present morphotypes similar to cultivar 52 from Vanuatu, their chemotypes clearly differ. Fijian cultivars *matakaro* and *matakaro balavu,* however, are probably the same cultivar, presenting similar morphotypes and chemotypes. Cultivar *omoa*, collected on Fatu Hiva in the Marquesas, chemically and morphologically resembles *o'ahu 241* from Hawai'i. The same kind of interisland relations can be observed for other cultivars, such as *aigen* from the Melanesian island of Tanna in southern Vanuatu, which has a chemotype identical to *ava ulu* from the island of Tutu'ila in American Samoa. Human dispersal of planting material has undoubtedly taken place in central Polynesia, as well as between Fiji and Tonga, Wallis, or Samoa (see chapter 2). Proto-Polynesian travelers passing through Vanuatu no doubt selected the most desirable clones. This selection discouraged the eastward spread of kava cultivars with wilder characters—cultivars of chemotypes A–D and F.

The chemotypic diversity of kava within Vanuatu is greater than anywhere else in the Pacific, and variability among the cultivars from a single island, Pentecost, is as great as that found on all other islands of the archipelago. All five chemotype groups selected during the domestication of kava are present today in Vanuatu (E–I).

A genealogy of kava chemotypes, from the truly wild species to the most desirable cultivars, is outlined in figure 3.3. This genealogy supports the assertion that Vanuatu is the place of origin of *P. methysticum*. Domestication could not have occurred anywhere in New Guinea because of the unsuitable chemotypes of wild forms of *P. wichmannii* found in this country. The same observation holds true for the Solomon Islands.

The genealogy indicates that the cultivars of *P. methysticum* found in New Guinea today were exported from Vanuatu early in the domestication process. These cultivars possess poorly improved chemical characters—particularly a low kavain content. This suggests an early transmission of kava to a few isolated areas of New Guinea with little subsequent selection. The kava cultivars of Polynesia were probably obtained from northern Vanuatu more recently in kava's ancestry, for these all exhibit improved chemotypes with lower percentages of DHK and DHM. This holds true also for the south of Vanuatu, where cultivars of chemotypes A, B, C, and D, with high DHK and DHM contents, are absent, confirming a relatively recent introduction of kava from Polynesia (probably Samoa).

4. Ethnobotany
Cultivation, Classification, Preparation, and Medicinal Use

Each community of Pacific horticulturists cultivates its agricultural germplasm collection in its gardens. The Apma community (population 4,304 in 1986) of central Pentecost in Vanuatu, for example, possesses the following numbers of named cultivars: *Colocasia esculenta* (taro), 101; *Dioscorea* spp. (yams), 90; *Artocarpus altilis* (breadfruit), 42; *Musa* spp. (bananas), 25; *Albesmochus manihot* (aibika), 18; *Ipomoea batatas* (sweet potato), 13; *Pandanus* spp. (screw pine), 11; *Manihot utilissima* (manioc), 9; and *Piper methysticum* (kava), 14 (A. Walter, personal communication, 1986). Yam and taro, obviously, are the most important staples in the Apma community, but villagers also recognize and name 14 varieties of kava.

Most traditional Pacific crops are propagated asexually; their cultivars are all cloned. Cloning of a single selected individual normally results in a population of genetically identical progeny. Kava cultivars, too, are reproduced by vegetative propagation—by stem cuttings. In this chapter, we provide an ethnobotanical overview of the traditional and contemporary ways in which islanders cultivate, classify, and consume kava. We also note traditional medicinal uses of the plant and review, in conclusion, the state of kava's ethnobotanical heritage.

Cultivation Techniques

Kava is well suited to Pacific farming systems because it is flexible in its cultivation requirements and thrives in shade. It grows well in traditional multicrop Melanesian gardens, which are cut from the forest and partly shaded by taller crops such as banana and manioc. Newly planted stem cuttings must be protected from direct sunlight and from wind, which increases the rate of evapotranspiration. Choosing a site sheltered from the prevailing southeasterly tradewinds is particularly important, for the buffeting effects of these air currents can damage kava stems and rootstock, making them susceptible to disease. In intensive field cultivation of kava, shade must be provided during the first 30 months of growth. Kava is now often grown commercially in association with shade-providing cash crops (figure 4.1). It is potentially profitable when harvested after three to four years, the time needed for most small tree cash crops, such as coffee or cocoa, to reach maturity (see chapter 6).

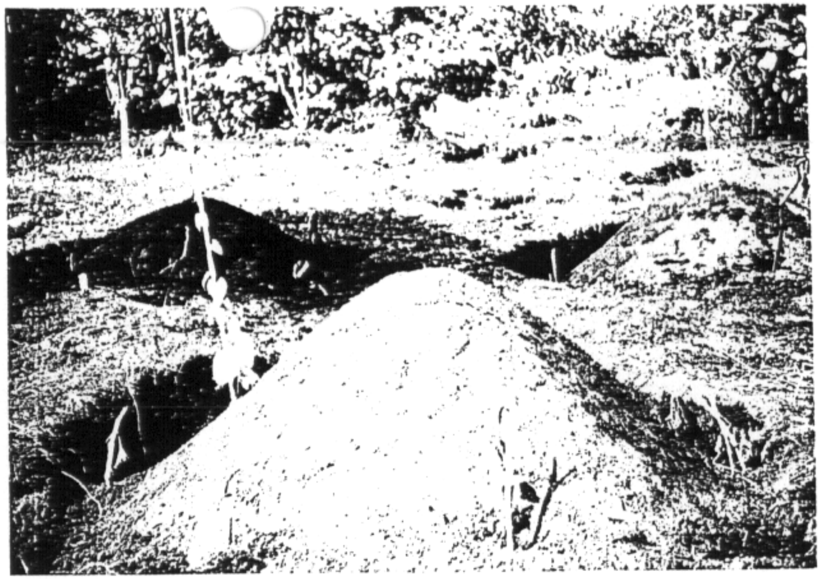


Figure 4.1. Kava stem cuttings planted along the edges of yam mounds, Tanna, Vanuatu (photo L. Lindstrom).

Along with adequate shade and protection from wind, *Piper methysticum* requires fairly high average temperatures (20°–35° C) and high humidity (70%–100% relative humidity). In the tropics at altitudes of generally less than 400 meters, the plant requires an average annual precipitation of over 2200 millimeters. At higher altitudes its minimum annual rainfall requirement averages approximately 1800 millimeters. This does not preclude cultivation of kava in some tropical climates with marked dry spells if drought is not too severe. In such climates it is important to set out cuttings at the start of the rainy season, for kava is most susceptible to water deficit during the first six months of growth (Lebot 1986).

Kava grows best in deep, friable, well-drained soils that are rich in organic matter. The plant is very nutrient demanding. Highest yields are obtained on silica-clay soils with a pH of 5.5 to 6.5. Because the kava root system has only limited tolerance for asphyxia, good drainage is essential. Accordingly, a garden site should have soil with high humus content and a physical structure conducive to the free movement of air and moisture. Hillsides are often well suited to kava growing because drainage there is better than in valley floors, where there may be risk of waterlogging (Lebot 1986).

S. M. Kamakau described nineteenth-century kava planting on Hawai'i:

> *'Awa* should be planted on large tracts of land in warm ities, beside streams, at the edge of woods, on slopes where *kukae pua'a* grass [*Digitaria setigera*] flourishes or where the *ama'u* fern grows, or in rainy localities. *'Awa*, *wauke* [*Broussonetia papyrifera*], and upland taro grow well in the same localities and under the same conditions.
>
> *'Awa* is planted much like sugarcane, by means of sections of the stalk, from whose joints grow the sprouts or "eyes" (*maka*). The planter carries to the place selected the stalks of the variety desired, and there cuts them into short sections, being careful not to break the "eyes." The sections later to be planted he lays in a trench filled with mud, leaving them to sprout there, while he clears his grounds and leaves the grass and weeds on the soil to rot. When the segments in the trench have sprouted, he removes them and plants them in shallow trenches. (Cited in Handy 1940)

S. H. Riesenberg's (1968) account of kava culture on Pohnpei provides a good description of cultivation techniques still common in island communities:

> Kava does not grow everywhere, but it is easy to tend; it is necessary to clean around it only once a month. The plant is grown from cuttings, usually from the young branches of an old bush brought to a feast. The cuttings are made two joints long if the branch is more than an inch in diameter, four joints if less; they are severed diagonally, between the nodes. They are planted about one yard apart in cleaned ground prepared first with a digging stick; later they are thinned out to two or more yards; but single plants may be seen sometimes growing in a thicket of other species of plants. The cutting is stuck into the ground somewhat diagonally to bury one node. Usually two cuttings are planted in the same spot to produce a large plant. If they cannot be planted the same day they are cut, they are bound into bundles and soaked in water by day, left in the dewy grass at night. . . . A small [kava garden] contains a hundred plants, a large one five or six hundred. A large garden is a greater source of pride but is usually kept very secret, for fear of witchcraft which will cause the plants to dry up.

Kava plants are usually harvested after 3 or 4 years but may be left growing for more than 20 years. The stump and roots become larger over time, although soil type and genotype are more important factors than plant age in determining yield (Lebot 1988). When kava is harvested the stems are cut off above the first node and laid aside. The underground stump can reach 30 to 60 centimeters in depth, depending on the cultivar, and some creeping roots may be more than 3 meters long. If the plant is growing on a slope, harvesting is straightforward; if not, a deep hole must be dug around and under each stump because the lateral roots are fragile and will break off in the ground unless carefully excavated.

The green weight of an individual rootstock varies from 5 to 50 kilograms,

depending upon a plan aturity and the type of cultivar. A three-year-old plant yields about 10 kilograms of fresh material, four-fifths of which is the stump and the rest the radicles. Drying reduces the rootstock to 20 percent of its original weight. These figures are averages and vary significantly with different cultivars and soil conditions. An extraordinary four-year-old kava plant grown in very sandy soil in Port Vila, Vanuatu, had a rootstock with a green weight of 132 kilograms (Lebot, field observations, 1986).

Although kava may not receive as elaborate horticultural care as major subsistence crops like yam and taro, some cultivars are intensively cultivated—especially those that are important for ritual, display, and exchange (figure 4.2). Several specialized techniques have been developed by kava growers to improve the yield or appearance of the root system (figure 4.3). On Tanna, Vanuatu, for example, a special technique of above-ground rootstock cultivation produces longer and more attractive plants for customary exchanges (see chapter 5). A stem cutting is planted in a hollow tree fern trunk (figure 4.4). Traditionally the trunk was horizontal or vertical (Guiart 1956b); only the vertical method is still in use. Growing in the hollow trunk, the stump swells along 20 to 40 centimeters of its

Figure 4.2. Decorated *nikava tapuga* variety of kava displayed and exchanged to mark the end of a recently circumcised young boy's period of seclusion in southeast Tanna, Vanuatu. The boy stands between his father and mother's brother (photo L. Lindstrom).

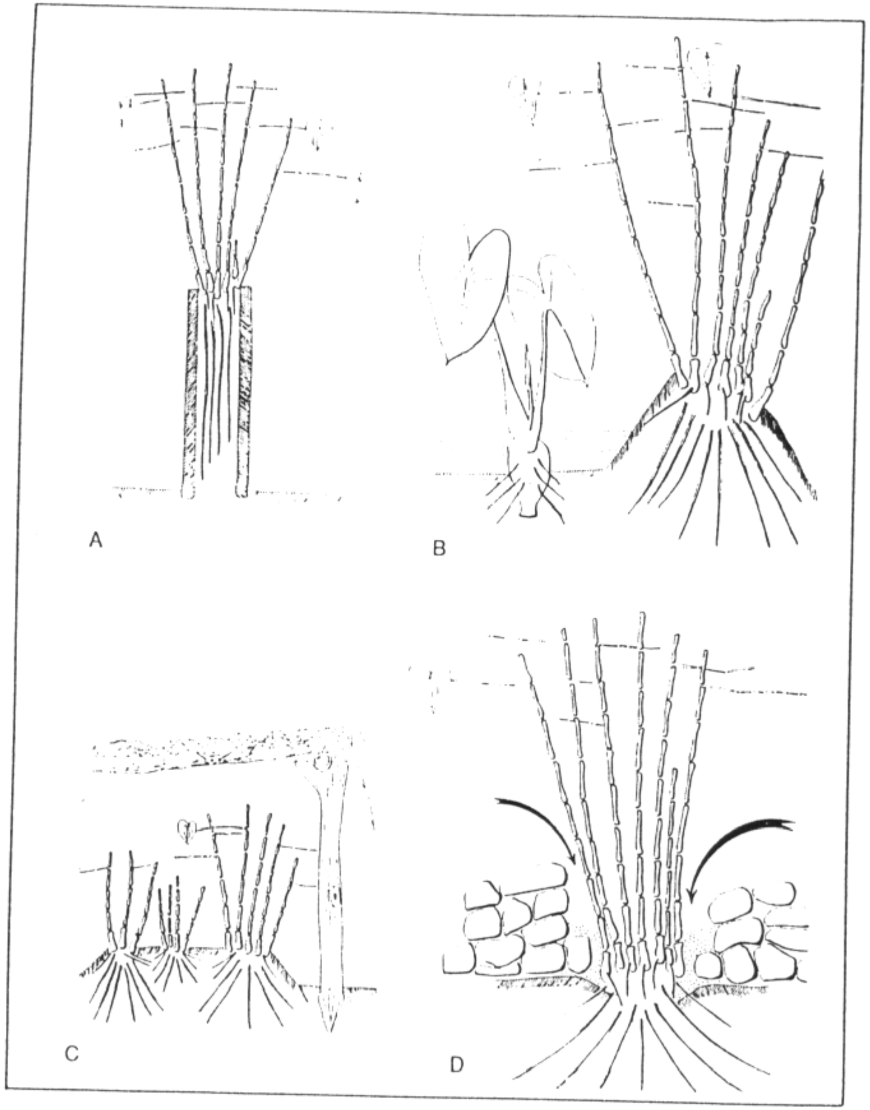


Figure 4.3. Traditional cultivation techniques: (A) In Tanna, Vanuatu, *nikava tapuga* kava is planted in the trunk of a tree fern; (B) In Maewo, Vanuatu, kava is planted around irrigated taro (*Colocasia esculenta*); (C) In the Fly River area of Papua New Guinea, kava is cultivated in beds shaded with sago palm leaves (*Metroxylon sago*); (D) In Savai'i, Western Samoa, kava is planted in volcanic soil (from Lebot 1991).

Figure 4.4. Intensive cultivation of *nikava tapuga* kava in Tanna, Vanuatu (photo J. Lévesque).

length, and lateral roots growing down into the soil can reach lengths of 2 meters. Kava grown this way is relatively well protected from nematodes, and the surface of the stump and roots is whiter and smoother than that of ordinary kava. This manipulated kava, called *nikava tapuga*, is known in island mythology as the plant of the powerful spirit Mwatiktiki (Mauitikitiki in Polynesia), who is evoked in agricultural magic. Whereas kava produced from plants cultivated by the usual method of setting cuttings directly in the ground can be drunk by all men on Tanna, only men from certain families possess the right to drink kava made from *nikava tapuga*—Mwatiktiki's kava (Guiart 1956b). Although this prescription is not always followed today, a member of one of these privileged families often will consume the first shell of an infusion of prepared tapuga.

Intensified kava culture also occurs on other Pacific islands. Early European visitors to Tahiti, for example, described well-tended kava gardens: "The cloth plant [paper mulberry], which is raised by seeds [*sic*] brought from the mountains, and the *ava,* or intoxicating pepper, which they defend from the sun when very young, by covering with leaves of the breadfruit tree, are almost the only things to which they seem to pay attention; and these they keep very clean" (Cook 1784; paper mulberry is grown from cuttings, not seeds). A later explorer, Captain William Wilson (1799), noted even more elaborate kava plantations: "Here I thought I got a sight of an European garden; the plots of *ava*-ground were laid out in such nice order: each bed formed a regular parallelogram, trenched two feet deep, and disposed with a great degree of taste; the whole enclosed with a fence of bamboo."

Today, on Maewo Island in Vanuatu, several kava cultivars that have high water requirements are planted on the ridges of irrigated taro terraces where they also contribute to the terraces' maintenance.

Large quantities of kava are grown at medium elevations (200–600 meters) on Savai'i Island in Western Samoa where ecological conditions are cool and moist. Samoan soils are volcanic, with lava and tuff substrates in relatively youthful stages of decomposition (especially on Savai'i), and water retention is poor; because kava is quite sensitive to drought, planting in Western Samoa usually takes place at the beginning of the rainy season (i.e., November and December). Where relatively young volcanic lava flows have not yet weathered into deep soils, Samoan growers cultivate kava in pits filled with organic matter. On the older island of Upolu, the steady rains and sloping land of the Fagaloa Bay area are very suitable for kava plantations and make that region the major producing area of the island.

In the Western Province of Papua New Guinea, where waterlogged soils and frequent droughts make kava hard to grow, farmers plant and tend cuttings in well-drained beds shaded by sago palm (*Metroxylon sago*) leaves (figures 4.5 and 4.6; Lebot, field surveys, 1987 and 1989). The current cultivation practices of farmers in the Fly River area are identical to those of Kolepom Island cultivators in the early 1960s, as described by Serpenti (1965):

> It is not easy on Frederik-Hendrik Island to grow *wati* [kava]. Only the older and abler cultivators can boast of having *wati* gardens of any significance. . . . The first condition for obtaining a good harvest lies on the selection of planting material. A month or two before the planting season, cuttings are taken from the side-stalks directly above and below the joints. . . . The planting season is in the months of January and February. Those who have not collected enough cuttings by November have to obtain them by barter, in exchange for a canoe, for instance. . . . The cuttings are placed in a row in a banana-leaf that has first been filled with a layer of decayed drift-grass. This leaf is carefully folded up

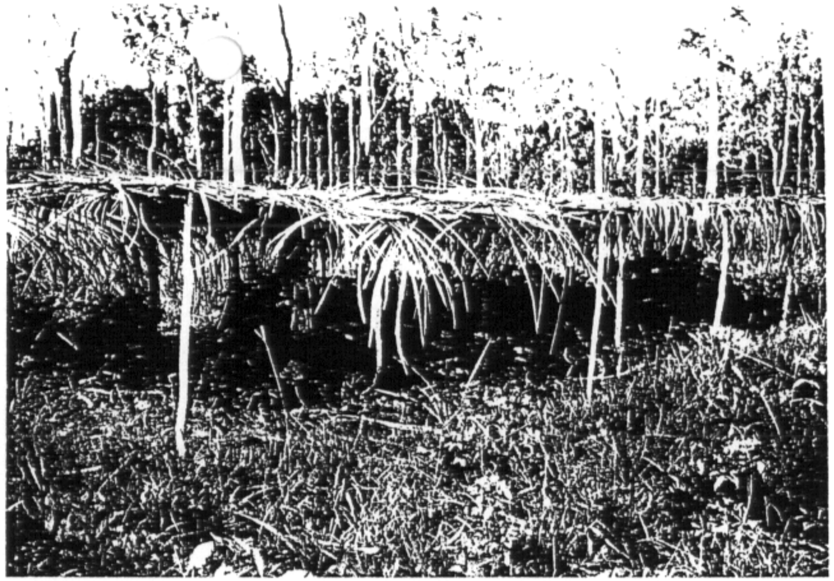


Figure 4.5. Intensive cultivation of kava under sago palm leaves in the Fly River area, Western Province, Papua New Guinea (photo V. Lebot).

Figure 4.6. Kava cultivation, Fly River area, Papua New Guinea (photo V. Lebot).

> and after a month or so small roots will begin to appea[r. At] that stage the cuttings are planted out on a nursery-bed with a roof to shelter from the burning sun. Each cutting is separately placed in an oblong lump of black clay with a high humus content, about 7 centimetres long and 3 fingers thick. . . . On this nursery-bed the cuttings stay for about 2 weeks, after which they are planted out on the final bed. This period forms the most critical stage, during which often a great part of the plant material dies. . . . The cuttings may be planted out when they have grown leaves. . . . The young plants, with the lumps, are then placed in plant mounds of grey clay, which are covered with a layer of drift-grass and clay. . . . Shade is absolutely necessary during the early stages. . . . *Wati* does not need to grow to full maturity before being fit for consumption.

Folk Classification of Cultivars

Within island communities, kava exists as numerous named cultivars that have specific uses. Pacific folk classification systems comprise an ethnobotany of kava which is often known fully only by local elders. The gross morphological variations observed among kava cultivars do not, according to Western botanists, warrant their classification as distinct varieties. These cultivar differences, however, are of great significance for the growers and drinkers who make use of them.

Folk classification of kava is strongly influenced by the characteristic physiological effects of different cultivars. On islands where kava is consumed fresh by farmers themselves, these farmers advance the kava selection process each time they uproot a plant for an evening's consumption. If that plant's physiological effect is not appreciated, it is not cloned. When harvesting a plant, a farmer trims off its stems and places them in the hole produced by the removal of the rootstock. He drinks kava prepared from the rootstock and judges its physiological character. If this is pleasant, he goes back to his garden several days later and collects the stem cuttings for clone propagation. If the kava's effect is weak or unpleasant, he merely leaves the stem cuttings in their hole, where they will soon collapse and rot. If a particular plant has outstanding psychoactive characteristics, the grower shares cuttings with relatives and neighbors. If the physiological effects are distinctive enough, a new cultivar may be named.

Cultivar classification systems, which vary from island to island, are based upon detailed morphological and physiological observations of both interclonal variability and, where it occurs, intraclonal variability. Clones of a single kava genotype may exhibit different phenotypes according to ecological circumstance. Classifications and descriptions are therefore typically valid only in localized areas. Each island or region has its own folk taxonomy that relies on a distinctive set of features in defining cultivars; certain morphological features may be significant in

the folk taxonomy o[f one] island or region but may be ignored elsewhere. The range of certain cultivars, moreover, is restricted to specific islands or regions, and if these cultivars are exchanged outside their place of origin they are regarded as aliens. Alternatively, the same cultivar may have different exchange or prestige value on two different islands. There is also a considerable degree of specialization in the use of particular cultivars. Some cultivars are used only in ceremonial exchange, and others only for the treatment of specific medical complaints. The most frequently planted cultivars are, of course, those grown for everyday drinking (Lebot and Brunton 1985; see appendix F).

Folk classification of clones involves the recognition of some varietal uniformity, or sets of distinctive features. These features are often reflected in a cultivar's name. Common distinctive features of cultivars involve both the aerial parts of the plant and its relative psychoactive efficacy. An individual plant's morphology and the way it develops help confirm its folk botanical classification. In the Vanuatu *nakamals* (men's houses or clearings or urban kava bars, where kava is consumed), the odor, flavor, and psychoactive effects of kava prepared from different cultivars also confirm its folk classification.

Typically, each folk taxon consists of a generic name (meaning "kava"), followed by a second word that acts as a taxonomic modifier or qualifier. Berlin's comparative analysis of folk taxonomic systems shows that at the specific level, the linguistic structure of most folk taxa "appears to be a specifiable form. Such names will be comprised of the generic names (in which they are included) plus a modifying attributive-like expression. In all cases, such . . . specific expressions will be binomial in structure" (Berlin 1971). Typically, these descriptors together form a double name, or binomial, comparable to those common within the Linnaean taxonomic system. The semantic qualifier usually refers to a cultivar's outstanding morphological or physiological feature (often its coloring), its legendary origins, or the name of the first person to develop the clone. For example, cultivars from Tanna include *nikava rhowen* ("white kava"), *nikava apin* ("black kava") and *nikava pia* ("smooth or naked kava").

The richness of folk classification systems is illustrated in the following review of vernacular kava cultivar names from a number of Pacific regions, including New Guinea, Fiji, Samoa, Wallis, Hawai'i, Tahiti, and especially Vanuatu, where folk taxonomies of kava are best documented.

Southwestern Papua New Guinea and Irian Jaya

Kava cuttings are often exchanged between villages throughout this region (Serpenti 1965). Farmers of Bamol village, on Kolepom Island, for example, obtain cuttings from farmers at Kiworo, who in turn get them from the Marind region. At

Bamol, five different varieties of *tigwa* (kava) have been doc... ted (Serpenti 1965):

1. *Kuraka:* Black stems; short maturation period; cultivated in a widely spaced arrangement among other crops.
2. *Dikoie:* Black stems; grown closely spaced.
3. *Namuru:* Long green stems; short maturation period; hard stalks.
4. *Kawadarre:* Very long stems.
5. *Ikawat:* Similar to *kawadarre;* very long stems; known to have been adopted from the Marind-Anim.

Fiji

Fijian farmers have a folk taxonomic system that efficiently differentiates cultivars of kava based on the color and shape of their internodes. Vernacular cultivar names refer to these distinctive features. For example, *vula kasa balavu* means "white with long internodes" (*vula,* "white"; *kasa,* "internode"; *balavu,* "long"); *dokobana* means "planting stick" (i.e., the internodes are as long and thick as a stick); and *matakaro* means "spotted." Cultivar *qila* is named after a famous village in Taveuni where the clone probably originated. As noted above, the Fijian cultivars *honolulu* and *business* are probably recent introductions.

In addition to classifying different cultivars, Fijian farmers and market traders also differentiate among parts of the kava plant. Scraped and dried pieces of lateral roots are called *waka.* These are cut into pieces 3 to 10 centimeters in length and 1 to 5 centimeters in diameter for further preparation and sale. The dried rootstock and the basal portion of the plant's stems—*lewena* and *kasa,* respectively—are also commercial items. In the market, *waka* (U.S. $12 per kilogram in 1990) costs more than *lewena* (U.S. $8 per kilogram), which is more expensive than *kasa* (U.S. $4 per kilogram). This commercial evaluation relates directly to relative kavalactone content in each of these parts of the plant (see chapter 3). Such grading is unknown in other Pacific islands and may be an innovation of the Fijian-Indian community.

Following the development of kava as a cash crop around 1950 in Fiji (Gatty 1956), farmers narrowed their plantings to the most productive cultivars. A farmer today commonly plants only two or three cultivars known for general hardiness and resistance to disease (e.g., *loa kasa leka* and *loa kasa balavu*), although these cultivars are not necessarily the most palatable ones. These "black" (actually purple) cultivars are less favored by drinkers because they produce a weaker beverage. They do, however, resist disease better and mature earlier than "white" (i.e., green) cultivars, the source of the best *yaqona.*

According to Lewin (1927), the strongest kava in Fiji once came from the

Polynesian island ...otuma where, he claims, the inhabitants enjoyed making passing sailors drunk. Morphotypic similarities, along with reported cultivar names, suggest that some exchange of planting material took place between Fiji and central Polynesia. About 15 cultivars reportedly were known in Fiji at the beginning of the 1900s, before the advent of commercial kava growing (Seemann 1862, 1868; B. E. V. Parham 1935; Steinmetz 1960). Today, kava in Fiji (excluding the Lau group and Rotuma, which are unsurveyed) is represented by eleven cultivars (eleven morphotypes):

1. *Loa kasa leka:* Dark purple stems; short, thick internodes with many lenticels; generally normal appearance with no leaf pubescence; regular, dark-green laminae with a purple tinge on the insert point of the petiole.
2. *Loa kasa balavu:* Dark purple stems; long, thin internodes with many lenticels; generally erect appearance; no leaf pubescence; regular, dark-green laminae with a purple tinge on the insert point of the petiole.
3. *Vula kasa leka:* Light green; short, thick internodes with many dark green spots; prostrate general appearance; pubescence on the edge of the lamina which is opened, regular, and pale green.
4. *Vula kasa balavu:* Light green stems with long, thin internodes and many dark green spots; generally erect appearance; pubescence on the edge of the opened, regular, dark green lamina.
5. *Dokobana vula:* Light green stems; long, thick internodes with many dark green spots; erect general appearance; dark green laminae that are opened, regular, and lacking pubescence.
6. *Qila leka:* Dark green stems with short, thick internodes and very few spots (on the upper part of the internode only); generally erect appearance; pubescence on the edge of the drooping, elongated, dark-green laminae.
7. *Qila balavu:* Dark green stems with long, thick internodes and many spots; erect general appearance; pubescence on the edge of the drooping, elongated, dark-green laminae.
8. *Matakaro leka:* Green with a purple tinge on the nodes of the orthotropic stems and plagiotropic branches; short, thick internodes with many spots; erect general appearance; undulate pale green laminae with no pubescence.
9. *Matakaro balavu:* Green with purple tinge at the nodes; long, thin internodes with many spots; erect appearance; pale green laminae with no pubescence.
10. *Honolulu:* Long, thin internodes that are light green with few dark green spots on the upper parts but uniform with a dark green tinge on the lower parts; regular, round, pale-green laminae with no pubescence; normal general appearance.
11. *Damu:* Purple stems with a green tinge; short, thick internodes with very few spots; regular, round, dark-green laminae with no pubescence.

Tonga

Farmers on Tongatapu and Vava'u recognize eight kava cultivars (Lebot, field survey, 1987). Cultivar names, many binomial, refer to distinctive morphological characteristics—for example, *huli*, "black" (or purple); *hina*, "white" (or light green); *akau*, "long internodes"; *leka*, "short internodes"; *fulufulu*, "hairy"; and *valu*, "eight." The traditional classification system, which is similar to that of Fiji, is based on a dichotomous choice between characters: first the color and then the shape of the internode. The eight cultivars are described below:

1. *Kula akau:* Tall and erect; thick purple stems with spots on long internodes.
2. *Kula:* Medium-sized; thick purple stems with spots along short internodes.
3. *Leka kula:* Dwarf or prostrate; thin purple stems with spots along short internodes.
4. *Hina akau:* Tall and erect; thick green stems with spots along short internodes.
5. *Hina:* Dwarf or prostrate; thick green spotted stems and short internodes.
6. *Lau fulufulu:* Tall and erect; thick, generally long, dull green stems with a few prominent spots around the purple pigmented nodes; adaxial leaf laminae with hairs.
7. *Ata:* A dwarf form of *lau fulufulu*.
8. *Valu:* Medium-sized; thin slender, dark-green stems with long internodes and a few spots around the nodes; light-green streaking in the internodal region.

Western and American Samoa

Seven cultivars are named traditionally in American Samoa, but only five cultivars are recognized by Western Samoan farmers. Three of these, *ava talo, ava mumu*, and *ava sa*, are uncommon. *Ava sa* is cultivated only on Savai'i. The other two, *ava lea* and *ava la'au*, are both equally popular and are by far the most commonly planted cultivars in Western Samoa.

Samoan folk taxa names reflect distinctive and unusual morphological characteristics of cultivars. For example, the relatively rare *talo* variety is named after its tuberous root system, which is compact like a corm of *Colocasia esculenta* (taro; *talo* in Samoan); and the name of the *mumu* variety refers to that cultivar's red internodes. *Ava sa* is a variant of *ava la'au* and is used for ceremonial purposes only. On Upolu, farmers also recognize a variant of *ava lea*, although they do not give it a distinctive name. In American Samoa, the word *ulu*, which refers to breadfruit (*Artocarpus altilis*), is used for a kava cultivar that flowers frequently and produces spadices similar to the male inflorescence of the breadfruit tree.

Wallis and Futuna

Only three cultivars are recognized by growers on the Polynesian islands of Wallis and Futuna: *hina kata loa, hina leka*, and *huli kata loa*. Here again, cultivar names reflect distinctive morphological characters: *hina*, "white"; *huli*, "black"; *leka*, "short"; *loa*, "long"; and *kata*, "internode." Kava is becoming scarce on Wallis, and communities have had to import rootstock from Futuna, and more recently from Vanuatu, for ceremonial purposes. On Futuna, however, Islanders continue to cultivate the plant in their subsistence gardens and to consume freshly prepared kava on a daily basis.

Society and Marquesas Islands

On Tahiti, Islanders no longer grow kava; kava cultivation is another part of the lost cultural tradition of the Society Islands. However, about 15 relict plants of past cultivation were located during a 1987 survey of the Papeno'o and Fatau'a valleys, in the thick, wet forests that still cover the upper reaches of these valleys. The Marquesas islands of Nuku Hiva, Ua Huka, Hiva Oa, and Fatu Hiva were surveyed in 1987. Although kava is no longer cultivated in the Marquesas, there, as in Tahiti, a few relict plants were found. Four accessions collected from these relicts, found in the forests of Fatu Hiva, have since been planted in the Papeete Botanical Garden.

As recently as the mid 1800s, Cuzent (1856, 1857) listed the vernacular names of 14 kava cultivars used traditionally by Tahitians and Marquesans. In 1935, Brown recorded the names of 21 cultivars still used by Marquesans during the earlier part of this century. He noted that the species "was intensively cultivated by the natives, who had selected 21 varieties differing in height, the length, and color of the internodes, the size of the leaf, or in chemical composition."

Cuzent (1860) claimed that the psychoactive quality and strength of the beverage obtained from a particular cultivar was the main distinctive characteristic in the Tahitian folk classification system. The physiological effects were more important than the morphological features in classifying a cultivar. If this indeed was the case, the Tahitian system was distinctive in this regard. Cuzent (1856) listed the following Tahitian cultivars:

1. *Hahatea'a:* Ligneous stems with dark green internodes approximately 3.5 centimeters in diameter; not very popular because it produced a weak beverage.
2. *Avini-ute:* Ligneous, purplish-red stems similar to those of Polynesian sugarcane (*Saccharum officinarum*); dark green leaves; tender roots that were easy to chew and were highly appreciated; cultivated in dry areas; called *avini* ("pleasure") because of its unusual aphrodisiac effect.

3. *Avina-tea:* Thin stems and pale green leaves.

4. *Toaparu* (also *to'oparu* or *paru*): Greenish-gray stems approximately 5 centimeters in diameter; very large fibrous roots that were difficult to chew; grown in dry areas.

5. *Toa:* Greenish-yellow thin stems; *toa* (hard) referred to its tough roots.

6. *Orava* (or *marava*): Reddish stems and dark leaves.

7. *Aue:* Dark stems and thick roots.

8. *Fauri:* Light green stems flecked with dark green spots in the upper part of the internodes; produced a desirable beverage.

9. *Taramaete:* Tall; thick, pale-green internodes with dark green spots; dedicated to the gods and used when human sacrifices were offered to the deities.

10. *Marea:* Root was lemon-yellow on the inside.

11. *Morotoi:* Dark, blackish stems; believed to have been introduced; very rare.

12. *Maopi:* Wrinkled edges of laminae.

13. *Poiha'a:* Short-stemmed.

14. *Ataura:* Reddish stems and roots; produced an ordinary beverage.

Hawai'i

'Awa is now a relic of traditional Hawaiian culture—an uncommon but attractive plant that can be found for sale as an ornamental in a few commercial nurseries. Surprisingly, one of the earliest post-contact (after 1778) export commodities in Hawai'i was *'awa* rootstock. The industry lasted about 14 years, exporting an estimated 8000 kilograms (Kepler 1983). On Hawai'i, the largest island, the district of Puna was famous for its kava, but very few specimens survive there today. Relict populations of kava can still be found in a few steep-sided, shady valleys on some islands. Abandoned populations also exist in Halawa, upper Ka'a'awa, and Waihole valleys on O'ahu (Merlin, field observations, 1983; Lebot, field observations, 1987). Surveys of relict populations on the islands of O'ahu and Hawai'i identified eleven kava morphotypes. Although, as on Tahiti, cultivar names have been lost, traditional folk taxonomy in Hawai'i appears once to have been detailed.

In 1940 Handy published a different list of 14 cultivars of *'awa,* but his brief descriptions for each do not permit us to reconstruct fully the traditional classification system:

1. *Apu:* Short internodes and green stems.

2. *Hiwa:* Long internodes and dark green stems.

3. *Ke'oke'o:* Described as "whitish in general appearance and more commonly found than the others."

4. *Kumakua:* Tall shrub with green internodes.

5. *Makea:* Lo[illegible]ernodes and stems of a lighter green than *Apu* and with reddish color at the nodes.

6. *Mamaka:* Short internodes and light green stems.

7. *Manienie:* White, smooth stems.

8. *Mo-i:* Short, dark-green internodes and whitish nodes.

9. *Mokohana:* Short yellowish green internodes; peculiar thin ("hairlike") rootlets.

10. *Nene:* Long internodes; general appearance "somewhat spotted with a bumpy bark and trunk."

11. *Papa:* Prostrate appearance; short internodes; spotted stems.

12. *Papa ele'ele:* Probably a dark (*ele'ele*) mutant of *papa.*

13. *Papa kea:* Like *papa ele'ele* as to internodes and appearance, but with a light green stalk.

14. *Kau la'au:* Famous cultivar from Puna on the big island of Hawai'i; according to the Hawaiians, it sometimes grew in the crotches of trees, planted by birds building nests with pieces of stem.

Micronesia

On the island of Pohnpei, in the Federated States of Micronesia, where kava is known as *sakau,* two cultivars are recognized today:

1. *Rahdmel:* Smooth stems; light color; relatively long internodes.
2. *Rahmwahnger:* Darker colored stems with light green spots.

No folk classification of kava on Kosrae (the other Micronesian island where kava was once used) was recorded before Kosrae Islanders abandoned kava culture upon their conversion to Christianity in the second half of the eighteenth century.

Vanuatu

Vanuatu has one of the highest ratios of number of languages to population size of any country in the world (Tryon 1976). One hundred and five different languages are spoken in the archipelago—approximately one language for every 1400 people in a total population of about 150,000. Vanuatu also possesses detailed folk taxonomic systems that distinguish and classify at least 247 kava cultivars clustered into 82 morphotypes (Lebot and Lévesque 1989). This taxonomic complexity no doubt relates in part to environmental factors. The numerous cultivars grown throughout the archipelago have adapted to diverse ecological conditions imposed by elevation (kava grows at altitudes up to 1100 meters on Santo and 800 meters on Maewo) and latitudinal variation (ranging from Anatom at 20° S to the Torres

Islands at 15° S). We believe that the complexity of folk taxo[...]ies of kava in Vanuatu also indicates the antiquity of the drug's use in these islands.

Although ecological conditions in Vanuatu are varied, kava cultivars are readily dispersed within the archipelago via traditional exchange networks. This cultivar exchange has enriched local germplasm collections. Shared generic and cultivar names for kava help trace the dispersal of clonal material from island to island. In northern Vanuatu, for example, it is interesting to note that the generic names for kava on Maewo (*maloku*), on Ambae (*malok*), in northern Pentecost (*mologu*), and at Nokovoula in West Santo (*malohu*) are all cognate with those of Tongoa (*namaluk*), Emae (*namaloku*), and Nguna (*namaloku*), and also with that used in the Big Nambas region of North Malakula (*malox*), even though the people of these islands speak languages belonging to three distinct linguistic groups (Tryon 1976). These cognates derive from a Proto-North Central Vanuatu form, **maloku*, that existed some 3000 years ago (Crowley 1990). One cultivar known on Ambae as *tarivarus* also occurs on Mota Lava (*tarivarus*), Vanua Lava (*tarvarus*), Maewo (*tariparaus*), northern Pentecost (*tarivarusi*), and southern Pentecost (*tarivarus*). This cultivar has retained the same name despite being scattered over several islands and a number of different language areas.

Most Vanuatu cultivar names refer to distinctive morphological features, to a legend, or in some cases to the name of the first person to develop and cultivate the clone. In the Ngwatua language of the Nduindui area of Ambae, *tari* (as in *tarivarus*) is a proper name. It may be that the *tari* cultivar was developed on Ambae and was subsequently traded out to other communities, although no one today claims to have originated the clone. The cultivar called *ngame* on Ureparapara undoubtedly has the same genotype as *nagame* on Motalava, *giemine* on Vanua Lava, *memea* in northern Pentecost, *tememe* in central Pentecost and *memea* on Ambae. All of these cultivar names, in fact, mean "red." A cultivar known as *rong rong vula* in North Pentecost appears to have the same genotype as one called *rogo rogo pula* in West Ambae and *rong rong wul* in central Pentecost. *Vula, pula,* and *wul* all mean "moon" in the respective languages of these three areas, while *rong rong* and *rogo rogo* both mean "to feel." A cultivar called *marino* in central Santo is said to be native to a place of the same name in northern Maewo. It is most likely a very recent introduction, possibly even by airplane.

The cultivar assemblages and folk taxonomy of *P. methysticum* are more varied and complex in some areas of Vanuatu than in others. The areas of greater diversity may or may not be regions where clonal selection originated. At the least, however, they are regions where, for ecological or sociocultural reasons, a diverse and substantial genetic assemblage has been developed. In these zones of intensive kava cultivation a relatively large part of the contemporary gene pool of *P. methysticum* is concentrated.

Two of these a[...]—the islands of Pentecost and Tanna—lie on opposite sides of a major biogeographic boundary located south of Efate, the central island of Vanuatu (Schmid 1975). This frontier is also a linguistic (Tryon 1976) and cultural divide. Between the regions on either side of this boundary, cultivar phenotypic distinctiveness is sometimes substantially greater than geographical separation. In other words, a cultivar from the Banks Islands may be morphologically more similar to an Epi cultivar than the latter is to a geographically more proximate cultivar from Tanna or Anatom. Kava morphotypes from the two major diversification centers, Pentecost and Tanna, are so different that a farmer from one center visiting the other will fail to recognize cultivars with which he is familiar. If the same farmer travels within his own region, on the other hand, he will encounter a number of the familiar cultivars that grow on his home island.

Clearly, significant differences in climatic conditions between the northern and southern areas of Vanuatu have a direct bearing on local kava morphotypes. We suggest that, in addition, kava has different origins in the two regions: it is a native domesticate in the north but an import via Polynesia (although ultimately from northern Vanuatu) in the south. According to the mythology of Tanna, kava was a relatively late introduction to that island. One origin myth claims that it appeared some centuries ago along with powerful magic and sorcery stones, the pig, and political phratries (Bonnemaison 1987; see also chapter 5). If so, then pigs and kava both may have been carried to Tanna from Samoa or perhaps Tonga. Neither kava nor pigs is recorded as having reached New Caledonia, somewhat farther to the southwest of Tanna. This history would also explain certain Polynesian influences on kava use on Tanna, such as the generic name *nikava* and the use of mastication rather than grinding to process the rootstock (Brunton 1989).

In the recent past, the biogeographic divide separating northern and southern Vanuatu has broken down. Northern cultivars have made their way south and vice versa. For example, the introduction to Erromango and Tanna of cultivars called *vila* (named after Port Vila on Efate—today no longer an important area of cultivation) was definitely recent. *Vila* cultivars are not necessarily all of the same genotype. They may be similar only in having passed through that town on their way south. Cultivars known as *lili* on Erromango and *riki* on Anatom, which growers believe are native to the island of Tongariki, are probably also recent imports from the north.

The folk classification systems of Vanuatu's two main diversification areas are summarized here:

Pentecost Cultivars. Growers on Pentecost believe that kava was introduced from Maewo Island immediately to the north. Farmers describe the various cultivars grown in central Pentecost (Melsisi area; Apma language) as follows:

1. *Borogu:* The stems of this cultivar have a regular thic[k…] and are brown, but turn green at the ends. The leaves have a fairly pale gree[n] [sh]ade, but turn dark when cultivated in a coastal or forest site. In dry areas, the ends of the leaves display a yellow tinge. They measure approximately 15 centimeters long and 10 centimeters wide. The internodes vary in length between 15 and 20 centimeters. Kava drink produced from this cultivar is slightly bitter but quite strong, and a single cupful produces the desired effect. *Boro* means "small in size." The root mass of the cultivar is fairly compact and does not grow deep, but rather spreads out at a shallow depth. This cultivar is a kava drinker's favorite. *Borogu* is called *borogoru* in the north of the island and *gorogoro* in the south.

2. *Borogu temit:* The appearance of this cultivar is identical to that of *borogu* except that the stems are lighter in color (*temit* means "white" or "light"). It is planted primarily in forest areas. Kava made from this cultivar has an effect comparable to that of *borogoru*. The cultivar is known as *borogoru maita* in the north and *gorogoro entepal* in the south of the island.

3. *Borogu tememe:* Grown mostly in forest areas, this plant has the appearance of the *borogu* cultivar but with violet stems (*tememe* means "red"). Kava made from this cultivar has stronger psychoactive effects than the drink produced from *borogoru temit*. *Borogoru memea* is the cultivar's name in the north; in the south it is *gorogoro entemet*.

4. *Melmel:* This cultivar produces very fine stems and branches and small yellow leaves. Kava drink made from it has very feeble effects; thus it is called *melmel*, which means "nothing." No aftereffects are felt the day following consumption, even if large quantities are consumed. Usually it is reserved for chiefs because it allows them to carry on drinking kava while talking for extended periods without losing control of their muscles or nodding off to sleep. The *melmel* cultivar is a small plant, under two meters tall, with internodes 20 to 25 centimeters long. In the north it is named *sese*.

5. *Lalahk:* The leaves of this cultivar are yellow, but of a paler shade than those of *melmel*. It may be encountered growing as a relict in forest areas. In leaf form and size it is identical to *malmalbo* (see cultivar 10 below), although the leaves are lighter in color. The same can be said of the stems, which are not as thick, although otherwise the same as those of *malmalbo*. The smell of this kava drink is similar to that of *melmel*, but its effect is very potent. The cultivar is called *fabulakalaka* in the north and *laklak* in the south.

6. *Abogae:* The name of this cultivar is not native to the Apma language of central Pentecost. It appears to have been introduced from the north, where it is known as *fabukhai*. The cultivar is also grown by Pentecost Islanders on Santo, where it is known as *tudei* ("two day") in the Bislama language. It produces a highly potent drink. Its stems are slender and green.

7. *Bukulit:* This cultivar produces yellow leaves larger than those of *melmel*.

Buku means "[…]" and *lit* refers to pale spots on the internodes which, by analogy, are asso[ci]ated with the skin spots on many Pentecost Islanders that are caused by various fungi (including *Pityriasis versicolor*). The cultivar is known as *bukelita* in the Raga language of northern Pentecost.

8. *Bogong:* This form of *P. wichmannii* is not cultivated but grows wild in the forest. *Bogong* means "big and strong." In the north it is called *bogongo*; in the south, *liap*.

9. *Bo:* This cultivar is rarely consumed except as an admixture with other cultivars. It is used to dilute quality kava (i.e., *melmel* and *borogu*) on feast days in order to increase quantities of the ritual beverage. Its leaves, however, are widely used in traditional medicine to treat boils and ulcers. *Bo* means "pig," a reference to an unpleasant odor given off when the roots are infused. This cultivar also belongs to the *P. wichmannii* taxon.

10. *Malmalbo: Malmal* means "rotten." The taste and smell of this cultivar are reminiscent of rotten pig meat. It produces a highly potent beverage, and drinkers experience its effects over two or three days. The cultivar is fairly uncommon and is used mainly in traditional medicine to relieve rheumatic pains. Its stems are paler than those of *borogu* and its leaves smell like those of *melmel* or *bukulit*. The laminae are a darker green than those of *borogu*.

11. *Take:* The underside of the lamina of this cultivar is a reddish-brown. Kava drink made from *take* is about as potent as *melmel* and has similar taste. *Buasitake* is the name of a little brown bird with a long tail, perhaps the inspiration, by analogy of color, for the name of this cultivar.

12. *Tabal:* This cultivar is similar in general form to *borogu tememe*, but much larger. It is often used as a windbreak near huts because it is very durable and decorative. A five-year-old clone generally reaches a height of three to four meters. *Tabal* is a rarely used for kava drinks because it produces a highly potent beverage. When a drinker feels its effects he is reminded of war, *balan*, or doing battle, *tabalan*, the image evoked by the name of this cultivar.

13. *Rong rong wul:* This is a dark cultivar with purplish-blue stems and veins. It is small and not very popular. *Rong rong* means "to feel" and *wul* means "moon." It reportedly must be planted at full moon to grow properly.

14. *Maga:* This is a large, dark-green cultivar. *Maga* means "green."

15. *Rara:* The name of this cultivar means "of a perfectly even color," or unblemished. Its internodes are indeed uniformly colored. It is also known as *rara* in the northern Raga language.

16. *Renkaru:* This is a very rare and potent cultivar.

Additional Pentecost cultivars include *tarivarusi* in the north (*tarivarus* in the south), which is not grown in the center of the island. A cultivar called *sese jarakara* in the north is probably an environmental variant of the central *sese* cultivar.

Another cultivar, known as *jabualeva* in the north, is very rar… …d used only by chiefs during ceremonies. It is difficult to locate relatives of t… cultivar in the center or south of the island. Cultivar *tamaevo* ("from Maewo") in the south has no taxonomic equivalent in the central or northern areas. The same is true of the *kerakra* and *kwik* cultivars.

Tanna Cultivars. The folk taxonomy used in the central region (Lowiakimak) of Tanna classifies cultivars as follows:

1. *Pia:* The name of this cultivar means "smooth" or "hairless," referring to the appearance of the internodes. A possible ecotypic variant of *pia* named *erman* ("man") is distinguished by the arrangement of its internodes. The beverage produced from this cultivar is the kava of reconciliation, traditionally used to settle disputes and misunderstandings or to appease angry ancestors and spirits.

2. *Rhowen:* The name of this cultivar refers to its "white" stems, which are actually very pale green in color. The beverage made from *rhowen* is drunk to guard against sorcerers.

3. *Fare:* The name of this cultivar means "with roots coming out of the ground" (adventitious prop roots). When the great *nakwiari* pig exchange and dance festival takes place, this cultivar is used in kava exchange contests in which growers compete to display and give away large plants.

4. *Leai:* This cultivar is named after a well-known sorcerer who lived in the south of the island during the early part of this century and claimed to have found the first specimen at the bottom of a volcanic crater. *Leai* also means "imp," "gnome," "dwarf," and other "little creatures dwelling in the forest." It is popular because the beverage produced from the cultivar has a relatively mild psychoactive effect. It attains heights of approximately 1.5 meters.

5. *Apin:* Meaning "black," the name of this cultivar refers to its dark purplish-blue stems. It is not very popular and is mainly used to treat rheumatism. It is also planted close to the sacred area of the *nakamal* (kava drinking ground) where drinkers spit *tamafa*, or kava libations, to their ancestors (see chapter 5). *Apin* is believed to be a "magical" kava. It grows very slowly.

6. *Ahouia:* The stump of this cultivar (whose name means "yellow") has a very distinct yellow interior, indicating that it is very potent (i.e., rich in kavalactone resin; see chapter 3).

7. *Tikiskis:* This cultivar is named after a very jittery little bird. Indeed, if too much *tikiskis* kava is drunk, nervousness results. The cultivar is grown mainly in the northwest of the island on the White Grass Plateau.

8. *Kiskisnian:* This cultivar is multicolored and is mainly decorative. *Nian*—the name of a coconut that has two different varieties, one "green" and the other

"white"—refers …he variegated appearance of the leaves of this kava cultivar (probably due to a somatic mutation perpetuated by cloning).

9. *Mira:* This cultivar has very thick heavy roots, slender stems, and yellow leaves. It usually looks dry and withered, but this is its normal appearance. The leaf laminae are small and the young stems, which are highly erect, grow in the middle of the bunch. Kava beverage produced from this cultivar has a powerful effect.

10. *Malamala:* The name of this cultivar means "bat." Its stems are identical to those of *pia* except that they have no flecks. It grows tall, to over three meters. Fruit bats, known locally as "flying foxes" (*Pteropus* sp.) often perch on the plants. It grows under a wide range of environmental conditions and can be used to produce a potent kava drink.

11. *Paama:* This very popular cultivar was probably introduced recently from Paama Island. It has thick stems and short internodes.

12. *Yam:* This cultivar has a Bislama name evocative of its slender stems, which are similar to those of yams (*Dioscorea alata*). The stems are roughly textured, perhaps owing to cutaneous necrosis.

13. *Nik:* This cultivar has thick, woody stems that are difficult to cut.

14. *Nare:* The young stems of this cultivar have very pale patches on the internodes.

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

16. *Tuan:* This cultivar is similar to *pia* but has much paler leaves.

Several additional cultivars grown today on Tanna (*pentecost, vila, tudei,* and *fiji*) were probably introduced recently. They have no ritual display or customary exchange significance.

The relative complexity of a community's folk ethnobotanical classification system is not unequivocal evidence of botanical antiquity, or even domestication, within that region. Although Tanna possesses a rich folk taxonomy for kava, as noted above, *P. methysticum* appears to have arrived here from Polynesian sources to the east. Folk taxonomic complexity is nonetheless probable evidence for a local history at least of clonal selection and development. The degree of elaboration and detail within a folk taxonomy (which reflects, of course, local diversity in kava-germplasm collections) should be considered alongside morphological and genetic evidence in determining the origin of kava.

Preparation and Consumption

Where kava is consumed today in the Pacific, it is typically drunk at dusk, usually before the evening meal because a full stomach can hinder appreciation of the plant's normally subtle psychoactive properties. Infused kava is never kept for long; Islanders prepare kava for immediate consumption. Aft[hole punch] king, people eat small amounts of food because kava tends to reduce appe[hole punch] and because overeating may induce nausea. In some regions, including Papua New Guinea, Vanuatu, and Wallis and Futuna islands, kava is processed soon after it is harvested. In others areas, such as Fiji, Samoa, and Tonga, people often dry the root first.

The several traditional methods of kava preparation all serve to extract the active chemical constituents from fresh or dried rootstock. Processing basically involves chewing, grating, grinding, or pounding kava stumps and roots and then infusing the processed mass in cold water (figures 4.7 and 4.8). These methods break up and macerate the rootstock so that kavalactones are more readily released into the cold water. Today, mastication of fresh rootstock is practiced only in the southern and central parts of Vanuatu and among several tribal groups in Papua New Guinea. Lou Islanders once masticated kava (R. Parkinson 1907) but stop-

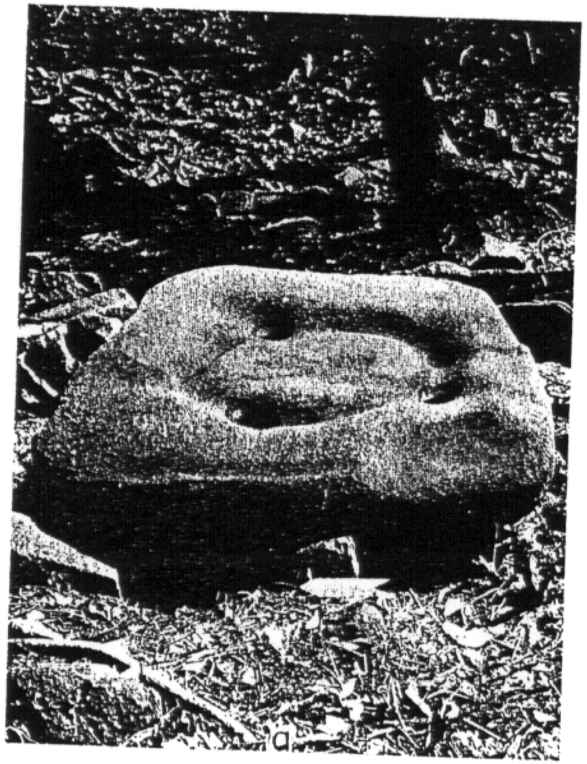


Figure 4.7. Old kava pounding stone found at the ruins of Nan Madol, Pohnpei (courtesy of S. Riesenberg).

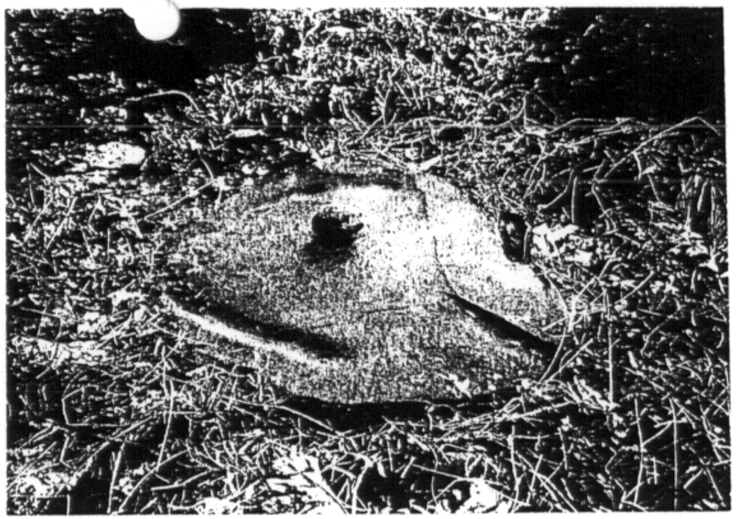


Figure 4.8. Large flat basalt stone from the prehistoric archaeological remains at Lelu, Kosrae (photo M. Merlin).

ped using the drug in the early 1970s. This method was also once common throughout Polynesia and Fiji (Beaglehole and Beaglehole 1941; Titcomb 1948).

Kava preparation techniques in Fiji are of interest. The current employment of so-called traditional kava circles to symbolize chiefly hierarchy, the use of round wooden drinking bowls supported by four or more legs (*tanoa*), and the practice of mastication to prepare the rootstock probably all were borrowed from Tongan sources only around 1750 (Clunie 1986; Tora 1986). Before that date kava drinking in Fiji was much more closely associated with ancestor worship. Men serving as village priests prepared kava each morning in *būrau* (men's houses, or houses of ancestor worship) as an offering to village ancestors. The priest and other men of the community then drank kava together. The rootstock was prepared by grinding, not mastication, and the drink was infused in leaf-lined holes in the ground, in shallow wooden bowls that were sometimes human or animal in shape, or in plain clay vessels. Early Fijians filtered their kava by pouring it through bunches of bracken fern leaves held in a woven canister-like device, rather than using a strainer of *Hibiscus tiliaceus* bark as is common in Polynesia. Furthermore, Fijians did not drink kava from coconut shell cups (*bilo*) as they do today, but instead sucked infused kava straight from the container, sometimes using straws.

Before the eighteenth century, then, kava preparation in Fiji was far more Melanesian than Polynesian in character. Clunie (1986) suggests that eighteenth-century Christian missionaries encouraged the transformation of Fijian kava-consumption rituals toward a Polynesian style: "Being an essential part of the indigenous religion, *bürau* bore the full brunt of the Christian onslaught, and went into eclipse with the gods it served, while the more 'innocent'—from a missionary viewpoint—Tonganified *kava* ceremonials were tolerated to survive to this day as one of the hallmarks of 'Fijian Culture.' "

After 1750 the "traditional" manner of kava preparation switched to mastication (although it reverted back to grinding a century later because of European interference). Preparation began with pounding of the rootstock on a stone into pieces small enough to be chewed by either men or women. Young girls (and in some cases also boys) with strong jaws and healthy teeth were obliged to chew their elders' kava. Once chewing was complete, the kava preparer deposited her mouthful of pulp in a large wooden bowl (*tanoa*), where she mixed and infused the kava with water (figures 4.9 and 4.10). After a thorough infusion, she extracted the masticated kava residue, strained the mixture, and served half coconut shells (*bilo*) of the beverage to each guest (Steinmetz 1960).

Similarly, in the traditional Samoan ceremony, a young girl chewed and served kàva (Mead 1930; see also chapter 5). The girl was preferably a virgin, who purified herself for kava preparation by washing her hands and wrists (Steinmetz 1960). After chewing kava, she mixed and infused the macerated root in a kava bowl and filtered out the solid residue with a fibrous sheath of *H. tiliaceus* inner

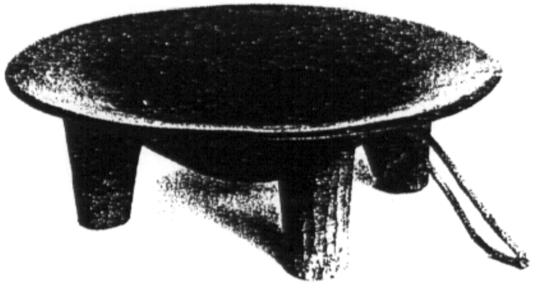


Figure 4.9. Tongan kava bowl, or *tano'a* (copyright © the British Museum).

Figure 4.10. Hawaiian kava bowl (copyright © the British Museum).

bark. Such a filter was called *fau* in Samoa and *hau* or *'au* elsewhere in Polynesia. (In Hawai'i, the fibers of mature sedges—*Mariscus javanicus* [*'ahu 'awa*] and *Torulium odoratum* [*pu'u ka'a*]—were also used to strain the masticated, infused kava [Titcomb 1948; Wagner, Herbst, and Sohmer 1990].) Samoan ceremony required the girl who chewed and infused the kava to sit cross-legged and bare-breasted on a mat behind the kava bowl, with flowers carefully arranged in her hair and her hips swathed in a grass skirt. This presented an image of beauty that added to the aesthetic dimension of kava preparation.

Kava mastication in Fiji and Polynesia was largely abandoned when challenged by nineteenth-century colonial administrators and missionaries, who considered the practice unhygienic. In Fiji, mastication nonetheless continued for some time in village kava circles because Fijians correctly insisted that chewed kava produces a more potent drink. Today, however, Fijians grind their kava. In the Polynesian islands, the traditional obligation of young boys and girls to chew kava also disappeared soon after European contact. In Samoa, for example, "the ruminating process, so horrifying to English readers and certain over-squeamish early voyagers, [gave] place in the civilised districts to grating" (Christian 1899). Mastication persisted longer on some islands than on others; on East Futuna, for instance, the practice did not cease until 1930, when a missionary mandated an alternative grinding technique that less outraged colonial sensibilities (Gaillot 1962). Formal kava ceremonies remain commonplace in Samoa, Tonga, and Fiji in spite of the fact that kava is now prepared by grinding rather than chewing, and the virginal kava preparer usually wears a blouse.

In Vanuatu, kava is now cultivated and consumed on almos ry island, although drinking rituals and methods of preparation vary. Whereas in Fiji, Wallis, Samoa, Tonga, and some regions of Pohnpei kava is first dried then ground, in Vanuatu it is typically consumed fresh. On the southern and central Vanuatu islands of Anatom, Tanna, West Futuna, Aniwa, Erromango, Nguna, Emae, Tongoa, Tongariki, Epi, and Paama, the root is still masticated. In the north—Pentecost, Maewo, Ambae, Banks, Torres, and Santo—it is prepared by grinding using a coral abrading stone held over a wooden dish. There are exceptions: the inhabitants of the now-abandoned village of Nokovoula in the interior mountain range of Santo Island prepared their kava by mastication (Lebot, field observations, 1985), and kava chewing has also been reported in southwestern Santo, in some Malakulan communities, and on Efate (Codrington 1891; Speiser 1923; Guiart 1958).

In the Banks Islands of northern Vanuatu, kava drinkers traditionally split into two groups, and a person from each group prepares kava for a person from the other. As on most of the northern islands of Vanuatu, preparation in the Banks group involves the grinding of fresh kava over a large wooden dish using an elongated coral abrading stone (figure 4.11). The inner surfaces of these wooden

Figure 4.11. Kava preparation using coral abraders and wooden platters, Maewo Island, Vanuatu (courtesy of P. Crowe).

dishes eventually bec overed with a grayish-green deposit that is also found at the bottom of coconut shells used as drinking bowls. This deposit is a resinous kavalactone residue that contains the plant's active ingredients in concentrated form. Some drinkers periodically scrape the resin from their dishes and mix this with fresh water to obtain a brew with very powerful effects (figure 4.12).

On Tanna, in the south of the archipelago, kava preparation still includes mastication. On this island, the drug is prepared daily and is drunk communally as the sun is setting (Gray 1892; Humphreys 1926; Guiart 1956b; Brunton 1979, 1989; Bonnemaison 1975, 1987; Lindstrom 1980, 1981). Kava drinking here is an exclusively male perquisite. Young men who have been circumcised (i.e., recognized as full members of the male community) chew for older men, although adult men also masticate kava, particularly for a friend or guest.

Kava rootstock is first cut into smaller pieces with a knife, then scraped and rubbed with coconut husks to clean away dirt. Tanna's volcanic soils are rich in silica particles, and cleaning does not always remove all silica dust from the surface of the roots. As men chew kava roots over their lifetime, these particles produce a characteristic erosion of the teeth. Mouthfuls of polished kava are thoroughly

Figure 4.12. Filtering kava through a strainer of fibrous coconut frond sheathing held high above the drinking cup to insure a head of froth, Ambae, Vanuatu (courtesy of P. Crowe).

masticated and deposited onto a leaf (of *H. tiliaceus*, for examp, [illegible] laid flat on the ground (figures 4.13 and 4.14). Several mouthfuls of chewed pulp are then placed in the burlap-like stipule sheath of a coconut frond, and fresh water poured onto the kava as a young, circumcised virgin boy mixes the pulp in water with his hand (figures 4.15). The first filtrate, called "the body," which contains most of the available kavalactones, strains down into half a coconut shell. (These shells typically hold about 100 milliliters of kava.) The vigorously compressed residue, (called *nipar* in Tanna's Kwamera language and *makas* in Bislama) is set aside to be used for a second infusion with weaker physiological effects.

Drinkers quaff the entire coconut shell of kava at once and in silence. They then expectorate. This spitting is the *tamafa*, a kind of prayer to a drinker's

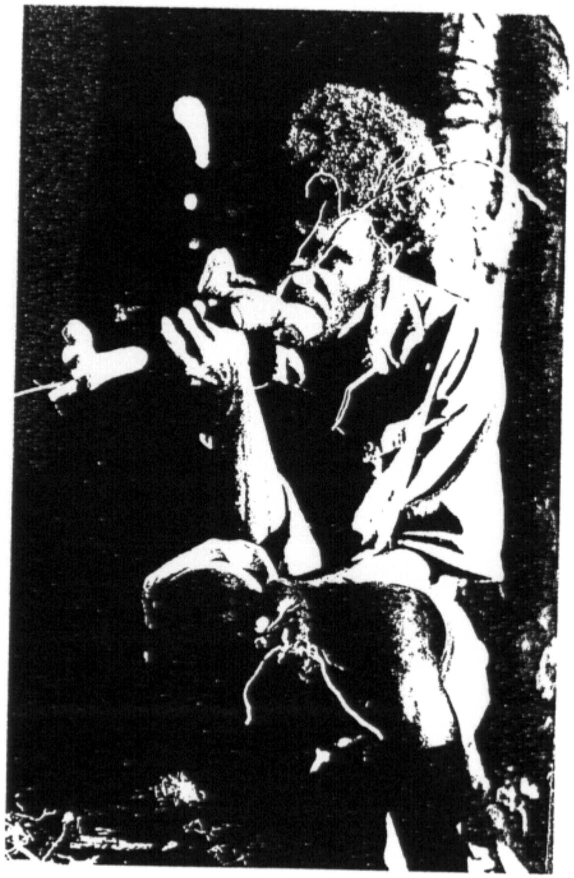


Figure 4.13. Chewing kava, Tanna, Vanuatu (photo P. Cowan).

Figure 4.14. Chewed kava on a banana leaf, Tanna, Vanuatu (photo P. Cowan).

ancestors in which he may express a personal demand or wish (see chapter 5). Following this, drinkers sit down beside small fires to "listen to the song of the kava"—that is, to feel its effects (in Bislama, *harem singsing blong kava* or *harem kava*). Each participant eventually moves away from the others to sit beside some glowing embers and smoke tobacco. Silence reigns over the drinking ground. The Tannese believe that too much noise or too much light may "kill the kava."

Local cultural expectations about kava intoxication as well as the specific physiological effects of a given cultivar influence a drinker's comportment while intoxicated. On Malakula, for example, drinkers continue to talk as they consume multiple shells of kava. "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

Figure 4.15. Filtering chewed kava through a strainer made from the stipule of a coconut frond, Tanna, Vanuatu (photo P. Cowan).

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" (Crowe 1986; see also Harrisson 1937).

Kava in Traditional Pharmacopoeia and Medi :ine

E hānai 'awa a ikaika ka makani
Feed with kava so that the spirit may gain strength
—HAWAIIAN PROVERB (Pukui 1983)

Kava is an important ingredient in the pharmacopoeia of many Pacific Islands societies. Zepernick (1972), for example, recorded numerous medical syndromes treated with kava-based preparations in traditional Polynesia (see also table 4.1). Knowledge and belief about the medicinal efficacy of kava still lead many island healers to prescribe its use to treat a variety of ailments and diseases. Medical science tries to find a logical relation between cause and effect to certify etiologic or symptomatic remedies, whereas traditional Pacific Island medicine seeks the causes of illness (often supernatural, primarily in the breaching of taboo) and then treats diseases with empiric:lly tested folk medicines.

Condi·	Medicinal treatment
Inflammation of the urogenital system	Drinking macerated stump and young kava shoots
Gonorrhea and chronic cystitis	Drinking prepared kava
Difficulties in urinating	Drinking macerated stump
Female puberty syndromes, weakness	Drinking masticated kava
Menstrual problems, dysmenorrhea	Drinking prepared kava
Vaginal prolapsus	Application of macerated kava
To provoke an abortion	Kava leaves in the vagina
Migraine related to women's sicknesses	Drinking masticated kava
Headaches	Masticated root tissues, eaten or drunk as an infusion
General weakness	Drinking of masticated, macerated kava diluted with water and boiled
Chills	Drinking macerated kava; fumigation with the leaves
Chills and sleeping problems	Drinking of masticated, macerated kava diluted in water and boiled
General treatment of diseases	Fumigation with the leaves
To prevent infection	Drinking of masticated kava
Rheumatism	Drinking of macerated stump
Weight gain	Drinking of macerated stump
Gastrointestinal upsets	Drinking of macerated stump mixed with other medicinal plants
Irritation of the respiratory tract and asthma	Drinking of macerated stump
Pulmonary pains	Drinking masticated kava
Tuberculosis	Drinking juice extracted from the stump
Leprosy	External application of masticated stump
Skin diseases	Application of masticated stump in a poultice
Certain skin diseases	Kava cure to cause desquamations; at the end of the cure, new healthy skin is formed.
To prevent suppuration	Application of masticated stump in a poultice
To calm nervous children	Drinking of kava drink prepared from the *nene* variety

Source: Lebot and Cabalion 1986, after: Aitken 1930; Degener 1945a, 1945b; Handy 1940; Handy, Pukui, and Livermore 1934; Hänsel 1968; Hänsel, Weiss, and Schmidt 1966; Steinmetz 1960; and Titcomb 1948.

Recent research indicates that the chemical properties of kavalactones in the rootstock of kava and alkaloids in the leaves may explain much of its usefulness in traditional medicine, although not all its applications can be accounted for scientifically (e.g., those for menstrual ailments). For example, the bactericidal or bacteriostatic activity of kavalactones underlies kava's reputation as a remedy for urogenital infections. Its traditionally perceived analgesic properties make it a common remedy for various aches and pains. Its diuretic effects may relieve symptoms of gonorrhea. Traditional uses of the plant as a contraceptive, abortifacient, or stimulant remain to be scientifically verified and explained, perhaps by research to identify physiologically active compounds other than kavalactones. Some reliance on kava within folk medicinal systems no doubt reflects its symbolic rather than chemical attributes. Use of kava to induce women's breast milk flow, for example, may relate to the general symbolic appreciation of kava as a fertile fluid (see chapter 5). We summarize some of the traditional medicinal uses of kava by region below.

New Guinea

In Irian Jaya, the internal part of *P. methysticum* bark is used for toothache (Aufenanger and Höltker 1940). In Papua New Guinea, scraped bark and masticated roots are used to relieve sore throats, and the juice from the leaves is used to treat cuts and is imbibed as a general tonic (Holdsworth 1977). Women drink fresh masticated kava root as an anesthetic when they are being tattooed. Women in some areas of this country also reportedly drink large quantities when they are pregnant, especially just before delivery, to stimulate milk production (Steinmetz 1960).

Vanuatu

The soporific properties of kava have been known in Vanuatu for many generations. Garanger (1972) provides some remarkable evidence of this. Archaeological excavation of the burial site of Roy Mata, a chief who reigned over the Shepherd Islands and Efate in the thirteenth century, uncovered male skeletons in positions suggesting that they were buried alive while in a peaceful state of mind, whereas the position of associated female skeletons suggests they put up a struggle. According to oral tradition, the men interred alive were under the influence of kava but their wives were not allowed the soporific potion.

Today on Mota Lava, in the Banks Islands of Vanuatu, kava is used in a drink to

treat constipation. It is also used to treat conjunctivitis: the eyes are washed with water mixed with juice squeezed from the leaves (Vienne 1981).

In Melsisi, on Pentecost, juice expressed from kava leaves is dropped into the ears to treat earache (Lebot, field observations, 1986). A. Walter (personal communication, 1987) noted a similar use of kava in Vansemakul, another Apma-speaking village in the same area. Also on Pentecost, a plaster made from heated and pounded kava leaves is applied to the abdomen to relieve an upset stomach. For feverish coughing, a handful of bark is ground up in a small amount of water, which the patient drinks in small doses. To relieve sickness characterized by fever followed by asthenia, sufferers drink half a glass of juice extracted from kava leaves. To burst a boil, people grind kava leaves and heat them over fire. The warm leaves are then pressed, and the juice obtained is applied to the boil, which is also covered with the pulverized kava leaves held in place by another leaf. For headaches, hot leaves are placed on the head. A sickness known in the Apma region bears a generic name of kava (*sini*); symptoms include swollen legs followed by fever. Sini is treated by bathing with a maçeration of four leaves from the *sini bo* cultivar ground in a bowl of water. A poultice made from four *sini bo* leaves heated in the fire is also applied to swollen legs associated with a similar illness (Lebot and Cabalion 1986).

On Tongoa, to treat general indisposition and lack of energy, juice is extracted from ground kava leaves, mixed in cold water, and applied by massage to the body.

On Erromango, a complex preparation containing kava is reputed to act against both asthma and tuberculosis (see Lebot and Cabalion 1986). The ingredients of the asthma remedy include leaves of a Compositae (*Crassocephalum crepidioides*), locally referred to as *sarndoo;* a Papilionaceae (*Abrus precatorius*) called *tamsi;* two cultivars of a Musaceae (*Heliconia indica,* var. *indica*), *mevong* and *mevong netukus;* and kava, called *naghave* (or *nagave* according to Lynch 1983). These leaves are pressed and the juice extracted and drunk. The sick person is restricted to a salt-free diet (no sea water) throughout the course of treatment. This medication is not administered to pregnant or menstruating women. On Tanna, however, juice extracted from the leaves of kava and a Cyperaceae species (*Fimbristylis cymosa*) is given to pregnant women who are approaching their delivery date, "when the baby has to turn round," to be sure it presents itself favorably for birth.

There are Erromangan tales of a kava syndrome called *naghave,* attributed to sorcery performed with various leaves. The symptoms of the illness are blurred vision and dizziness resembling those of an overdose of kava (these symptoms could simply result from jaundice). In 1982, two people in the southwest of the island still knew the method of casting this spell. More than ten local plants are used in preparing various remedies for kava sickness. There is also a kava sickness in New Guinea (Astrolabe Bay), referred to as *kial* (kava). *Kial* is purported to have a special effect on the backbone; old people who walk with a hunch prematurely are said to have either ringworm or *kial* sickness (Hagen 1899).

Fiji

In the early part of this century, Rougier (1907) recorded several medicinal uses of kava in Fiji. For example, a sickness characterized by a pain inside the head and both ears associated with "blurred vision" that "sometimes disappears at high tide, and in other cases at sunset," was treated with various remedies, one of which contained leaves of *Ipomoea peltata* and kava. Rougier also reported that "the best sedative drug is a draught prepared by scraping and pounding the kava root," and that "there were various means of contraception, one of which was masticating and swallowing kava leaves."

According to Degener (1949; see also Zepernick 1972), Fijians also soften kava leaves in a fire and apply these as a poultice against suppurations. Hocart (1929) noted the use of kava in a treatment for "convalescence." H. B. Parham (1939) reported that kava is considered to be a powerful diaphoretic. Fijian women regard it as a fortifying drink, laxative, and diuretic. In pregnancy, the absorption of small quantities of kava is said to facilitate delivery. In Fiji as in parts of New Guinea, doses of kava are thought to favor the production of milk. The absorption of several cups of kava reportedly helps clear up initial stages of diarrhea (Thomson 1908; Steinmetz 1960; Sterly 1970). On the Polynesian island of Rotuma, which politically is part of Fiji, kava is consumed to control asthma (Manner and Bryant 1988).

Polynesia

In Tahiti, a drink made from masticated kava rootstock was believed to be an effective remedy for gonorrhea (Sterly 1970; Maclet and Barrau 1959; Steinmetz 1960). In the Cook Islands, kava is still consumed to treat urinary tract problems (*mimi*), probably because of its diuretic action (Whistler 1990). In American Samoa, kava is also used against gonorrhea (MacCuddin 1974). The medicinal potion includes four small kava roots ground together with 12 chili peppers (*Capsicum annuum*), 24 leaves of a native tree (*Colubrina asiatica*), and the pith of the sweet orange tree (*Citrus sinensis*). The extracted juice is administered orally.

Another kava remedy is used in American Samoa to cure a urinary infection, supposedly caused by the spirit of a dead person, the symptoms of which are a distended bladder, a small emission of urine, and painful micturition (the illness probably results from a gonococcus infection, whose origin is generously attributed to the spirits of the dead). Therapy for this malady involves scraping the internal bark of a kava stalk, extracting the juice, mixing it with the juice of a dried *Pandanus* species root, and adding water to make a concoction that the patient drinks.

Kava is also utilized in the relief of a medical syndrome comprised of ocular

pains, difficulty in ...ing the eyes, and a feeling of having a swollen head, accompanied by a col... sweat, dizziness, and numbing of the legs. Eight kava leaves 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.

In Samoa, for an injury caused by a fish spine, a dried kava root is burned. A dry coconut shell is placed over the embers, allowing the smoke to escape through the opened "eyes" of the nut, and the injury is exposed to the escaping smoke.

Pohnpei

Islanders here state that kava drinking generally is beneficial to their health. They also use it as a prophylactic against gonorrhea, and one report states that they formerly employed kava as an abortifacient (Riesenberg 1968).

Ethnobotanical Heritage

On some islands, ethnobotanical knowledge supporting the cultivation, classification, and preparation of kava has attenuated and fragmented. During the nineteenth century, kava's traditional religious and political significance made it a target of European missionaries and colonialists who were arriving in increasing numbers to convert, exploit, and administer the South Seas. Religious campaigners struggling against alcohol and tobacco consumption in Europe, Australia, and North America—increasingly active in the 1800s—also focused their temperance movement animus upon Pacific kava, typically defining the drug as a sort of native alcohol or beer: "It is styled the 'nasty root' and the 'accursed liquor' by certain good and worthy missionaries whose convictions are sometimes sturdier than their charity" (Christian 1899).

Christian missionaries also soon appreciated the power of kava to conjoin drinkers with their ancestors and gods and, because of this traditional religious function, saw to its prohibition where they could (see Turner 1861; Gunn 1914; Aitken 1930; Titcomb 1948; Guiart 1956a; Serpenti 1965; Firth 1970; O'Brien 1971; Gregory, Gregory, and Peck 1981). Kava abstainers, put out of touch with their ancestors, might turn instead to God and Jesus for supernatural support. In Micronesia, where kava was part of ceremonial chiefly tribute, mission bans on kava consumption also served to undermine the traditional political system in favor of emerging missionary-supported polities (O'Brien 1971; Marshall and Marshall 1976).

Efforts to eradicate the drug succeeded in a number of Pacific communities, including Tahiti, in Polynesia, and Kosrae, in Micronesia. In Hawai'i in the 1850s a law was passed that forbade the consumption of kava without medical control or advice. Although this law was not well enforced, it signaled the decline of the traditional drug in this archipelago and its replacement by alcohol and, in the twentieth century, marijuana and other substances.

In Vanuatu, hostility toward kava was particularly marked in the early Presbyterian and more recent Pentecostal and Adventist missions (Guiart 1956a; Gadjusek 1967; Brunton 1979; Gregory, Gregory, and Peck 1981). Members of several other denominations, including the Holiness Fellowship Church, are also obliged to give up not only kava but also tobacco and alcohol. The Catholic missions, on the other hand, generally have tolerated kava. Some Marist and Columban fathers continue to use it with their village neighbors. Anglicans, too, have taken a friendlier stance toward the drug.

Ironically, the decline of kava drinking on some Pacific islands coincided with a rapid increase in consumption of alcohol. Restrictions imposed on kava drinking have had the unintended consequence of swelling sales of alcoholic spirits. Over a hundred years ago on Atiu island in the southern Cook Islands, for example, the London Missionary Society stamped out the traditional use of kava. The precontact kava ceremony of the *tumu nu* has persisted, however, with the replacement of kava by an alcoholic home brew made from fermented orange juice and sugar (Lemert 1976). Today *tumu nu* has four meanings: the coconut trunk, the container made from it, the place where the beverage is drunk, and the social institution where men gather to sit and exchange ideas and of course to drink home brew—in the same way that people in other countries do at pubs (Mokoroa 1984).

Even after a century or more of this sort of Christian and colonial interference, ethnobotanical knowledge and consumption of kava have been preserved in some societies, while in others impinging forces and influences have led Islanders to new, alien drugs like alcohol, nicotine, and marijuana. Although some Islanders now possess only fading recollections of the customs governing their traditional drink and the ethnobotanical knowledge necessary for kava cultivation, others who traditionally never consumed kava or who abandoned its use are turning or returning to the drug. In Vanuatu, particularly, local traditions of kava preparation and consumption are tending to change toward a modern national norm. In more than one contemporary Pacific community the ethnobotany of kava and its consumption are being reshaped by vibrant and creative innovation.

5. Anthropology
The Cultural Significance and Social Uses of Kava

Georg Forster, a young naturalist on James Cook's second Pacific voyage, gave us an early account of kava drinking. It was September 1773, and Cook was moored off the island of Raiatea, 250 kilometers or so west of Tahiti. A Tahitian youth named Porea, whom Cook had picked up earlier, brought a new Raiatean acquaintance on board. In Cook's own cabin the two Polynesians together prepared and drank kava while Forster watched.

> [Kava] is made in the most disgustful manner that can be imagined, from the juice contained in the roots of a species of pepper-tree. This root is cut small, and the pieces chewed by several people, who spit the macerated mass into a bowl, where some water (milk) of coconuts is poured upon it. They then strain it through a quantity of the fibres of coconuts, squeezing the chips, till all their juices mix with the coconut-milk; and the whole liquor is decanted into another bowl. They swallow this nauseous stuff as fast as possible; and some old topers value themselves on being able to empty a great number of bowls. . . . The pepper-plant is in high esteem with all the natives of these islands as a sign of peace; perhaps, because getting drunk together, naturally implies good fellowship. (Forster 1777)

Although clearly no kava enthusiast himself, Forster does tell us something about the significance of kava in Pacific Island societies. Two new friends meet to cement their acquaintanceship over a bowl of kava. They do so, moreover, in the most prestigious, perhaps even sacred, space they can find—inside Captain James Cook's cabin on the *Resolution*.

Over the past two centuries, kava has maintained its central place within many Pacific Island societies. Kava drinking still signals good fellowship (figure 5.1). This fellowship may be that between leaders and followers, chiefs and commoners, or prime ministers and voters, or it may be a fellowship of friends and equals. By sharing kava, Islanders create new relations with strangers and repair these relations when they falter. Kava consumption evokes feelings of camaraderie—an emotional response that symbolizes within a drinker's body the strength of ongoing social relations.

Kava is a valuable exchange item within political, religious, and economic structures—the main spheres of everyday island social life. First, bowls of kava