Association for Hawaiian ʻAwa

Hawaiian ʻAwa

Views of an Ethnobotanical Treasure

Edited by Ed Johnston and Helen Rogers

Ē ka ʻohu kolo ē, hoʻoua ʻia mai i ulu ka ʻawa.
(O creeping mist, make it rain so that the ʻawa will grow.)

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Edited by Ed Johnston and Helen Rogers
Association for Hawaiian ʻAwa
Hilo, HI

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Association for Hawaiian ʻAwa
Hilo, HI

The quotation on front cover is from Mary Kawena Pukui and Samuel H. Elbert's *Hawaiian Dictionary*, revised and enlarged edition, 1986, p. 361.

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This book is dedicated to Mr. Genesis Lee Loy,
ʻawa grower of Panaʻewa,
kupuna and director of the Association for Hawaiian ʻAwa
since its founding in 1998.

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About the Association for Hawaiian ʻAwa

The Association for Hawaiian ʻAwa (AHA) is a charitable organization established for "research, education, and preservation of the cultural and medicinal values associated with the ʻawa plant." Formed in 1998 with a federal grant from the Rural Economic Transitional Assistance-Hawaiʻi program, AHA received additional support at its inception from the Sacharuna Foundation.

AHA's original board of directors was comprised of Jerry Konanui, Jeri Ooka, Ed Johnston, Genesis Lee Loy, Joel McCleary, and Noelani Whittington.

By sponsoring a number of publications, workshops and conferences, AHA has shown people around the islands how to grow the plant, recognize the different Hawaiian varieties, and prepare the drink.

AHA has generally focused on ʻawa as a traditional drink consumed at the end of the workday to relax and have a deep, restful night's sleep. This was one of the numerous uses of ʻawa in old Hawaiʻi, and its importance and relevance to the populace cannot be overemphasized. We believe that, with thoughtful and responsible use, ʻawa can play a significant beneficial role in Hawaiʻi today.

AHA's Current Board of Directors	
Jerry Konanui	President
Jeri Ooka	Vice President
Ed Johnston	Project Coordinator
Genesis Lee Loy	Kupuna
Jorge Nijensohn	Director

Chapter 1

Introduction

Ed Johnston and Helen Rogers

The Plant

The plant called *'awa* in the Hawaiian language is known throughout the world as *kava*.[1] It has become prominent in alternative medicine for its ability to reduce anxiety, soothe sore muscles, and induce relaxation, calm, and sleep, without being addictive or impairing the user's judgment.

The botanical name is *Piper methysticum,* meaning "intoxicating pepper." According to James A. Duke (2000, 135), "Phytochemicals called kavalactones provide kava's stress-beating, muscle-relaxing influence. Each produces a somewhat different physiologic effect in the body and all of them working together are better than any one of them acting alone."

'Awa's origin has been called "one of the classic enigmas of Oceanic ethnobotany" (Lebot, Merlin, and Lindstrom 1992, 10). It is found throughout the migratory routes of Pacific Islanders, who prized the drink made from the rootstock.[2] The Hawaiian Islands were the final stop in 'awa's long voyage from Melanesia through Polynesia (see figure 1.2).

Y.N. Singh (1992, 13) has noted that the "kava custom . . . so widespread throughout Oceania . . . might be considered the one item in their material culture that linked together most of the peoples of Oceania." Over the centuries, the various Pacific regions developed unique cultivars[3] of this plant, each with its own distinguishing features and chemical profile.

According to Lebot, Merlin, and Lindstrom (1992, 53), "it is possible that all kava cultivars trace back to a single ancestral plant somewhere in northern Vanuatu that has been repeatedly cloned, developed, and dispersed by stem cuttings over perhaps three millennia."

This ancestral plant probably was *Piper methysticum* var. *wichmannii* (often referred to as *Piper wichmannii*), whose roots also contain the psychoactive chemicals. However, in this wild relative of 'awa, the less desirable kavalactones predominate. Its roots would make a much inferior drink.

P. methysticum lost the ability to produce seed during the course of its long developmental history. Thus, improved varieties could not arise from sexual reproduction, and native cultivators propagated it exclusively through stem cuttings. Nevertheless, through millennia of vegetative propagation, unique cultivars emerged.

Pacific Islanders produced varieties of 'awa by selecting the somatic mutations sometimes arising as offshoots of the parent. "Somatic mutation" is the process whereby the genetic make-up of part of the plant changes. A single stem in a plant might look different from the others, leading a farmer to propagate from that stem, thus creating a plant with a different appearance.

Likewise, changes in the chemistry of the roots that alter the drink's effects could prompt the native planter to retain a new variety (Lebot, Merlin, and Lindstrom 1992, 39). If the drink was not to their liking, they stopped cultivating the plant. This selection process has produced numerous cultivars throughout the Pacific, each with the potential to act somewhat differently on the body and mind.

Fig. 1.1. Drawing by Sydney Parkinson, 1769. 'Awa: *Piper methysticum* var. *methysticum*

[1] The names are used interchangeably in this book, though 'awa is favored, especially in discussions of the plant in the Hawaiian context.

[2] For a picture of the rootstock, see figure 8.13 on page 77.

[3] Short for "cultivated variety," a cultivar is a plant variety found only under cultivation. Within a species, there may be a number of named cultivars individually recognized by distinctive characteristics (Robinson 2001, 34).

Fig. 1.2. ʻAwa's progress through the Pacific to Hawaiʻi.
Based on map entitled *Oceania* by the U.S. Central Intelligence Agency (2001) and Lebot, Merlin, and Lindstrom (1992, 52).

ʻAwa Comes to Hawaiʻi

As Pacific Islanders migrated throughout the vast ocean of scattered islands, they brought with them their most important plants. This is the way ʻawa came to Hawaiʻi, at the outer reaches of Polynesia, with the early settlers. The cuttings, brought as "canoe plants" probably from the Marquesas, became the cultivars we grow and consume in Hawaiʻi today.

ʻAwa had many uses in old Hawaiʻi. Margaret Titcomb summarized them in her article, "Kava in Hawaii":

> The awa custom is of interest in Hawaii because it was a sacred drink of importance in many phases of Hawaiian life. Outside of water and drinking coconut, no other drink was known. Its effect is to relax mind and body and it was used by farmer and fisherman for this purpose. Medical *kahunas* (learned men) had many uses for it. It was customary for chiefs to drink it before meals, for commoners also if obtainable. It was essential on occasions of hospitality and feasting, and as the drink of pleasure of the chiefs. The manner of its use indicated rank, though not to the extent displayed in western Polynesia. It was a fit and necessary offering to the gods and the gods shared with man the desire for its potent effect (Titcomb 1948, 106).

Chapter 2 of this book, Kepā Maly's paper entitled "ʻAwa: Cultural-Historical Perspectives in Hawaiʻi," discusses many of the uses of ʻawa in Hawaiʻi.

Hawaiʻi's unique climate and environmental conditions caused the plant to mutate to suit the new

surroundings. In addition, Hawaiian planters worked with nature to develop new plant cultivars:

> In the matter of shrewd observation of varieties and careful, conscious selection of mutants in the creation of subvarieties of their plants, the Hawaiians were true experimental horticulturists. New varieties are still consciously created by selecting sports from bud or slip mutation. A variant sport … is termed a *keiki* (child) (Handy and Handy 1991, 21).

The mutations that pleased the horticulturists were kept and propagated for Hawaiian gardens, while undesirable ones were discarded. In this way, ‘awa cultivars developed as an expression of Hawaiian culture and became a part of the rich cultural legacy of Hawai‘i's people.

In 1999, *Economic Botany* published the first research paper specifically about the ‘awa cultivars of Hawai‘i. DNA was studied in 22 plants, and 44 plants were analyzed for major kavalactones and morphological traits. The article concluded that thirteen distinct cultivars unique to Hawai‘i are now known and that our ‘awa cultivars are likely to be somatic mutations from a single variety introduced by Polynesian voyagers to Hawai‘i (Lebot et al. 1999, 407).

The thirteen cultivars remaining to us in Hawai‘i reflect the intentions of the people who selected and preserved them in cultivation. It is not surprising then that Hawai‘i's cultivars are highest in those kavalactones most "valued for their especially pleasant effects" (Lebot et al. 1999, 415).

These Hawaiian cultivars are described and shown in photographs in chapter 5. Information on seven non-Hawaiian cultivars also grown here is given in chapter 6.

We have fewer ‘awa cultivars now, growing in our farms and gardens, than the ancient Hawaiians had. In the days before the missionaries held sway in Hawai‘i, ‘awa was central to daily life. There may have been 35 different cultivars, possibly more (Winter 2004, 80). It is entirely possible that some of the lost ‘awa cultivars of old Hawai‘i still remain, just out of view, growing in isolated valleys or perhaps in someone’s backyard.

Horticultural knowledge can help us protect and sustain the varieties we still have. To this end, the Association for Hawaiian ‘Awa‘s *‘Awa Production Guidebook*, first published in 1999, has been updated and incorporated into this book as chapter 8. Following it is a chapter by Scot Nelson on pest and disease management for ‘awa plants.

Misconceptions about ‘Awa

Health Food of the Gods or Dangerous Drug?

‘Awa was often mistrusted by newcomers to the Pacific. Captain James King, who sailed under Captain Cook, was understandably concerned about it:

> The Excess with which the Chief[s] drink the Kava, destroys their Strength & makes them sad objects of Debauchery, they far outdo in the use of this pernicious root all the other Indians we have vist'd; the more Scaly their bodies are, the more honourable it is with them. . . . Many before they are forty are miserable Objects, their whole frame trembles, their Eyes are so sore & redned, that they seem in Constant pain; yet I believe in a short time by disusing this liquor the soreness of the Eyes goes away; at least we made some of our friends refrain & they recovered amazingly (Cook [1784] 1967, 3:617).

Captain Cook noted that "though these islanders have this liquor always fresh prepared … I have seen them drink it seven times before noon" (Cook 1784, 3:142).

It is true that very excessive consumption can cause the skin condition called "kava dermopathy." It disappears quickly once the patient stops taking ‘awa (Norton 1994, 94). In fact, Hawaiians used to deliberately induce kava dermopathy as a skin peel and cure for skin conditions. After the drinker stopped using so much ‘awa, the scales came off, leaving smooth, new skin instead (Titcomb 1948, 125-126).

‘Awa had many medicinal purposes, notably to treat insomnia, muscle aches, and excessive weight (Krauss 1993, 102; Kamakau [1869] 1976, 43). In general, native Hawaiians saw ‘awa as a healthy drink and important medicine—a plant that helps people—and an offering essential for winning the favor of the gods.

‘Awa use continued despite the antipathy it aroused in the missionaries, who recognized its importance to the old Hawaiian religion and feared its intoxicating effects. A few years after missionaries arrived in the early 1820s, Queen Ka‘ahumanu declared that "the planting of ‘awa is prohibited. Neither

chiefs nor commoners are to drink ʻawa" (Kamakau [1868] 1961, 299). However, missionary John S. Emerson was soon complaining that "laws against rum, awa, idolatry, kakauing (tattooing), gambling & the like have been laid aside . . ." (Emerson 1840, quoted in Sahlins 1992, 1:158).

Laws were enacted later in the 19th century to restrict ʻawa to medicinal uses and to require expensive licenses to cultivate or sell it (Brown 2003, 102). Nevertheless, the use of ʻawa continued. Indeed, Isabella Bird remarked that

> No law on the islands is so grossly violated. It is easy to *give* it, and easy to grow it, or dig it up in the woods, so that, in spite of the legal restrictions, it is used to an enormous extent (Bird [1875] 1964, 178).

There were prosecutions, however, and the laws must have made ʻawa consumption more difficult in some localities.

Mark Twain saw ʻawa being sold in the market when he came through Hawaiʻi in 1866: "It is said that but for the use of this root the destruction of the people in former times by certain imported diseases would have been far greater than it was . . . but all are not willing to allow to the awa the virtues claimed for it" (Twain [1871] 1993, 452).

A Mormon mission president on Oʻahu caused a rift in his church in 1874 when he attempted to stop some of his congregation from cultivating, selling, or drinking it. When the crops were ordered destroyed, "this pronouncement almost caused a riot in the chapel" (Britsch 1989, 85-86).

Such was ʻawa's reputation that even people born in the islands, with no first-hand evidence against ʻawa, believed it should be banned. In 1903, the Rev. Oliver P. Emerson wrote of chewing the root himself and of his surprise that a certain Hawaiian man, whom he knew to be full of strength and stamina, drank ʻawa in the evenings to soothe sore muscles and sleep — with no ill effects. Nevertheless, Emerson (140) concluded that "alcohol, opium and awa are allies, bringing their victims to the same woeful end."

The name of the plant is also the name of the drink made from it. Unfortunately, today the name "kava" is also given to commercially available pills and extracts. These often contain only some of the chemical constituents of the ʻawa rootstock and may be adulterated with other material.

Recently, very rare cases of liver failure have been linked to the pills and extracts, which is surprising since numerous clinical trials of ʻawa revealed few side effects. Several countries have banned ʻawa altogether, though it is still lawful to sell and use it in the United States. At present, the prohibitions against ʻawa in Europe are being reviewed and may be repealed. ʻAwa's chemistry and safety are covered in chapters 3 and 4 of this book.

People considering ʻawa for themselves must weigh the risks associated with ʻawa against its benefits. There are warnings to be aware of (Singh 2004, 133). Pregnant and lactating women and depressed people should not drink ʻawa. Drinkers are cautioned against operating machinery or driving. ʻAwa should not be used with alcohol or other central nervous system depressants, and there is potential for interaction with other drugs. (Consequently, people facing surgery or anesthesia should ask their doctors when to begin abstaining from ʻawa.) Parkinson's disease patients should definitely avoid ʻawa. The U.S. Food and Drug Administration has advised people with existing liver disease or taking medications affecting the liver to consult their doctors before using ʻawa (U.S. Food and Drug Administration 2002). [The supplement to this book provides information about more recent studies on potential health effects of ʻawa.-Editors.]

ʻAwa Confused with Alcohol

Misconceptions about ʻawa originate most commonly outside the Pacific Island peoples who know it well. Westerners often thought of ʻawa as a pernicious vice, at least as harmful as alcohol can be. Indeed, as late as 1997, a standard reference book from a respected university press declared ʻawa to actually ***be*** a fermented, alcoholic drink (Vaughan and Geissler 1997, 146).

In reality, ʻawa's effects are relatively mild and quite unlike alcohol's. In the words of an anonymous Hawaiian from 1871:

> [I]t is not right to arrest those under the influence of ʻawa; for when one looks at a person who is intoxicated with rum one can plainly see that he is drunk, but with ʻawa it is not possible to tell whether one is drunk or not. And too, one who is

> drunk with ʻawa does not make trouble like the one who is drunk with rum, who talks out loud. He may have received his glassful from another person but it is he who fights and shouts aloud before others. On the other hand, when a man is drunk with ʻawa, his body relaxes, his mind also relaxes, and he does nothing to interfere with the peace of others so that it becomes necessary to forbid and blame him (Anonymous, 1871, quoted in Brown 2003, 103).

It has been far from easy for societies around the world to accommodate alcohol. Down through the ages, excessive drinking and the resulting social problems have been widely deplored. From the innermost heart of the Western literary canon, Shakespeare himself has one of his characters admit, "I could well wish courtesy would invent some other custom of entertainment" (*Othello* 2.3.26). Hawaiians had that alternative in ʻawa, which was "the drink of pleasure," at least for the aliʻi.

As alcohol became more important in Hawaiian life, ʻawa lost influence in many arenas. Alcohol even began to replace ʻawa in offerings to Pele (Pukui n.d. quoted in Winter 2004, 39). At present, it's not uncommon for the popular press to state that the traditional offering to Pele is brandy, gin, or whiskey, with no mention of ʻawa at all. The fact is, in the words of Margaret Titcomb, "all the gods demanded ʻawa, lesser gods, male and female, personal, family gods and hero gods" (1948, 157). Pele, in particular, is associated with ʻawa (Kanahele and Wise 1989, 43-64; Titcomb 148, 129). The widespread belief that alcohol is her traditional offering is a major indication that ʻawa's eclipse by alcohol in Hawaiʻi is very nearly complete.

Although the use of ʻawa is increasing around the state, Kāwika Winter notes that alcohol customs have supplanted ʼawa customs. Social drinking in bars is now the way ʻawa is used instead of the many practices respecting ʻawa that Hawaiians formerly maintained (Winter 2004, 117).

False ʻAwa: *Piper auritum*

A number of plants are sometimes mistaken for ʻawa, including *Piper auritum*, sometimes called "false ʻawa" (Ram 1999a, 8). These species are in the *Piper* genus, but they do not have kavalactones and, thus, do not provide ʻawa's psychoactive effects.

Nurseries have even sold *P. auritum* under the name ʻawa. Luckily, several important characteristics enable us to tell the plants apart. The leaf of *P. auritum*

Fig. 1.3. Comparison of the leaves of *Piper auritum* (left) and *Piper methysticum* (right)

has a more elongated shape than ʻawa leaves do, and *P. auritum*'s leaf features a midrib through the center, with veins branching out along it. ʻAwa leaves, on the other hand, have nine to thirteen veins radiating out from the point where the leaf meets the stem.

The smell of the crushed leaves is also quite different. The safrole in the leaves of *P. auritum* makes them smell like sassafras or root beer.

Often, *Piper* species that look like ʻawa are actually invasive species, capable of choking out desirable plants. If your land has an ʻawa look-alike instead of ʻawa, you should consider uprooting and discarding it. The many photographs in chapter 5, showing ʻawa's overall appearance, swollen stem nodes, and distinctive leaves, will help growers avoid the counterfeits.

There is More to ʻAwa than Just Kavalactones

Chapters 3 and 4 discuss kavalactones, the chemical components that cause ʻawa's psychoactivity. These chapters also describe other chemicals in ʻawa with physiological effects. In fact, researchers are studying the possibility that certain compounds in ʻawa called flavokawains[4] may help prevent cancer (Zi and Simoneau 2005, 3479; Folmer et al., forthcoming). [The supplement to this book provides information about more recent studies on potential health effects of ʻawa.-Editors.]

[4] Also spelled flavokawin, flavokavin, or flavokavain.

Chapter 7, which explains how to prepare the ʻawa drink from fresh and dried roots, also lists the sugars, amino acids, and minerals found in ʻawa.

The above-ground parts of the plant (stems and leaves) contain an alkaloid that may be damaging to the liver. This is why it's advisable to avoid consuming anything but the rootstock (the stump and roots growing from it). Chapter 4 gives more information.

Conclusion

The heart of this book is its presentation of the thirteen Hawaiian cultivars still in existence. These are all that have been found growing throughout the islands in farms, gardens, forests, and gulches—that we know of. Each is the result of careful observation, centuries of use, and a wealth of experience in growing this remarkable plant. The Hawaiian people can take pride in naming them among the treasures of their culture.

Chapter 2

ʻAwa: Cultural-Historical Perspectives in Hawaiʻi

Kepā Maly

Introduction

By way of this small collection of native Hawaiian traditional and historical accounts, I wish to provide readers with a general overview of the cultural context of ʻawa[1] (*Piper methysticum*) in Hawaiʻi. The narratives include documentation from two primary sources — (a) the writings of nineteenth and early twentieth century Hawaiian historians, and (2) oral history interviews with kūpuna (elders) born between c. 1912 to 1930. This collection of historical accounts is by no means exhaustive, nor does it include references to all cultural materials published on ʻawa in Hawaiʻi. Instead, and perhaps of greatest interest, you will be introduced to several little known historical accounts about ʻawa, that were recorded by native writers in Hawaiian language newspapers.

It is significant to note here that, in Hawaiʻi, ʻawa was important in many aspects of Hawaiian life. Uses of ʻawa ranged from ceremonial observances and offerings—including ceremonies in the affairs of state—to residential use. It is not uncommon to learn from kūpuna around the Hawaiian Islands that, following a hard day's toil in the agricultural fields or upon the ocean fishery, their own kūpuna often found comfort and restoration in a cup of ʻawa.

In reading this small collection of historical accounts, I also share with you a saying taught to me by my kūpuna hānai (adoptive grandparents) on Lānaʻi —

O ka mea maikaʻi mālama, o ka mea maikaʻi ʻole, kāpae ʻia.
(Keep that which is good and set that which is not good aside)

---

[1] '*Awa* — the ancestors of the Hawaiian people came from Kahiki (various islands of lower and middle Polynesia), as early as ca. 500 A.D. Those who are familiar with Polynesian cultures can see many aspects of the religious, political, social, and material culture of the Hawaiians that resemble those of the people of Kahiki. Upon study, it is also clear that in Hawaiʻi, over the centuries, the cultural attributes of the Polynesian ancestors underwent change, adapting to the unique and isolated environment of the Hawaiian Archipelago. In the Hawaiian word ʻ*awa*, we see one of the localized modifications that occurred in the spoken language. A glottal mark – ʻ – in a Hawaiian word emphasizes the pronunciation of the vowel that follows it. Use of the mark also tells us that in the older spoken language, there was a – **t** or **k** – at the place where the glottal mark occurs. Thus, the word ʻ*awa* is a unique, centuries old, Hawaiian adaptation from the ancestral word "*kawa*" or "*tawa*" (*i.e.*, *kava*). It will be seen in the native accounts cited in this paper, that not only the word ʻ*awa* was changed in Hawaiʻi, but also the forms of its use also evolved. In Hawaiʻi, uses of ʻawa ranged from ceremonial to medicinal, and ʻawa was also enjoyed casually by the makaʻāinana (people of the land).

ʻAwa was the food of the gods, just as poi was to the Hawaiians.
No religious ceremony was complete without the ʻawa.
Ms. M.K. Pukui ca. 1942

There are several native traditions regarding the origin of ʻawa in Hawaiʻi. Perhaps the most significant narratives describe ʻawa as having been brought to Hawaiʻi from Kahiki (the ancestral homelands) by the akua (gods) Kāne and Kanaloa. These two akua — Kāne, a Hawaiian god and ancestor of the chiefs and commoners, a god of sunlight, fresh water, verdant growth, and forests; and Kanaloa, a god of the ocean, marine life, healing, and a companion of Kāne (cf. Pukui 1973) — planted ʻawa at various localities throughout the islands. In places where no water could be found with which to prepare the ʻawa, Kāne even caused water to appear, thus forming many springs and streams in the islands (cf. Kamakau 1961:193 & Handy et al., 1972:189).

Writing in the 1860s, Hawaiian historian, Samuel Mānaiakalani Kamakau (born in ca. 1815) wrote that:

> ʻAwa was one of the choice foods of the planter. ʻAwa is a handsome plant, with nicely rounded leaves and stems and shiny jointed sections. . . . ʻAwa grows well on lands with plenty of rain, and on warm lands… From of old there are places made famous by the intoxicating quality of their ʻawa, such as Koʻukoʻu on Kauai, Hena on Oahu, Lanakila on Maui, and Puna on Hawaii. In places where wauke and dry taro are planted, ʻawa may also be planted. These plantings together with those of bananas and sugar canes, were the pride of the farmer. . . . It takes from two to three years for ʻawa to mature, and it will keep on growing for many years and be a bequest to one's descendants. [Kamakau 1976:41-42]

A later account written by native historians of the early twentieth century recorded a mele (chant) used to cause the newly planted ʻawa to grow abundantly. Thus even in cultivation protocol was set in place. In this mele, the agriculturist—in a dryland environment—called upon the goddess Ka-ʻohu-kolo-mai-iluna o ka lāʻau (The-mist-which-crawls-atop-the-forest) to cause the ʻawa to grow—

E Ka-ʻohu-kolo-mai-iluna-o-ka-lāʻau	Hail Ka-ʻohu-kolo-mai-iluna-o-ka-lāʻau
E hoʻoūlu aʻe ʻoe i ke aka o ka ʻawa	You who cause the ʻawa stalks to grow
E Hoʻolaupaʻi aʻe ʻoe i ka lau o ke ʻawa	Cause the leaves of the ʻawa to increase
E hoʻopiha aʻe ʻoe a piha ka mākālua	And fill the planting holes
I ka ʻawa hiwa a ka ʻiole e ʻai ai	With the dark ʻawa which the rat likes to eat
I ka ʻawa lau a ka manu i lawe ai	The ʻawa of the gods, planted by the birds
I ka ʻawa kapu a kuʻu makuakāne	The sacred ʻawa of my father
A Pōhaku-o-Kāne-maka-iʻa e	Pōhaku-o-Kāne-maka-iʻa
E Ka-ʻohu-kolo e	Say Ka-ʻohu-kolo-mai-iluna-o-ka-lāʻau
Hoʻoua ʻia i ulu ka ʻawa a kāua	Let the rains increase the ʻawa growth
E ola iaʻu la Ka-Miki la	Let life come to me, Ka-Miki

Ka Hōkū o Hawaiʻi, March 26, 1914; Maly, translator

In Kamakau's writings, we also find detailed descriptions of cultivation techniques and uses of ʻawa. While he records that ʻawa was important as an offering in rituals and ceremonies, he also informs us that ʻawa was also in general use among the people of the land. In his narratives, we learn of the broad significance of ʻawa in Hawaiian culture:

> Ka poʻe kahiko [the ancient people] liked ʻawa as a means of reducing weight. When a man saw himself growing too fat, or perhaps constantly being sick, then ʻawa was the thing to restore health or to slim the body. The way to do it was to drink ʻawa like the ʻaumakua [family gods] or the kaula prophets, that is, copiously, until the skin scaled. . . . ʻAwa was a refuge and an absolution. Over the ʻawa cup were handed down the tabus and laws of the chiefs, and the tabus of the gods, and the laws of the gods governing solemn vows and here the wrongdoer received absolution of his wrongdoing. [Kamakau 1976:43]

ʻAwa — In the Customs and Practices of Hawaiʻi

Kamakau observed that it was through prayers and offerings of ʻawa that the ancient people of Hawaiʻi sought to ensure the well-being of the native population. Planters offered ʻawa to ensure the success of future crops, and the fishermen did so, to ensure bountiful catches (ibid.: 43-44). Eldest of the nineteenth century Hawaiian historians, David Malo (born in ca. 1793), wrote about the customs of canoe makers going to the mountains to choose a koa log for a canoe (Malo 1951). ʻAwa was one of the offerings made in the ceremonies of the kahuna kālai waʻa (master canoe maker-priest). After the kahuna had gone to the mountain to pray and make offerings, he then determined which tree was best. He then returned to the people and:

> 5. …Preparations were made accordingly to go into the mountains and hew the koa into a canoe. They took with them, as offerings, a pig, cocoanuts, red fish (*kumu*), and *awa*.
>
> Having come to the place they camped down for the night, sacrificing these things to the gods with incantations (*hoomana*) and prayers, and there they slept.
>
> 6. In the morning they baked the hog in an oven made close to the root of the koa, and after eating the same they examined the tree . . . to measure the part suitable for the hollow of the canoe. . . .
>
> 7. Then the *kahuna* took the ax of stone and called upon the gods: "O Ku-pulupulu, Ku-alana-wao, Ku-moku-halii, Ku-ka-ieie, Ku-palalake, Ku-ka-ohia-laka. . . . " "O Lea and Ka-pua-o-alakai, listen now to the ax.
>
> This is the ax that is to fell the tree for the canoe . . . ." [Malo 1951: 126-127; see also p. 88]

Paraphrasing several other early native accounts, ethnographer Martha Beckwith (1970) provides readers with further documentation of practices and uses of ʻawa in Hawaiian culture:

> Different varieties [of ʻawa] are distinguished by their color and markings and by the size of the root sections. Babies were given the juice of the nene variety as a soothing syrup. "This is a fretful (onene) child and must be given the awa nene," is the saying.[3] Only the most common variety could be used by the commoner; the rarer kinds were reserved for the chiefs. For the gods and on ceremonial occasions the moi[4] (royal), hiwa (black), and papa (recumbent) were used, the papa from which the moi was often an offshoot, being specially offered to female deities. The most highly prized was that which sprouted upon trees so that the roots to be gathered grew exposed on the tree. It was called awa "resting on trees" (kau laau) or "planted by the birds" (a ka manu).
>
> Awa offered to a god was either poured or sprinkled over the image, or, if there was no image, the kahuna sprinkled it in the air and drank the remainder in the cup. The cups used were always made of polished coconut shells, cut lengthwise in the shape called kanoa. The cups were

[3] In this case, use of the word *nēnē* is symbolic of murmuring, like the soft chatter of the native geese. By the play on the word *nēnē*, use of the *ʻawa nēnē* was believed to help temper the voice of the youngster.

[4] Pronounced *mōʻī*.

never placed on the floor itself but on a piece of bark cloth spread before the priest or server, and never where they might be stepped over or otherwise desecrated. As soon as the ceremony was over, they were washed, placed in a net (koko), and hung from the rafters. The strainer was also carefully washed and hung in a tree to dry. The order of serving also was important. At the entertainment of a guest, it was considered an insult to the host if the guest refused the cup or passed the cup handed to him, as guest of honor, to an inferior chief. Before war especially all chiefs drank together a cup of awa, which passed from hand to hand in order of rank. In passing the cup to a chief it was customary to utter some appropriate remark or sing a chant, but no particular form was fixed by tradition. [Beckwith 1970:94]

In an account of ceremonies of the hālau hula (schools of chant and dance), native historian Mary Kawena Pukui (1943) presented readers with examples of mele that were used in offering ʻawa to the gods and in partaking in the ʻawa drink:

A portion (apu) of ʻawa was given to each dancer. The first portion was poured as an oblation upon the altar while the master chanted:

Eia ka ʻawa, e ke akua!	Here is the ʻawa, o god!
He ʻawa lani wale no.	It is only heavenly ʻawa for you.
Inu a ke kama iki;	Drink of the beloved child;
I ka ʻawa lau lena,	The ʻawa of the yellow leaf,
I ka ʻawa Ke-ahi-a-Laka	The ʻawa of Ke-ahi-a-Laka [in Puna]
Hālāwai akula me Pele,	Meeting with Pele,
Ke ako ala i ka lehua,	Plucking the lehua,
Ke kuʻi ala i kai o Hōpoe, la.	Stringing it [into a garland] down by Hōpoe [on the shore of Keaʻau].
He ʻawa no nā kāne	ʻAwa for the men,
A me nā wahine o ka lani	And women of the heavens,
He ʻawa no nā kāne	ʻAwa for the men,
Me nā wahine o ka lua.	And for the women of the pit [volcano].
Pēlā aku, pēlā mai,	Thus it was, thus it is,
E mū ka waha, e,	Silence the mouth,
E holoi i ka lima.	Wash the hands.
Elieli kapu, elieli noa,	Sacred is the taboo, sacred is the freeing,
Noa ke kapu, noa ka hele,	The taboo is lifted and one can go,
Noa kānawai a ke akua	The law is lifted by the gods

Pukui 1943:216-217

ʻAwa—He Moʻolelo Kaʻao (A Native Tale)

In the period between 1914 to 1917, several native historians compiled and wrote a traditional account of the journey of two brothers around the island of Hawaiʻi via the ala loa (an ancient trail system), which encircled the island. Titled "Kaʻao Hoʻoniua Puʻuwai no Ka-Miki," or "The Heart Stirring Story of Ka-Miki" (Maly, translator), the narratives provide us with several detailed accounts of ʻawa—sources, preparation, ceremony, and customs—and rich place name accounts. Selected excerpts from the tradition for the districts of Kona, Kohala, Hāmākua, Hilo, and Puna are presented below:

> Ka-Miki and his brother Maka-ʻiole, the great grandchildren of the forest and earth-form goddess Ka-uluhe-nui-hihi-kolo-i-uka were trained in all manner of Hawaiian martial arts. The purpose of their training was to have them rid the trails and royal communities of individuals who abused the people and lands around Hawaiʻi.
>
> When their training had been completed, Ka-uluhe instructed Ka-Miki to journey to the hālau aliʻi (royal compound) of one of their elder relatives, Poliʻahu on Mauna Kea. Poliʻahu and her companion Lilinoe were the guardians of Waiau and the sacred water of Kāne. Maka-ʻiole was instructed to go collect the ʻawa (*Piper methysticum*) of the god Luanuʻu at Waipiʻo. These two items would be used in an ʻai-lolo (ceremony of graduation), commemorating sacred nature of the brothers and completion of their training in ʻōlohe skills. Ka-uluhe told the brothers —
>
> You, Maka-ʻiole, are to fetch the ʻawa ili lena (yellow barked ʻawa) which the gods drink till they are drunk, and bleary eyed. Till their eyes are reeling, it is the ʻawa that is there along the sacred cliff of Waipiʻo in the breast (the ledge) of Haʻiwahine, at the long plain of ʻĀpua… And you, Ka-Miki, are to fetch the sacred water of Kāne which is there atop the summit of the mountain [Mauna Kea], at the royal compound of Poliʻahu, Lilinoe, and their ward Ka-piko-o-Waiau. The water is there below the ledge of the platform of Pōhakuakāne, from where you may look down to Pōhakuloa; they are your family through your father's genealogy. You are to fetch the water that will be used to make the ʻawa for you two. . . .
>
> Ka-uluhe also told the brothers that they were to go to the place of their ancestress Lani-kuʻi-a-mamao-loa (whose name is commemorated in the place name Lani-mamao at Waimea); for she had the kānoa (ʻawa bowl) that was called Hōkūʻula and the mauʻu ʻawa (strainer) Ka-lau-o-ke-Kāhuli, which would be used in preparing the ʻawa ceremony.
>
> Ka-uluhe then told Ka-Miki—"dip the kānoa ʻawa into the sacred water of Kāne and Kanaloa and hold it close to your breast while returning. You shall be at the heights of the mountainous region, at the whitened peaks, leaping on the mountain top, the sacred and astonishing mountain, that causes people to go astray, and the voice is wearied by calling out—indeed it is so." Ka-Miki and Maka-ʻiole then set out to complete their tasks, first traveling to meet their ancestress Lani-mamao on the windward plains of Waimea (in the region of Mahiki). [February 5, 1914]
>
> The brothers greeted their kupuna with genealogical chants, and gained her recognition of their descent. When Lani-mamao inquired of their journey and quest, Maka-ʻiole called out to her with a mele (chant):

Aia la ilalo o Waipiʻo,	[The ʻawa] is there below in Waipiʻo
I ka pali o Kaholokuaīwa	Along the cliff of Kaholokuaīwa
I ka ʻawa ʻili lena	The yellow barked ʻawa
I ka papa lohi o ʻĀpua	of the long glistening plain of ʻĀpua
A kini o ke akua	[ʻAwa] of the 40,000 gods
A ka mano o ke akua	[ʻAwa] of the 4,000 gods
A ka lehu o ke akua e inu a—i	[ʻAwa] which the 400,000 gods drink.

Lani-mamao then asked, "What is your kupuna thinking of, sending you to fetch the cherished ʻawa of Luanuʻu-a-nuʻu-pōʻele-ka-pō-loa, king of the hordes of ghosts who dwelt at Waipiʻo? And where is the water that she told you to fetch?" Ka-Miki answered — "It is the sacred water of Kāne and Kanaloa at the sacred platform of Pōhaku-a-Kāne, overcome by the mists Kākīkepa, that is like the steaming mists of the woman [Pele] who dwells at the crater."

Because of the great challenges the brothers would face while going to fetch the ʻawa and water of the gods, Lani-mamao tested their ʻōlohe [fighting skills]. Because Ka-Miki was so adept at the arts, Lani-mamao told Ka-Miki that he would need to fetch the ʻawa of the ghost king Luanuʻu. [February 12, 1914]

Ka-Miki agreed to go to Waipiʻo, and Lani-mamao sent Maka-ʻiole to fetch the strainer Kalau-o-ke-kāhuli [from the plain of Waikōloa]. Lani-mamao warned Ka-Miki not to make any sounds lest he awaken the gods as he drew near the ledge of Haʻiwahine — When you reach the hill of Puaʻahuku, gaze below to the heiau of Pākaʻalana, and look upon Waipiʻo, there you will see the cliff of Kaluahine. Then look to the side and go into the ʻōhiʻa forest of Kaʻauana. It is there that you will find the ʻawa container called Ka-pāpāiaoa [Ka pāpāiaʻawa (The ceremonial ʻawa)], which Luanuʻu-a-nuʻu-pōʻele-ka-pō uses as his pillow so that no one may take it. Luanuʻu will be there in the center of his hālau hale aliʻi (royal compound), and the assembly of 4,000, 40,000, 400,000 ghosts will be outside."

Upon finishing her instructions Ka-Miki disappeared, leaping to the forest of Mahiki. Leaping again, Ka-Miki arrived at Puaʻahuku, and he looked upon the beauty of Waipiʻo. Ka-Miki then turned and leapt to the heights of Kaʻauana, and went to the cliff of Kaholokuaīwa where he saw the royal compound of Luanuʻu along the ledge of Hea-ke-Akua, overlooking Nā-poʻopoʻo (The nooks and crannies), in Waipiʻo, not Kona.

Indeed, there were innumerable ghost beings throughout the region. Ka-Miki called upon Kaʻohu-kolo-mai-iluna-o-ka-lāʻau, and a thick mist settled on Waipiʻo, even covering the compound of Luanuʻu. Ka-Miki then leapt and landed upon the ridge pole of the gods' long house. Ka-Miki parted the bird feathers, for this is what the house was thatched with, and looked in. He saw that the god and those with him were sleeping, nestled in the mists of the ʻawa. Now those in the house were of various shapes and sizes, some with hollow eyes, others with long thin necks, or hands that reached to their feet, truly, things which living people would fear.

While Ka-Miki was looking in the house, he heard the voice of Luanuʻu's lead ghosts, Hio and Nana-nui call out in a chant. When the lesser ghost heard the call, they all arose and left Luanuʻu alone in his house with only his guardians Mū-kī and Mū-kā, who also served as Luanuʻu's messengers.

Before taking Luanuʻu's ʻawa, Ka-Miki played a trick on Luanuʻu and awakened him from his ʻawa induced sleep. Ka-Miki then hid unseen amongst the rafters of the hālau. Luanuʻu called upon his kūkini, Mū-kā and Mū-kī, commanding that they capture the one who would attempt stealing his cherished ʻawa. He sent his messengers to places where ʻawa was grown or would be consumed. Mū-kā was sent to the cliff of Mōlīlele by Palahemo, Kaʻū. Mū-kī was sent to start at the cliff of Kaʻenamakaohue (at Neue, Kohala), where the wind entered along the cliff Makanikāhiō. Mū-kī was then to encircle the island searching, Kapākai and Kahuā (Kohala), Kalinaʻōpelu, on the plain of Kanikū (at Puʻu Anahulu); and ascend the hills of Anahulu (Kona) to look for a sign from the image of the god Kapuko-malo.

They were also instructed to circle around to the heights of Humuʻula and inquire of the deity ʻŌmaʻokoili and ʻŌmaʻokanihae if either of them knew who this rascal thief was. "Encircle Kapiko-o-Waiau, the ward of the chiefesses Poliʻahu and Lilinoe. Peer down upon the multitudes, and watch the sacred water of Kāne mā[5]. Look too, to where they dug the ʻauwai (water channel)." Then Luanuʻu commanded them to go to Puʻu-o-Moeʻawa in the forest of Mahiki and stand guard.

[5] *Mā* is a Hawaiian word that means "and companions, friends," or "and others."

Mū-kā and Mū-kī departed and the multitudes of other ghosts wandered (ʻauana) through the depths of forests of Mahiki and Pōkāhi in search of this rebel. Ka-Miki heard the indistinct voices of these many ghosts ascend the cliff, and pass through the forests to the heights of Pūʻawaliʻi in the thick mist which ensnares the fished birds (Pōkāhi). When all the ghosts were gone Luanuʻu fell back to sleep with the ʻawa container as his pillow. Ka-Miki then leapt from the ridge pole and took Ka-pāpāiaoa which was filled with ʻawa that had been made ready to use and bundled into balls [wrapped] with limu pāʻihiʻihi (*Nasturtium sarementosum*).

Luanuʻu arose greatly angered thinking that he would ensnare this rascal upstart in the net of Nananana-nui-hoʻomakua (Nana-nui was also one of Luanuʻu's ghost marshals). But unseen, Ka-Miki hid on the ridge pole of the hālau hale aliʻi where he held the ʻawa container [February 19, 1914].

Luanuʻu, who was also called Pahulu-nui, then leapt to the place where the sacred pahu (drum) Lono Hāwea was kept at the heiau of Pākaʻalana. Striking the pahu, he called all the wandering ghosts to return to the lowlands of Waipiʻo. The voice of this drum was a great sign that all of the pathways were to be sealed. The command was heard by all; along the hulaʻana cliffs from Waipiʻo to the ledge of Makanikāhiō; heard by those who were at Koholālele and Maulua; heard by those who were by the steep cliffs looking to the uplands of Kaleiʻeha (Humuʻula); and heard by those who were in the forest of Mahiki. And so all of the pathways and swimming trails were blocked, and the net trap was set.

While all of this occurred Ka-Miki remained hidden in the rafters of the hālau. One of the ghosts looked inside and saw Ka-Miki upon the ridge pole and prepared to call out on the hōkio (gourd nose flute) which would alert the ghosts that the upstart had been found. With great speed, Ka-Miki then leapt from Heakeakua up to the ridge heights, and landed on a kāwaʻu (*Ilex anomala*) tree branch. Kaʻohu-kolo-mai-iluna-o-ka-lāʻau then covered the region in a thick mist, blocking everything from sight.

The cry of the ghost hordes could be heard from uplands to shore, as they hungrily looked for Ka-Miki, having been thwarted in their attempts to ensnare him in their supernatural net Nananana-nui-hoʻomakua, just as birds were caught. Because the ghosts wandered along the cliffs and forests of Kaʻauana (Kohala side of Waipiʻo) and Mahiki (Hāmākua side of Waipiʻo), and were unable to catch Ka-Miki, they went hungry. Under the cover of his ancestress' mist body form, Ka-Miki leapt from the kawaʻu tree to Puʻu-o-Moeʻawa in the forest of Mahiki. The ghosts wandered hungrily about and two place names commemorate their wandering and having gone hungry: Ka-ʻauana (The wandering), and in Mahiki, Pōloli-ke-akua (The gods [ghosts] are hungry) which is also called Pōloli-(i)-ka-manu (Hungry for the bird). At Puʻuomoeʻawa, Ka-Miki met with the ghost runner Mū-kī who had been stationed there by Luanuʻu [February 26, 1914].

Ka-Miki thwarted his efforts at catching him by throwing foul smelling dirt (dabs of excrement) at him. Though many other ghosts arrived for the fight, they were all driven off, as Ka-Miki began destroying them. Hio and Nananui, Luanuʻu's ghost marshals told their chief about the events at Puʻuomoeʻawa, and Luanuʻu blew the conch Hā-nō, also called Kiha-pū, which was the conch that the supernatural dog Puapualenalena stole from the ghosts of Waipiʻo. Hearing the call of the conch, the remaining ghosts fled from Puʻuomoeʻawa, leaving Ka-Miki who returned to Lanimaomao. Ka-Miki presented the sacred ʻawa container Kapāpāiaoa and ʻawa to his ancestress, and she bathed him in her rains, and caused lighting and thunder to praise his accomplishments… Lanimamao then gave Ka-Miki the kānoa ʻawa (ʻawa bowl), Hōkūʻula—with the kapu of Lono-Makahiki—so that he could go get the wai kapu (sacred water) of Kāne and Kanaloa (at Mauna Kea). [March 5, 1914].

Ka-Miki then leapt and disappeared in the mists that seem to crawl upon the forest growth. Arriving at the spring, Ka-Miki began dipping the ladle into the sacred water of Kāne, to fill the

ʻawa bowl Hōkūʻula. At that time, Pōhakuakāne and Pōhakuloa, guardians of the water, saw the water rippling, and overflowing from the spring. As they went to investigate, they saw a shadow pass them by. Because of the overflowing of the water, the spring came to be called Ka-wai-hū-a-Kāne (The overflowing waters of Kāne), and so it remains named to this day. It overflowed because Ka-Miki scooped the water, filing the ʻawa bowl of the god. Ka-Miki then joined Maka-ʻiole at Holoholokū on the plain of Waikōloa. As they traveled along the hilltops, the wind goddess Wai-kō-loa (Water carried far) caused the water to splash over the brim of Hōkūʻula. Some of the water was carried afar by the wind and fell, forming a new spring. When the spring appeared, Pōhaku-a-Kāne fetched some of the water. And because of this, that place is called Waikiʻi (Water fetched) to this day. This happened near the hills of Puʻu Kekeʻe. Pōhaku-a-Kāne then took the water he retrieved to the base of the cliffs of Mauna Kea and dug into the earthen plain of Pōhakuloa and placed the water there. From Pōhakuloa, the water flowed under ground and appeared as springs at several other places, including Ana-o-Hiku at Hanakaumalu, Honuaʻula, and Kīpaheʻe-wai on the slopes of Hualālai. [March 12-19, 1914]

As noted earlier in this paper, ʻawa was cultivated in various places on Hawaiʻi and around the islands. At each of those localities, special techniques of cultivation and preparation were developed. Also, there evolved the practice of using certain "pūpū ʻawa" (condiments eaten or mixed with the ʻawa) which were known for their ability to intensify the strength of the ʻawa or for the symbolism in their uses. Several of those ancient places or pūpū ʻawa are commemorated in sayings recorded in native writings (in *Ka Hōkū o Hawaiʻi*). Among the accounts are:

- ʻAwa ʻili lena a ke akua i ka pali kapu o Waipiʻo — The yellowed barked ʻawa of the gods . . . grows on the sacred cliff of Waipiʻo.
- Ka ʻawa ʻili lena a ka manu i kanu ai iluna o ka lāʻau — The yellow skinned ʻawa planted by birds atop the tree branches (grown in Puna)
- Ka ʻawa kau lāʻau a ka manu i Kealakomo — The ʻawa of Kealakomo, placed upon the branches by the birds (grown in Puna)
- The famous ʻawa of Kaʻawaloa grew amongst the ʻili-ahi (sandalwood trees) at Manuʻa. The type of ʻawa grown here was the ʻawa hiwa (black ʻawa) called Mōʻī, and it was known as the ʻawa kapu o Manuʻa (sacred ʻawa of Manuʻa). The fragrance of ʻili-ahi permeated the ʻawa patch.
- On Maui, the ʻawa of Hāna was known for its potency. A drink of the ʻawa would put one in a state of comfortable sleep, likened to being nestled by the — ua liʻiliʻi noenoe o Hāna ua lani haʻahaʻa e iho mai la o ka ʻawa ʻililena i ka uka o Kailua (fine mists of Hāna with the low heavens descended with the yellow skinned ʻawa which grows at Kailua, Maui).
- At Niumalu, Kona, the pūpū ʻawa was made of the hīnālea (wrasse fish) found along those shores.
- At Kalapana (Puna), there grew the famous coconut stand called Niu moe o Kalapana (Reclining coconut trees of Kalapana), also known as Niu-a-poe in ancient times. In Puna, the water from the coconuts of Niu-a-poe was used as the pūpū ʻawa, while preparing a highly coveted ʻawa drink, for aliʻi and dignitaries.
- In the native account of Kekuhaupiʻo (born ca. 1730), the famous warrior-instructor and companion of Kamehameha I, it is recorded that the eyes of the niuhi (great white shark) were used in the ʻai lolo (completion of training ceremonies) which Kekuhaupiʻo underwent as a young warrior. To complete his training, Kekuhaupiʻo had to catch and fight with a niuhi off of Nāpuʻuapele, Kaʻū. Being victorious, Kekuhaupiʻo offered one of the shark's eyes to Kāne and Lono in the temple above the bay of Kapuʻa, and the other eye was mixed with the pūpū ʻawa and eaten by Kekuhaupiʻo (in *Ka Hōkū o Hawaiʻi*).
- In 1810, when King Kamehameha met with King Kaumualiʻi of Kauaʻi, the two shared ʻawa together. Prepared by Kaumualiʻi, he used the choice sugar cane of Halaliʻi, Niʻihau (puna kō momona o Halaliʻi) as the pūpū ʻawa.

Accounts of ʻAwa Cultivation and Use in the Early 20th Century

Over the years, I have been fortunate to speak with kūpuna around the islands. While most of my research is land, cultural resources, and family based, I do occasionally have the opportunity to speak with someone about ʻawa. From those conversations we learn about the continued use of, and adaptation of cultural practices to, the changing Hawaiian environment (both social and economic). Below are a few excerpts from some oral historical records, in which the interviewees discuss ʻawa.

> At Kalapakī, Kauaʻi, there is a black stone just off of the shore, named Pōhaku-manō (Shark-rock). Up until about the 1920s, Tūtū Enoka, would periodically go out to that stone, dressed only in a red malo, carrying an ʻumeke (calabash), in which he had prepared ʻawa root for his shark deity. Calling out in a chant, a shark would draw near the shore and Tūtū would feed the shark and scrape the barnacles off of it. Under this care, the shark served as a guardian of the bay. Whenever, malihini (foreign) sharks would swim into the bay, the friendly shark would chase them off, or nudge the swimmers out of the water. (pers comm. Gabriel ʻĪ; Apr. 1985)

> At Kaʻūpūlehu–Kalaemanō, Kona, up till about 1925, the elders there still fed an ancestral shark deity. Calling to the great shark in mele (chants), ʻawa was one of the choice foods given to the shark. Cut up in pieces, the kūpuna fed the shark several pieces at each encounter. Then, when out in their canoes, fishing for ʻōpelu and larger fish, the shark would drive the fish to their nets, and also cared for them if a canoe should be overturned. (pers comm. C. Kiniha'a Keākealani Pereira; Nov. 7, 1996)

Describing ʻawa growth and use in the Keahialaka-Oneloa vicinity of Puna in the 1920s to 1930s:

> ʻAwa, you see ʻum, you can see. They went plant that, it was common. When get maʻi [sick], they went to go get that. Some for inu [drink], some for lāʻau [medicine], eh. The old people, some take the coconut juice, water. Because they mahi ʻai [farm], the kino ʻeha [body is sore], the poʻe mahi ʻai [the farmers]. Soon as the poʻe [people] no mahi ʻai [farm], ah no more maʻi [sick], because no hana [work] eh? Mahi ʻai poʻe, that's different kind poʻe that. (pers comm. John Hale; June 12, 1998)

Describing ʻawa collection and sales in the 1930s:

> We used to go get ʻawa down by Kaliʻu. Me and my mother, and my sister and brother. We go up to ʻohi [pick] the ʻawa. Big kind [gestures circling arms around the root]! We bring ʻum home…we had one wooden station wagon, Ford, and we put all the ʻawa inside there, and bring ʻum home. The patch was about three miles from our house. So we pick ʻum and take ʻum down, and then we chopped ʻum up. Kaulaʻi [dry it], and the trust company, that's the one that bought that. They took it to Hilo and shipped it to Germany… And the stalk, they don't throw it away, they planted it again to make new ʻawa… (pers comm. Gabriel Kealoha; June 12, 1998)

Manaʻo Pani (Closing Thoughts)

As seen above, there is a deep cultural-historical relationship between the Hawaiians and ʻawa. We have much to learn about the varieties, cultivation techniques, and the protocols for continued use of ʻawa. The poʻe kahiko (ancient people) identified many values and uses of the ʻawa, and we are only skimming the surface—recapturing some of that knowledge, and perhaps making history ourselves. I urge anyone that knows elders who have knowledge of ʻawa and other native cultivars to try and record some of that history. It is important for us to know where we have come from, and to pass as much of that legacy on to those who will follow us.

"O ka mea maikaʻi mālama, o ka mea maikaʻi ʻole, kāpae ʻia"
(Keep that which is good and set that which is not good aside)

Chapter 3

The Active Ingredients in ʻAwa (Kava, *Piper Methysticum)*

Mel C. Jackson, Ph.D.

The known active ingredients in ʻawa are the kavalactones. There are around eighteen of these, but only six of them are routinely measured, as they represent greater than 90 percent of the total. They are:

Table 3.1. Kavalactone Numbering System

Kavalactone	Identifying number
desmethoxyyangonin	1
dihydrokavain	2
yangonin	3
kavain	4
dihydromethysticin	5
methysticin	6

The kavalactones are very similar two ring structures made up of a pyrone ring and a benzene ring, only differing by as little as two hydrogen atoms either in the hydrocarbon chain joining the two rings (kavain and dihydrokavain) or within the pyrone ring itself (kavain and yangonin). In addition, some kavalactones differ by only a methoxy group on the benzene ring. (To see the chemical structures of the six major kavalactones, see Figure 4.2 on page 21.)

In all cases, the differences are relatively minor. However, minor variations on the two-ring structure appear to cause differences in effect when ingested.

The relative concentration of the six major kavalactones in ʻawa root can be used to discriminate between ʻawa plants from different geographical locations and between plant parts from the same plant. In order to facilitate discrimination, Lebot and Lévesque (1989) have assigned a numbering system for this discrimination. The numbering system is set out in Table 3.1 above. This has now become an accepted way to discriminate between ʻawa plants from different locations. A six-digit code can be generated to qualitatively describe the relative concentrations.

A unique feature of Hawaiian ʻawa cultivar samples (composed of a mixture of root and stump) is that they have a six-digit sequence that almost without exception starts with the numbers 46, followed by a combination of the four remaining digits. This indicates that the Hawaiian ʻawa cultivars almost all have kavain as the highest relative kavalactone followed by methysticin.

In general, this starting sequence indicates that the ʻawa will have a pleasant psychoactive effect when drunk. This also probably reflects the narrow genetic base of ʻawa in Hawaiʻi suggesting that only a very few ʻawa plants were originally brought to Hawaiʻi from the South Pacific and that the numerous cultivars seen today were selected from this very narrow base.

In contrast, in the South Pacific, there are many ʻawa varieties, with many differences in the relative concentrations of the kavalactones. For example, in the islands of Vanuatu where there are at least 80 different ʻawa cultivars, the six-digit sequence may start with 26...., or 25...., indicating that the kavalactones in highest concentration are dihydrokavain and methysticin, and dihydrokavain and dihydromethysticin respectively. Those cultivars that have a sequence starting with 25.... or 52.... are not prized as good drinking ʻawas, because the highly potent dihydrokavain and dihydromethysticin are thought to cause nausea in the unwary drinker.

This does not mean, though, that the islands of Vanuatu have poor drinking ʻawa. On the contrary, the island of Pentecost is the home of an ʻawa variety called Borogu, famous for its excellent psychoactive effects. It has the six-digit sequence 245613, with dihdrokavain followed by kavain as its highest concentration kavalactone constituents (Lebot, Merlin and Lindstrom 1992).

This difference in relative concentration has been called a chemotype, however, this is not strictly true, as the relative concentration of the six major kavalactones can vary between the underground and above ground parts of the same plant. Given this discrepancy, it is advisable to list the plant part before

giving the relative kavalactone concentration sequence.

In Hawaiian ʻawa cultivars, there are differences in the relative concentration of kavalactones and the overall kavalactone concentration in different plant parts. As part of a collaborative study to optimize ʻawa cultural practices, undertaken by Hawaii Agriculture Research Center and the University of Hawaiʻi College of Tropical Agriculture and Human Resources, one year old Hawaiian ʻawa cultivar (Mōʻī) and a Papua New Guinea cultivar (ʻ*Isa*ʻ) were harvested after growing under exactly the same conditions. The whole harvested plant was split into roots, stump, lower stem, middle stem, upper stem and leaves and then analyzed for kavalactones. The table below shows the relative kavalactone content of each plant part as given by the six-digit sequence.

Table 3.2 Chemotype Comparison

Plant part	Isa	Mōʻī
Leaf	254316	254136
Upper stem	523416	523416
Middle stem	254316	254361
Lower stem	254361	425631
Stump	254631	426531
Root	245631	462531

It can be seen that, while the relative kavalactone content in the root and stump differ markedly between cultivars, this difference is gradually lost as parts further up the plant are analyzed. Any significant distinction is lost by the time the middle portion of the stems is reached.

Typically, ʻawa beverage is made from a mixture of stump and root, usually in the ratio of 2/3 to 1/3 respectively. Kavalactone concentrations were determined for this mix of root and stump in a number of cultivars harvested at two years old. It was found that kavalactone concentrations do not vary much between cultivars of the same age. For example, if plants are harvested at two years, Mōʻī has an average kavalactone content of 8.5% and generally exhibits a relative kavalactone content ranging from 423561 to 463251. Nēnē at harvest contains on average 7.5% kavalactones and has a relative kavalactone content ranging from 436125 to 462531. Mahakea has an average kavalactone content of about 8.2% and a relative kavalactone content ranging from 456231 to 413625.

Conversely, for typical South Pacific varieties from such islands as Tonga, Fiji, and Vanuatu, average kavalactone content is around 7.0% and the general relative kavalactone content ranges from 134652 to 423516.

The kavalactones have been studied for their physiological effects. In the 1960s, German researchers undertook many studies to determine the effect of kavalactones on the brain. One of the main findings was that the kavalactones have a pronounced sedative effect (Meyer 1966), with the unsaturated kavalactones (kavain, methysticin, yangonin) more potent than the others.

However, Kretzschmar and Teschendorf (1974) showed that the kavalactones do not induce sleep like true sedatives and do not inhibit the sensitivity of sensory nerves, nor do they reduce motor activity, but rather act as muscle relaxants and enhancers of deep sleep. Unlike sedatives, the kavalactones appear to work on the limbic system of the brain.

Holm et al. (1991) have shown that kavain increases the sensitivity of an area of the limbic system (hippocampus), an area indirectly associated with emotional excitability, due to its inhibition of the emotional centers of the brain cortex. It is interesting to note that the researchers found a more pronounced effect when an ʻawa extract was used, than kavain alone. This is probably because ʻawa extracts contain the other kavalactones which interact with the limbic system more completely than kavain alone. This agrees with ʻawa drinkers perceptions that ʻawa has a calming effect.

More recently Zi and Simoneau (2005) have reported that a chemical in ʻawa, flavokawain A, has tumor suppressing activity in bladder cancer cells. (The chemical structure of flavokawain A is shown in Figure 4.3 on page 23.) Zi and Simoneau showed that this compound appears to selectively kill these types of cells.

This work follows on from an intriguing epidemiological study by Steiner (2000) of cancer incidence in

Pacific island nations, which showed that "age-standardized cancer incidence for kava drinking countries is one-fourth to one-third the cancer incidence in non-kava drinking countries and non-kava drinking Polynesians." In addition, three kava drinking countries (Vanuatu, Fiji, and Western Samoa) have a lower incidence of cancer in men than in women. This is intriguing, because in these countries, men are much more likely to drink ʻawa.

[The supplement to this book provides information about more recent studies on potential health effects of ʻawa.-Editors.]

Chapter 4

Chemistry, Pharmacology, and Safety Aspects of Kava

Klaus Dragull, G. David Lin, and Chung-Shih Tang

Introduction

Kava (*'awa* in Hawaiian) consists of complex chemicals and thus potentially has profound pharmacological and toxicological effects, some of which are known and some still unknown. Kava beverage has been enjoyed by the Pacific Islanders for over two thousand years. Due to the anxiolytic and sedative properties of kavalactones, kava extract products gained popularity in Western countries over the last two decades. Moreover, kava use has grown in Hawai'i as we gained an appreciation of the high quality of Hawaiian cultivars and learned about its importance in Hawaiian culture.

The safety of kava was called into question in recent years after it was implicated in several liver failure cases (see Table 4.4), leading to its ban in many countries, although liver toxicity remains unproven. This has prompted wide discussion on the relative benefits and risks of kava as a social beverage and herbal remedy.

The major active ingredients in kava are known as kavalactones and are concentrated in the rootstock and roots rather than in the aerial parts (stems and leaves), which contain kavalactones in smaller amounts. Interestingly, leaves and peelings from stems contain another class of compounds called alkaloids, notably pipermethystine, and these alkaloids are potentially dangerous to ingest.

South Pacific Islanders use only the rootstock to prepare kava beverage and avoid using stem peelings and leaves. They knew and practiced this long before the chemistry of kavalactones and alkaloids were scientifically investigated. Their traditional wisdom in using appropriate parts of appropriate kava cultivars for ceremonial occasions and for medicinal purposes to treat specific illnesses, as documented in *Kava: The Pacific Drug* by Lebot, Merlin, and Lindstrom (1992), is extraordinary and should be respected at all times.

An unresolved modern issue is the potential liver toxicity (also known as "hepatotoxicity") associated with the use of kava products in pharmaceutical dosage forms prepared from concentrated extracts using ethanol or acetone, rather than water, as extracting solvents. These organic-solvent-prepared kava products have been blamed in several cases of irreversible liver damage occurring between 1998 and 2002.

There has curiously been no report of irreversible liver toxicity in any of the animal studies, human clinical trials, large outpatient observations (some 10,000 patients), and centuries-long use of kava beverage. Based on the review of the case reports, the link between kava and hepatotoxicity is variably con-sidered weak (Gruenwald and Skrabal 2003) to very probable (Stickel et al. 2003).

Researchers have proposed several mechanisms of potential hepatotoxicity and attempted to explain the perplexing lack of such reports with the traditional drink, which apparently continues to be used safely.

Let us first take a look at the chemical composition of kava and then direct our attention to its pharmacological and toxicological properties. In so doing, we hope to provide readers with some basic understanding of how kava works as an anxiolytic agent, how to assess benefits and risks in kava, and what constitutes the appropriate use of kava.

This review can only be a snapshot of the wealth of research that has accumulated over the decades and it does not attempt to be comprehensive.

I. Chemistry

Research on the chemical constituents of kava reaches back to 1850-1860. These first studies concerned rather ubiquitous substances such as starch and little characterized crystalline material. In the 1870s and 80s, the first kavalactones were obtained in pure form and characterized. It should be pointed out that the early investigators had to work with much more cumbersome methods of isolation and identification than we do today. The chemical structures of each new compound had later to be deduced by chemical modifications.

I.1 Kavalactones

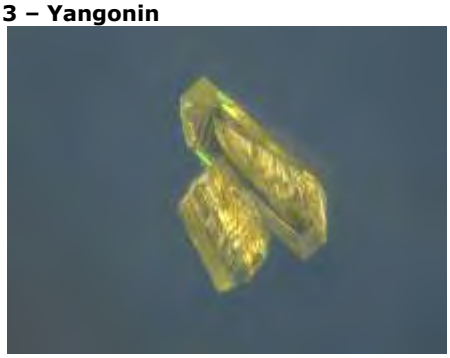
Kava chemistry is currently associated with six major kavalactones: methysticin and 7,8-dihydro-

Fig. 4.1. Crystallized kavalactones

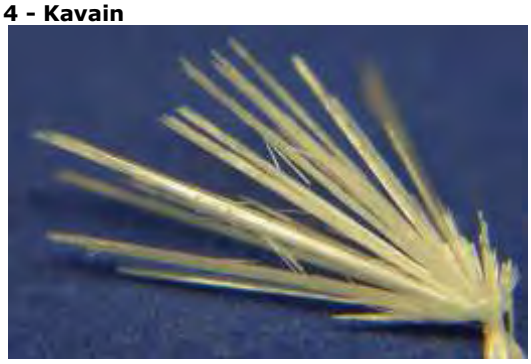
1 – Desmethoxyyangonin

2 – Dihydrokavain

3 – Yangonin



4 - Kavain



5 - Dihydromethysticin

6 - Methysticin

Photos by Klaus Dragull

methysticin, kavain and 7,8-dihydrokavain, yangonin and 12-desmethoxyyangonin (Figure 4.1 and 4.2). However, a number of variants of these basic kavalactone molecules are still being reported, and no end of discovery of minor kavalactones from kava is in sight.

Above are photographs of crystallized kavalactones taken through a macro lens.

It is not surprising that the kavalactones isolated first, yangonin (obtained in pure form first in 1874) and methysticin (1889), were the ones that readily crystallized from the solvent extract.

Much of the kava chemistry was worked out with the processing residues of “Gonosan” (a medicine once used for the treatment of gonorrhea) that was one of the first successful kava products on the European market, produced by the Riedel company in Berlin several years before 1914. Starting in 1914 and ending in 1933, Borsche and co-workers at the University of Frankfurt were dedicated to kava chemistry. From these commercial bulk materials provided for research by the Riedel company they isolated and investigated five kavalactones: methysticin and dihydromethysticin, kavain, dihydrokavain, and yangonin. Yangonin was erroneously formulated as gamma pyrone but in the 1950s was corrected to an alpha pyrone (lactone) by a Polish group working on yangonin synthesis (Keller and Klohs 1963, and references therein).

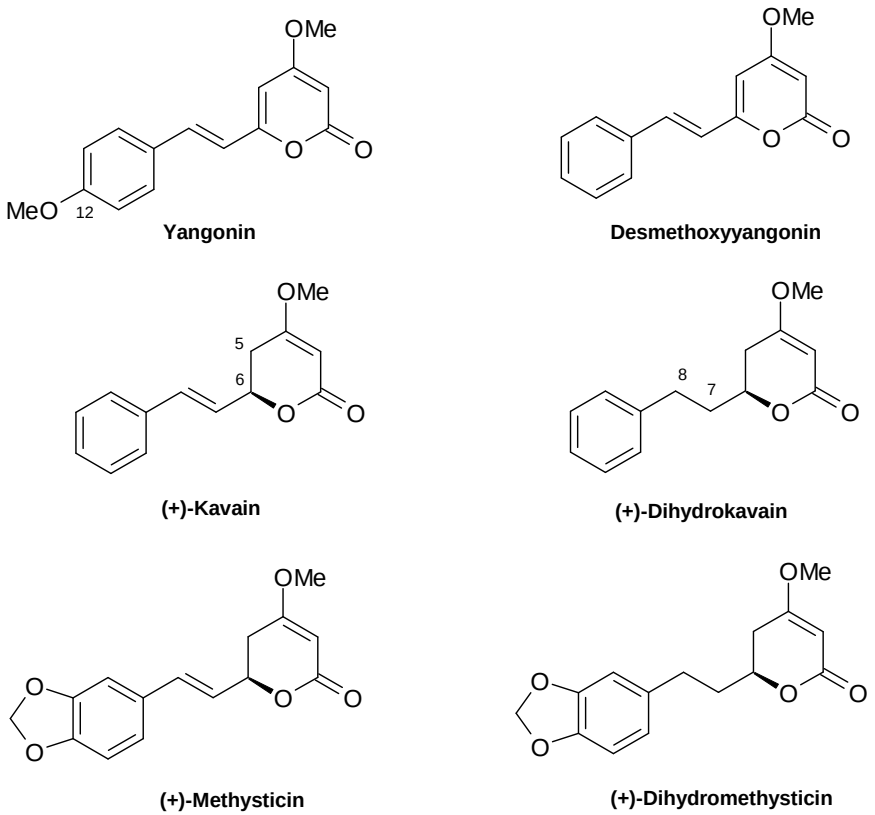


Fig. 4.2. Chemical structures of the major kavalactones present in kava beverage made from rhizomes and roots. Me=methyl group.

The major kavalactones are quite similar in physical properties, which can be illustrated on the example of "pseudomethysticin." Pseudomethysticin, a uniform, colorless crystalline material, derived from kava in the research laboratory of the Riedel company in 1908, was re-examined by Borsche et al. in 1928. They found "pseudomethysticin" to be simply a mixture of both methysticin and dihydromethysticin, which had formed uniform crystals in the laboratory. This uniformity in crystal shape is usually a property of a single pure compound and this had led to the confusion.

The sixth major kavalactone, desmethoxyyangonin, was discovered by Keller et al. at the laboratories of the Riker company, Northridge, California, in 1959. Their new "compound A" from kava was found to be identical to 5,6-dehydrokavain from an *Aniba* species (rosewood).

These six major kavalactones are lipophilic and can be dissolved in alcohol or, in the case of "Gonosan," in sandalwood oil. In water, kavalactones form an unstable emulsion. This is the reason why kava drinkers stir up the yellow, oily, and starchy bottom of their bowls often.

Kavain, usually the most abundant kavalactone in roots of Hawaiian kava, was chemically synthesized in 1950 by two different groups independently. The synthetic kavain is different from the natural form, a property called "racemic," "+/-" or "D/L." The natural form, by contrast, is the (+)–kavain.[1]

Interestingly, the natural (+) forms of kavalactones were only very recently synthesized at Williams College, Massachusetts (Smith et al. 2004). This leads to the prospect of cheaper kavalactones being available, accelerating research into their bioactivities, and having standards available for analytical methods.

It may not be that these synthetic pure compounds replace the kava beverage anytime soon, alone or in combination, since apparently kava is much more than just kavalactones.

Within the *Piper methysticum* complex, the proportions of kavalactones vary with cultivar and plant parts (see chapter 3). Progress in understanding variation among cultivars has come from the work led by Vincent Lebot, who is based in Vanuatu.

[1] (+) or D indicates that the compound rotates the plane of polarized light to the right (clockwise).

By extensive collection of root material around the Pacific Islands, followed by HPLC quantitation of the six major kavalactones and statistical analysis, Lebot and Lévesque (1996a) found six distinct kavalactone chemotypes. It should be noted that these are quantitative rather than qualitative chemotypes, meaning that none of the six kavalactones were missing in any of the chemotypes,[2] and only the ratios between them varied. Lebot et al. also found that these kavalactone profiles remain constant under different cultivating conditions and thus are constitutive rather than induced by changing environmental factors.

As a simplification, cultivars favored by the kava drinkers had a higher kavain content relative to the five other kavalactones. The cultivars disfavored, locally known for instance as "*Tudei*" (or "two-day") for the prolonged effect were especially high in dihydromethysticin relative to the five other kavalactones.

Lebot concluded that the domestication of kava was a long process that altered the ratio of kavalactones so as to improve desired effects caused by kavain and to avoid negative effects caused by a high proportion of dihydromethysticin. Actually, other factors that were not examined by this work, such as trace alkaloids, could cause negative effects as well, and causation by dihydromethysticin alone cannot automatically be assumed. Convincing evidence that this kavalactone might at least contribute to the "two-day effect" comes from earlier studies in mice in which methysticin and dihydromethysticin showed a later onset and longer lasting effect in comparison to kavain and dihydrokavain (Meyer 1967).

I.2. Other root constituents

Other groups of compounds with interesting bioactivities present in the lipophilic portion of kava root extracts include the flavokawins-A, -B, and bornyl esters of cinnamic acid and its 3,4-methylenedioxy analog (Figure 4.3), all of which have recently been tested on biological models.

Flavokawin-A has been shown to have antitumor activity (Zi and Simoneau 2005) lending more support to the inverse relationship found earlier between kava consumption and cancer incidence in various areas of the Pacific (Steiner 2000). The more kava was consumed, the lower the cancer incidence. Such correlations, however, are not to be confused with causation since kava consumption could be only indirectly linked through another factor that affects both kava consumption and lower cancer incidence.

Flavokawin-B is a typical lipophilic constituent of the kava root, and has, as well as the bornyl esters, recently been shown to be anti-inflammatory similar to aspirin *in vitro* (Wu et al. 2002). This finding supports anecdotal claims of kava use for treating inflammatory pain in traditional settings.

Roots also contain trace alkaloids, two pyrrolidines and an oxoaporphine. The same compounds are orders of magnitude more concentrated in the twigs of another pepper species, *Piper caninum,* which has recently been investigated. Compounds 1-cinnamoylpyrrolidine and cepharadione A were found to be major DNA damaging principles of *Piper caninum* twigs (J. Ma et al. 2004a, 2004b).

I.3. Aerial constituents

Methysticin and kavain decrease progressively from the root towards the stems and leaves relative to their 7,8-dihydro counterparts, while an alkaloid that was not detectable in roots, pipermethystine, was found to be present in the stems and leaves (Smith 1983). (The mention of pipermethystine also being in roots in an earlier report from 1979 by the same author may therefore have been in error.)

Alkaloids differ from kavalactones in that they contain the element nitrogen and are usually found to be of pharmaco-toxicological importance due to their reactivity and/or interaction with the human nervous system. A study on kava alkaloids from our laboratory (Dragull et al. 2003) found pipermethystine, together with two novel alkaloids: awaine in the young leaves and pipermethystine epoxide in stem peelings and leaves.

Pipermethystine, originally reported from two Fijian cultivars (Smith 1979, 1983), was confirmed in different cultivars from Melanesia, Micronesia, and Polynesia that are maintained in Hawai‘i.

Pipermethystine epoxide was found only in the cultivar '*Isa*' from Papua New Guinea, but not in the other ten cultivars examined. This was surprising, since '*Isa*' is close to other kavas in that it contains the six major kavalactones, and in addition pipermethystine and awaine. While being different from true *P. methysticum* var. *methysticum*, it is not grouped with

[2] In some plants from Vanuatu, the kavain content was very low.

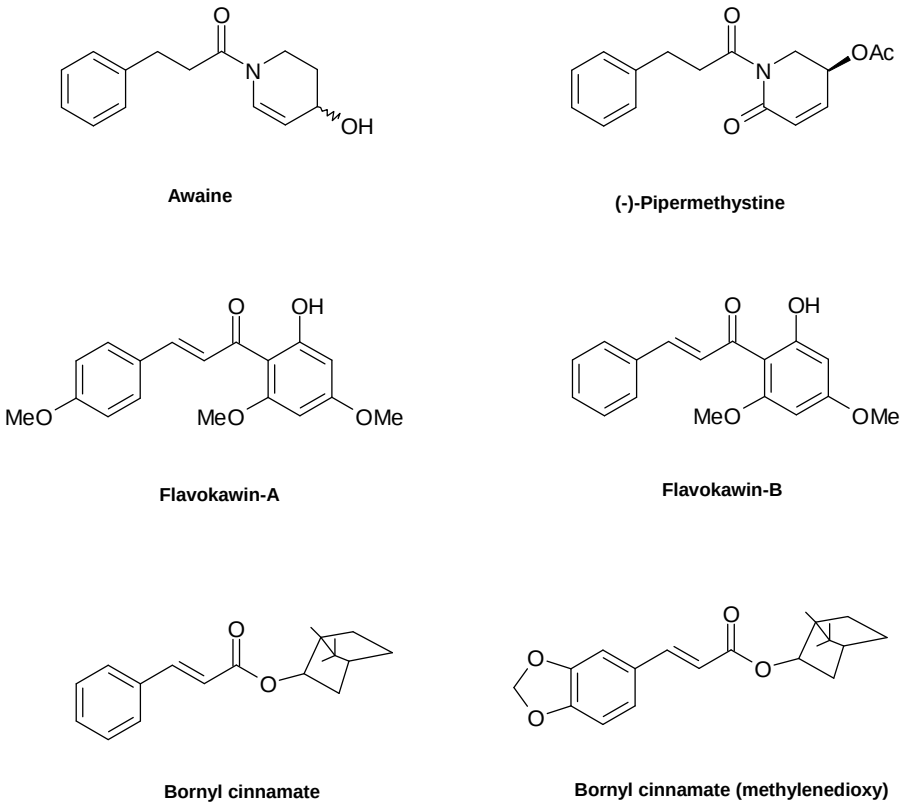


Fig. 4.3. Chemical structures of miscellaneous compounds from kava. Awaine occurs only in unopened young leaves and pipermethystine is particularly concentrated in leaves and peelings from the basal stems. Flavokawins and bornyl cinnamates are instead constituents of roots. Ac=acetyl group, Me=methyl group.

the rather wild type *P. methysticum* var. *wichmannii (=P. subullatum*[3]*)* plants.

Other than serving basic science, this study on piperidine alkaloids showed that trade in the ill-defined term "peelings" and the use of leaves may lead to considerable alkaloid contamination of resulting products. Aerial parts should therefore not be used at all. This phytochemical work in conjunction with traditional practices provided the basis for testable hypotheses regarding the kava hepatotoxicity association from 1998-2002 (see Section II.3).

I.4. Chemical Analysis

Analytical methods have typically focused on the six major kavalactones. This is understandable since much of kava's activity is linked to these major components. However, analyses of kavalactones alone will not tell us if they came from the correct plant parts (roots and stump), nor will they show us contamination coming from other materials such as leaves, stem peelings, or closely allied species not traditionally preferred for consumption. This is a current challenge for improving the safety of kava being sold as powders or extracts.

We found that, when a commonly used HPLC method was applied to aerial parts, it could not clearly distinguish between yangonin, the typical major kavalactone, and pipermethystine, the aerial alkaloid. This should not be surprising since the method was developed on root material and not on aerial parts. However, it means that, if pipermethystine was present in extracts implicated in hepatotoxicity cases, it would not necessarily have been recognized, and therefore aerial parts would likely have gone through the quality control process.

[3] *P. wichmannii* was found to be identical with *P. subullatum* by taxonomist Chew in 1992. *P. subullatum* reaches in distribution as far as the Philippines. For practical reasons we here still use Lebot's intraspecific classification proposed in 1996 into two groups of varieties, *P. methysticum* var. *wichmannii* and *P. methysticum* var. *methysticum* (Lebot and Lévesque 1996b).

Future methods will ideally include constituents that are most indicative of the correct plant part and cultivar, and not give false-positive signals if applied to possible contaminants. We find gas chromatography a true alternative to HPLC, because it can distinguish between kavalactones and alkaloids, and has a high resolving power for other lipophilic constituents.

I.5. Isolation of Kavalactones

For analytical methods and bioactivity testing a researcher may need large amounts—in the gram scale—of a purified kavalactone. However, currently the kavalactones are expensive, costing $245 US for only 10 mg. This is a serious impediment to kava research.

With expertise in chemical synthesis, there is now a method available to obtain kavalactones that way. If the expertise of the researcher is not in chemical synthesis, for instance at a biological laboratory, one can prepare kavalactones in a rather straightforward manner by isolation from root material. In this approach, further bioactives can be obtained as by-products, which is an advantage over synthesis.

Our laboratory set out to find a simple way to the kavalactones by isolation. Starting from a moderate amount of raw material, 500 g dry root of the '*Isa*' cultivar, we found that the elution behavior against silica gel and differences in crystallization are sufficient to arrive at the six major kavalactones at more than one gram for each and at 98% purity. The method does not need expensive equipment, and interesting minor by-products, such as the bornyl esters and flavokawins, are obtained (manuscript in preparation).

First, portions of yangonin and methysticin crystallize from ethyl acetate and ethyl acetate/hexane mixture, respectively. Next, the extract is fractionated with ethyl acetate/hexane against silica, the collected eluate is conveniently separated into classes of compounds and crude individual kavalactones by their increasing polarity into liter #1 the two bornyl esters, liter #2 the two flavokawins, liter #3 desmethoxyyangonin, liter #4 dihydrokavain, liter #5 kavain, after that, yangonin, dihydromethysticin, and methysticin.

In the following purification step, each collected fraction of the extract is crystallized in the freezer from ethyl acetate-hexane by seeding with a small crystal. It is continued only with the nearly colorless crystalline materials and the yellow supernatants are removed. Like yangonin and methysticin, crude desmethoxyyangonin and crude kavain can be obtained at high purity by repeated crystallization from suitable solvents. Crude dihydrokavain and dihydromethysticin, on the other hand, need to be re-run on two different columns to remove minor impurities that spontaneously co-crystallize.

Pipermethystine would elute just before the first kavalactone, but it is not detectable in roots. It can be obtained in a similar manner—after charcoal treatment of the extract by elution with the same solvents against silica—from kava leaves from the cultivar Mō‘ī, for instance.

Investigating with pure compounds, scientists can better attribute beneficial or possibly harmful effects to specific components of kava.

II. Pharmacology and Toxicology

In addition to the knowledge of kava chemistry above, an understanding of various kava products and dosage forms is important since both desirable and adverse effects of kava are dependent on the kinds of products/chemicals and doses. A variety of kava products and dosage forms have been developed and formulated (Table 4.1). Some were sold as dietary supplements and some were used in pharmacological and toxicological studies, clinical trials, and toxicity case-reports, which are summarized in Tables 4.2, 4.3, and 4.4 respectively. Details are discussed as follows.

II.1. Kava Products (Dosage Forms)

Raw kava powders from rootstock for making beverage and capsules

Fresh or dried, raw kava rootstock (stump and roots) is ground and mixed with water and/or coconut water to prepare kava beverage (detailed preparation instructions are in chapter 7) for short-term consumption. Powders from dried rootstock are also filled into capsules by licensed manufacturers. This dosage form is convenient for consumers and contains approximately 500 mg of the dried rootstock powder per capsule, equivalent to 50 mg kavalactones (here after abbreviated as KL) per capsule, if we assume 10% KL content in the powder (Table 4.1).

Kava extracts from rootstock for making capsules and tablets

Kava extracts prepared from rootstock provide a more concentrated dosage form (containing 30% to sometimes as high as 70% KL) than raw kava powder (containing 3-20% KL). Commercial kava extracts usually

Table 4.1 Major kava products and dosage forms

Category	Made from	Kavalactones (KL)	Use	Dose
Traditional beverage	Fresh or dried raw rootstock in water	0.3-2% in fresh rootstock; 3-20% in the dried	For ceremonies and social recreation	Various, from one bowl to several bowls per day, depending on drinkers
Raw kava powders	Dried raw rootstock	3-20% in the dried rootstock	To make beverage or capsules	30-100 g dried powder per liter for beverage 500 mg dried powder per capsule
"Standard" kava extract powders	Concentrated extract, using ethanol and acetone as solvents	30% (standard) – sometimes as high as 70% in the extract powder	To make capsules or tablets	60-240 mg KL per day. (The concentrated extract was spray-dried on polysaccharide solids and converted to powder forms.)
Capsules	Raw kava powder	3-20% in the dried raw powder	As dietary supplements	50 mg KL per capsule, assuming 10% KL content in the raw kava powder
Capsules	Standardized extract powders	30-70% in the extract powder	As dietary supplements	60 mg KL per capsule (standardized)
Tablets	Standardized extract powders	30-70% in the extract powder	As dietary supplements	Standardized at 60 mg KL per tablet
Tinctures	One part of dried kava powder in 5 parts of ethanol-water (25:75)	10-20 mg KL per ml	For use in naturopathic and herbal medicine	7.5-15 ml per day or as directed by naturopathic doctors and herbalists
Tea bags	Dried rootstock powders	3-20% in the dried powder	As an herbal tea	2-3 g per tea bag, 1-3 cups per day
Tea bags	Occasionally kava leaves	Also contains alkaloids, pipermethystine	Should not be consumed	This type of product only appeared in late 1990s and early 2000s
Snack food	As an ingredients in health food	Generally low or very low KL per serving	As healthy food	Various, depending on consumers

use ethanol–water or acetone–water mixtures as extraction solvents, and sometimes are produced by supercritical fluid extraction, which uses carbon dioxide as an extraction solvent. In this case, no solvent residues are left in the extract, since carbon dioxide is completely escaped.

The initial liquid extract after removal of solvent is spray-dried on to a solid support such as starch, dextrose, and cellulose to form a concentrated extract powder. The powder is then sold and used for manufacturing kava capsules or tablets. If low ethanol content (less than 25%) is used as a solvent, the original extract is a tincture for herbalists or naturopathic doctors (Table 4.1). Kava tea bags are a convenient dosage form for consumption but kava leaves should not be used due to the presence of alkaloids such as pipermethystine in Figure 4.2.

II.2. Relaxing and Hypnotic Action

The relaxing and hypnotic action of kava has been demonstrated in both animal studies (Table 4.2) and clinical trials (Table 4.3). Relaxation and a feeling of well-being are the most common action of kava after normal ingestion. At higher doses hypnotic and relaxation of skeletal muscles are evident. Anticonvulsion, neuroprotection, local anesthesia, analgesia, and increased performance and concentration are also documented (Mills and Bone 2000).

To understand the multiple actions of kava, Baum and co-workers (1998) studied the interaction of kava with neuroreceptors and neurotransmitters in rats (Table 4.2). They intraperitoneally injected kava extracts (20, 120, 220 mg per kg of rat) or individual kavalactones (30, 60, 120 mg per kg) and observed the changes of neurotransmitter levels, as well as behavioral changes including muscle relaxation and sedation.

The level of dopamine, a neurotransmitter in the brain, increased in the case of kava extracts (120 mg/kg). With respect to the individual lactones, kavain at low doses decreased the dopamine levels and at higher doses either increased or did not change the dopamine concentrations. Yangonin on the other hand decreased the dopamine level, and desmethoxyyangonin increased it. Dihydrokavain, methysticin and dihydromethysticin did not produce significant changes of dopamine levels. Furthermore concentrations of 5-hydroxytryptamine (5-HT, another neurotransmitter) were also affected by kavalactones, notably kavain causing a decrease in 5-HT levels. The activation of the dopaminergic neurons may explain the relaxing and slightly euphoric actions, and the

Table 4.2. Selected pharmacological and toxicological studies

Observed Action	Study System	Kava Preparations/ Administration	Dose and Duration	Reference
Changes of dopamine and 5-hydroxytrytomine (neurotransmitters) concentrations, Changes of behavior	Rats, 5–12 per group	Kava extract and individual kavalactones Intraperitoneal injection	20–220 mg extract or KL per kg of rat Single dose	Baum et al. 1998
Increased sleeping time with alcohol, Increased toxicity with alcohol	Mice, 5-14 per group	Lipid soluble extract Oral	200-600 mg extract per kg mouse (KL content unknown) Single dose	Jamieson and Duffield 1990
Inhibited convulsion induced by strychnine	Mice, 10	Chloroform kava extract and individual isolated kavalactones. Oral	Various concentrations, single doses, 15 min prior to strychnine injection	Klohs et al. 1959
	Mice, 10–30 per group	Individual isolated kavalactones dissolved in peanut oil. Intraperitoneal injection	Various concentrations, single dose, 30 minutes prior to strychnine injection	Kretzschmar et al. 1970
Aqueous kava extract was not toxic to rats	Rats	Aqueous extract	Kavalactones 200 or 500 mg per kg per day, 2 or 4 weeks	Singh and Devkota 2003
Inhibition of human cytochrome P450 (CYP450) drug metabolic enzymes	Recombinant CYP450	The six major kavalactones	Various concentrations	Zou et al. 2002
Organic kava extract caused glutathione depletion, but not aqueous extract	Amoeba cells	Ethanol, acetone, and aqueous kava extracts	Various concentrations and treatments to the cells	Whitton et al. 2003
Pipermethystine was more cytotoxic than kavalactones	Human liver cancer cells (HepG2)	Isolated pipermethystine, dihydrokavain, dihydromethyscin, and desmethoxyyangonin	Various concentrations up to 200 micro mole per liter Exposed to cells for hours to days	Nerurkar et al. 2004
Cytotoxic synergy between kavain and pipermethystine	HepG2 cells	Isolated kavain and pipermethystine	A range of contractions (0.1 to 1000 µg/ml) exposed to cells for 48 hours	Lin et al. 2005

reduction of the activity of 5-HT neurons could account for the sleep-inducing action.

Jamieson and Duffield (1990) found that the sleep time induced by kava increased with co-administration of ethanol to mice, and this would also increase the toxic effect of alcohol and possibly kava as well. Kava extracts and kavalactones were noted for anticonvulsion action when they were administered orally (Klohs et al. 1959) or intraperitoneally (Krezschmar et al. 1970).

In a randomized and double blinded trial involving 40 patients, Malsh and Kieser (2001) concluded that standardized kava extract was significantly superior to placebo in the treatment of anxiety disorders of nonpsychotic origin at a dose of 300 mg/day for three weeks after benzodiazepine treatment was tapered off over two weeks. Lehmann and co-workers (1996) observed similar results with 58 patients over four weeks (Table 4.3).

In a 25-week study involving 100 patients, Volz and Kieser (1997) observed a significant reduction of nervous anxiety and tension in patients treated with standardized kava extract at 210 mg kavalactones per day.

More convincing evidence came from a systematic review of seven appropriately designed clinical trials (randomized, placebo-controlled, double-blinded studies) by Pittler and Ernst in 2000, who concluded that kava extract significantly reduced anxiety.

In a recent study conducted over the internet, kava was not more effective than placebo for treating anxiety and insomnia (Jacobs et al. 2005). This contradicts the earlier studies. The use of the internet to conduct randomized, placebo-controlled and blinded trials needs further verification.

Foo and Lemon (1997) studied the interaction of aqueous kava extract (beverage) with alcohol in 40 human volunteers and observed that co-administration of kava extract and alcohol increased sedation and intoxication, and impaired cognition and coordi-

Table 4.3. Selected clinical trials or studies

Observed Action	Subjects and Numbers	Kava Preparations/ Administration	Dose and Duration	Reference
Superior to placebo in the treatment of anxiety disorders of nonpsychotic origin	40 anxiety patients previously treated with benzodiazepines	Standard kava extract Oral	Kavalactones 50-300 mg per day 5 weeks	Malsh and Kieser 2001
Kava significantly reduced anxiety compared to placebo	Systematic review of 7 published human clinical trials	Standard kava extract Oral	Kavalactones 60-240 mg per day 1 - 24 weeks	Pittler and Ernst 2000
Significant reduction of nervous anxiety, tension, restless of nonpsychotic origin	100 patients, randomized, placebo-controlled, double-blinded	Standard kava extract Oral	Kavalactones 210 mg per day 25 weeks	Volz and Kieser 1997
Significant reduction of anxiety of nonpsychotic origin	58 patients, randomized, placebo-controlled, double-blinded	Standard kava extract Oral	Kavalactones 210 mg per day 4 weeks	Lehmann et al. 1996
Kava did not relieve anxiety or insomnia more than placebo	391 subjects recruited through internet, randomized, placebo-controlled	Standard kava extract in softgel capsules Oral	Kavalactones 300 mg per day 28 days	Jacobs et al. 2005
Potentiated sedation, intoxication, and impairment of cognition/co-ordination with alcohol	Human volunteers, 40 (9–11 per placebo, kava, alcohol, and combination group)	Beverage (kava powder 1g per kg body wt. in 500 ml water) Oral	500 ml beverage 0.75 g alcohol per kg body wt. Single dose	Foo and Lemon 1997

nation. This is a typical example of drug interaction, which may lead to adverse effects or toxicity.

II.3. Potential Liver Toxicity and Possible Causes

In recent years, kava has been implicated in several liver failure cases (Table 4.4), notably in Europe. This led to its ban or restricted use in many countries including Germany, Switzerland, France, Britain, Canada, and Australia. On March 25, 2002, the Center for Food Safety and Applied Nutrition, U.S. Food and Drug Administration issued a warning to consumers that kava-containing dietary supplements may be associated with severe liver injury.

Liver damage appears to be rare. The causality of the case reports of liver toxicity and the German official assessment were questionable. The FDA believes consumers should be informed of the potential risk of liver-related injuries, which include hepatitis, cirrhosis, and liver failure. Symptoms of serious liver disease include jaundice (yellowing of the skin or whites of the eyes) and brown urine. Non-specific symptoms of liver disease can be nausea, vomiting, light-colored stools, unusual tiredness, weakness, stomach or abdominal pain, and loss of appetite.

Consumers may identify kava products or kava components in dietary supplements by reading the product label. The following are commonly used names for kava:

ava	kawa-kawa
ava pepper	kew
awa (Hawaii)	*Piper methysticum*
intoxicating pepper	*Piper methysticum* Forst.f.
kava (America)	*Piper methysticum* G. Forst.
kava kava	rauschpfeffer
kava-kava	sakau
kava pepper	tonga
kava root	kavakavawurzelstock
kawa (Europe)	yangona (Fiji)
kawa kawa	wati

Potential toxicity of kava may be due to the following mechanisms:

a. Interaction with Cytochrome P450 enzymes responsible for drug metabolism

Zou and co-workers investigated the effect of the individual kavalactones kavain, dihydrokavain, methysticin, dihydromethysticin, yangonin, and desmethoxyyangonin on recombinant human cytochrome P450 (CYP450) enzyme isoforms. It was observed that concentrations as low as 0.1 microgram per ml would inhibit CYP450 enzymes and thus reduce the ability of these enzymes to metabolize drugs and toxic substances in the body. This indicates that kava has a high potential for causing drug interactions. However, no systematic studies investigating interactions between kava and specific drugs or other herbs have been carried out.

Table 4.4. Selected case-reports (severe liver failure cases)

Patient and Observation	Kava Preparations	Dose and Duration	Co-medication	Reference
A 56-year-old female Fatigue, jaundice, liver Necrosis, death	Tablets, label-claimed KL 60 mg per tablet and contained passionflower and skullcap.	One tablet, 3 times a day. 4 months	Three more dietary supplements	Gow et al. 2003
An 81-year-old female Fulminant liver failure, death	Standardized kava extract	230 mg kavalactone per day. 10 months	None	Stickel et al. 2003
A 61-year-old female Fulminant liver failure, death	Standardized kava extract	120 kavalactone mg per day. 2 months	Ginkgo Omeprazole	Stickel et al. 2003
A 32-year-old male Fulminant liver failure, alive	Standardized kava extract	240 mg kavalactone per day, 3 months	None	Stickel et al. 2003
A 45-year-old female Fulminant liver failure, death	Standardized kava extract	120 mg kavalactone per day, 4 months	None	Stickel et al. 2003

In contrast, increase rather than inhibition in the activity of a specific CYP450 isoform (CYP3A23) has been found in response to desmethoxyyangonin and dihydromethysticin treatment (Y. Ma et al. 2004).

Yet another aspect of CYP450 activity is the ability to form reactive metabolites, specifically from the methysticins (Johnson et al. 2003). As the methysticins are typical components of kava, the relevance of this finding to kava toxicity depends on occasional sensitivity of patients or saturation of the detoxifying pathways.

b. Interactions with central nervous system depressants

The known sedative effects of kava (Tables 4.2 and 4.3) have led to the assumption that kavalactones in isolated forms or in extracts would interact with CNS-depressants like benzodiazepines, barbiturates, and alcohol.

c. Different preparation methods

Whitton and co-workers (2003) demonstrated that kava extracts prepared in water contained much higher levels of glutathione, a powerful antioxidant, than those extracted using organic solvents (Table 4.2). When amoeba cells were exposed to both types of extracts, kava extracts made with organic solvents were more toxic to the cells than the aqueous extract. It appears the glutathione in aqueous extract protects amoeba cells from harm.

d. Cytotoxic kava alkaloids and synergic interactions with kavalactones

Dragull and co-workers (2003) at the University of Hawai'i showed that kava leaves and stem peelings contain considerable amounts of pipermethystine, an alkaloid. Nerurkar et al. (2004) demonstrated that pipermethystine is more toxic to human hepatoma cell line HepG2 than kavalactones (Table 4.2). Lin and co-workers (2005) studied the combined effect of pipermethystine and kavain on HepG2 cells and revealed that the combined mixture showed synergistic (here meaning 1 + 1 > 2) toxicity. In other words, the combined mixture produced more toxic effect than that of pipermethystine or kavain alone. These studies open another dimension in our warning that the alkaloid-rich kava leaves and stem peelings may have adverse effects on the liver and should not be consumed.

II.4. Risks, Benefits and Ways to Avoid Toxicity

None of the proposed mechanisms of liver toxicity in section II.3 above could satisfactorily explain the liver failure observed in Table 4.4. Relevant hepatotoxic effect of kava still needs to be proven, as stated by the Society for Medicinal Plant Research (2003). It appears more likely that the several cases of liver damage were caused by rare idiosyncratic-immunological reactions, sometimes induced by drugs or allergens. This phenomenon can occur after taking prescription drugs or even over-the-counter drugs. The frequency of hepatotoxicity possibly caused by kava is still lower than many conventional drugs.

Herbal medicines, like conventional drugs, are quite likely to be associated with low frequency of hepatotoxicity. The question is: what level of risk is acceptable from a public health point of view? A number of clinical trials have indicated that kava is effective for the treatment of anxiety, which is prevalent in today's life. Kava should be available for the public, or naturopathic doctors and herbalists. Banning a popular supplement like kava in some countries will not keep people from obtaining it in today's globa-

lized environment and internet age. Educating consumers and manufacturers in the appropriate use of low-risk supplements may be the key. Or it may be necessary to make them available only on professional advice.

Liver toxicity is associated with multiple factors. Lipophilic extracts of kava rootstock and possible contamination with alkaloid-containing raw materials, such as stem peelings, are more likely to have caused the hepatotoxic reactions in the affected patients. If the quality and appropriate use of kava are ensured, liver toxicity could be avoided. This means use the best cultivars (and Hawaiian cultivars are among the best for desirable psychoactive effects), older plants (three years or more), the correct plant parts (rootstock and no aerial parts), water as the extraction solvent, and moderation in consumption. Consumers also must avoid using kava with alcohol or other central nervous system depressants.

[The supplement to this book provides information about more recent studies on potential health effects of 'awa.-Editors.]

III. Concluding remarks

One difficulty in interpreting kava phytochemical work is that often the botanical material from which the new compounds were obtained is poorly characterized. In the literature we find batch numbers of commercial kava extracts, or commercial "kava root," without cultivar name or voucher deposition. (A voucher specimen is a dried plant that is accessible for other scientists to verify the plant's identity by comparing morphological features with those of related plants.) Therefore, compounds reported as new for kava could be specific to only the particular material it was taken from.

'*Isa*' might not be the only odd cultivar. For instance, 11-methoxy-nor-yangonin has been reported from a PNG plant designated P. sp. Wormersley (Haensel et. al. 1966), which was well described in the phytochemical paper as anatomically distinct from other true *Piper methysticum*, but which has later been lumped together with the *Piper methysticum* var. w*ichmannii* group. Differences between materials further concerns 5-hydroxy-7,8-dihydrokavain. Cheng and co-workers (1988) had found the compound after water treatment in material from Vanuatu, but the authors were unable to detect it in dried or fresh roots from Fiji using identical conditions.

The chemistry and botany of kava and its closely allied, rather wild-type plants need more detailed clarification. Many questions are still waiting to be resolved. The maintenance of diverse cultivars is a prerequisite for preserving an array of interesting plant chemicals and for better understanding the ongoing kava domestication process.

Kava, if used appropriately, is an effective anxiolytic agent and an alterative to many chemical drugs. There is need for further investigations in pharmacology and toxicology to fully understand its clinical significance and its potential adverse effects or toxicity in kava users.

Further Readings

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Chapter 5

Hawaiian Cultivars

Ed Johnston and Helen Rogers

‘Awa was never completely forgotten in Hawai‘i. People still occasionally cultivated it, even in the latter half of the 20th century. However, in the 1980s, Joel Lau of the Nature Conservancy was actively looking for it. His job took him all over the wild places of the Hawaiian islands. When he ran across an ‘awa variety, he took a cutting to preserve in his collection, which he generously shared with botanical gardens and private collections.

In the late 1990s, a number of ‘awa enthusiasts formed the Association for Hawaiian ‘Awa and began organizing workshops to inform people about this little-known gift of the ancient Pacific horticulturists. More people began to drink ‘awa privately and with friends. ‘Awa bars started up.

‘Awa drinking is increasing in Hawai‘i as people become aware of its uses and effects. However, as of now, because of concerns about potential liver damage, it is doubtful that ‘awa will become the important export for Hawai‘i that was envisioned in the 1990s.

Deciding on Cultivar Names

The traits distinguishing the cultivars can be difficult to perceive. In describing the plant, Margaret Titcomb reported that "The stems are jointed, the spaces between the joints sometimes determining the native name of the species, as do also the intensity of the green of the leaves, the colour of the stems and the quality of the root" (Titcomb 1948, 109).

This is not so different from the way we tell the cultivars apart in Hawai‘i today. We rely more on the characteristics of the stalks than on the leaves. The leaf characteristics of Hawai‘i's cultivars are quite similar, unlike in Vanuatu where there is a greater amount of variation in their ‘awa. The color of the leaf piko (where the leaf blade meets the stem) is not usually too helpful in making distinctions. The piko tends to be the same color as the stem.

To identify a plant, we use the central portion of a mature plant's stalks (at least 18 months old). The more upright stalks display the unique traits of the cultivar most consistently. Traits such as stem color and internode configuration (stripes, spots, etc.) and length are all shown on the following cultivar pages, as well is each cultivar's overall growth habit: erect, normal, or prostrate (see figure 5.1).

Identification often rests on the appearance of the stem's lenticels (from the Latin *lenticella*, meaning

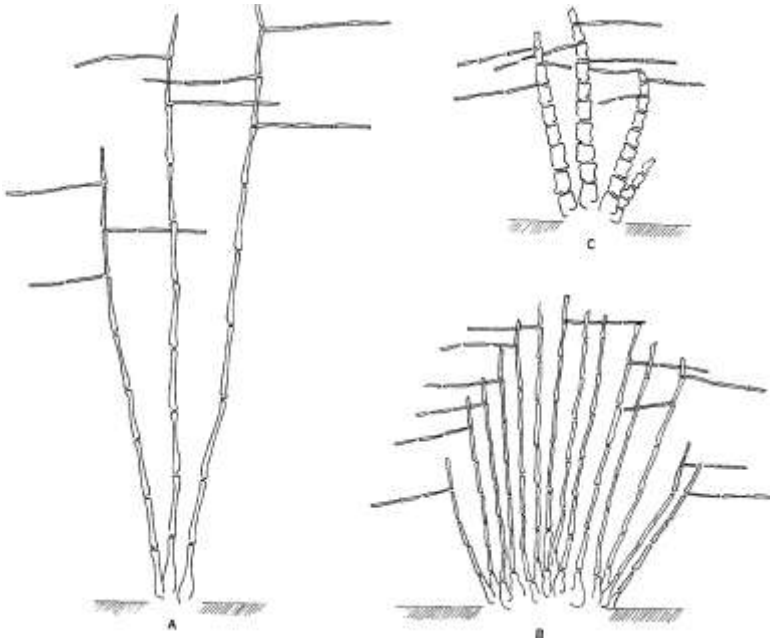


Fig. 5.1. Variations in the growth habit of `awa plants. A=erect, B=normal, C=prostrate
Picture by Vincent Lebot, reproduced with permission of National Tropical Botanical Garden

"small window"). These are "spongy areas on the surface of the stem . . . " appearing as spots or speckles (Raven, Evert, and Eichhorn 1986, 734).

As ʻawa growers found new cultivars, we began to call them by the names associated with physical traits documented in ethnographic accounts. (Kāwika Winter's 2004 master's thesis provides an excellent compilation of ethnographic references to different Hawaiian cultivars.) The unfinished task of applying the old names to cultivars is complicated by a number of factors. The few descriptions that have come down to us are quite sketchy. Also, the same cultivars were called by different names in different localities. The old Hawaiian cultivar names used in the present book are: Hiwa, Kūmakua, Mahakea (also called Mākea), Mōʻī, Nēnē (also called Kua ʻea), Papa ʻeleʻele, and Papa kea (also called Keʻokeʻo).

The remaining six Hawaiian cultivars profiled in this book cannot be recognized in the written or oral evidence identified thus far. These cultivars have been given names that relate to the places where they were discovered or to physical characteristics. We call them: ʻOpihikao (also "spotted Hiwa"), Papa ʻele ʻele puʻu puʻu, Mapulehu, Hanakāpīʻai (or Nēnē ʻeleʻele), Panaʻewa, and Honokāne Iki.

Right or wrong, these are the names that are now being used in our plant nurseries and botanical gardens. Information may come to light in the future to correct some of the names. Until then, the names at least allow us to tell the cultivars apart.

Chemotypes

This chapter also provides each cultivar's chemotype (kavalactone profile), which is most likely the key to why the Hawaiians chose to keep a particular variety in cultivation. (Refer to chapter 3, "The Active Ingredients in ʻAwa," by Mel C. Jackson, for a concise explanation of the six-digit chemotype characterizing the relative concentration of the six major kavalactones in the plants.)

The kavalactone levels reported in the present chapter are for lateral roots only, and the analyses were all done by Madis Botanicals for the 1999 *Economic Botany* paper by Lebot et al. Keep in mind that most drinks are made by combining the lateral roots with the stump, which generally has a chemotype nearly identical to the lateral roots but a lower total percentage of kavalactones.

Close readers of this chapter will notice that, within cultivars, chemotypes in the lateral roots can vary slightly from plant to plant, even when analyzed in the same laboratory.[1] While the chemotype is determined by cultivar rather than the environment in which the plant grows or by the cultivation methods used to raise it (Lebot, Merlin, and Lindstrom 1992, 79), there are slight variations. The difference does not seem to be enough to affect the drinking experience.

In fact, the chemotypes of all the Hawaiian varieties are so similar that drinkers in Hawaiʻi today do not often report experiencing differences in psychoactive effects from one cultivar to another. This may not have been the case, however, for native Hawaiians in the pre-contact period, whose perceptions would have been sharpened by a much wider and deeper experience with ʻawa, since its use permeated so many aspects of the culture.

Kavain is the predominant kavalactone in all Hawaiian varieties, and it lays the foundation for the excellent drinking experience to be had with our varieties. Kavain creates the feeling of well-being or mild euphoria that is the hallmark of the ʻawa experience. It also acts quickly--within ten minutes or so.

The first three kavalactones in the lateral roots of Hawaiian cultivars, almost always representing over 65 percent of the total, are generally kavain, methysticin, and dihydrokavain. In Vanuatu, there are many quite distinct ʻawa varieties used for different purposes, and cultivars rich in these three kavalactones are the ones used for a pleasant and fast-acting daily drink, instead of ceremonially or medicinally (Lebot and Siméoni 2004, 23).

Hawaiian varieties also have a low proportion of dihydromethysticin (DHM). According to Lebot, Merlin, and Lindstrom, "chemotypes with a high percentage of kavain and a low percentage of DHM induce the most desirable psychoactive effects" (1992, 78).

[1] The results of kavalactone analyses tend to vary greatly between laboratories (Ram 1999b, 7). Here are a number of factors that can affect the outcome:

- the manner in which the ʻawa is extracted
- the solvents used
- the analytical tool (for instance high pressure liquid chromatography, gas chromatography-mass spectrometry, ultraviolet spectrometry, etc.)
- sampling method

Hanakāpīʻai has also gone by the name "Nēnē ʻeleʻele," however, neither are traditional names that have come down to us through chants or ethnographic studies.

This cultivar has been found, growing on its own, in only one area of Hawaiʻi, the Na Pali Coast of Kauaʻi, in Hanakāpīʻai Valley. When Joel Lau collected the cutting in 1983, he noted "One aggregation of this cultivar was observed" (notes on file at Waimea Arboretum on Oʻahu).

A Hawaiian settlement once flourished in this stunningly beautiful, remote, and archaeologically rich area. Literally translated, the name means "bay sprinkling food" (Pukui, Elbert, and Mookini 1974, 40).

This tall plant has an erect growing habit and can attain a height of ten feet or more, depending on the environment. Growing in the full sun, it may remain under eight feet.

It is a dark ʻawa with many spots and purple nodes. Under some conditions, this cultivar can develop a waxy shine on its stalks.

Table 5.2. Hanakāpīʻai
Kavalactone Analysis of Air-Dried Lateral Roots
(Lebot et al. 1999)
HPLC Analysis by Madis Botanicals, Inc.

Sample Name	**APN10**	**APN11**	**PAH3**
Chemotype	423615	423651	462351
Age of Plant (Years)	6	3	2.3
Soil Type	Hāmākua	Hāmākua	Pāhoa
Location (Hawaiʻi Island)	Hāmākua coast	Hāmākua coast	Puna
Shade (1=full sun; 4=full shade)	1.5	2	2
Growing Methods	Cultivated, irrigated, fertilized	Cultivated, irrigated, fertilized	Cultivated, rainfed, some fertilizer
Damage	No damage	No damage	No damage
Lateral Root Size	>2 cm.	1-0.5 cm.	>2 cm.
Percentage Kavalactones			
Kavalactone			
Desmethoxyyangonin (1)	1.50	1.03	0.75
Dihydrokavain (2)	2.75	2.33	1.90
Yangonin (3)	2.67	2.07	1.63
Kavain (4)	4.54	3.52	3.27
Dihydromethysticin (5)	1.43	1.18	1.05
Methysticin (6)	2.63	1.97	1.95
Total Kavalactones	**15.52**	**12.1**	**10.55**

Scale is in inches.

Fig. 5.2. The stems are especially dark around the node.

Fig. 5.3. The appearance overall is similar to ʻawa Nēnē, but Hanakāpīʻai is darker. (Photo by G. Brad Lewis)

Fig. 5.4. This stem has a waxy look.

"Hiwa, the darkest of all varieties, was the ritualistic awa used by the kahunas and may have been reserved for such use. All the other varieties were common awa which anyone might use" (Handy 1940, 204).

Oscar P. Cox, in a letter to G.R. Carter in 1930, comments on Hiwa: "They also use this kind of Awa in the sacrificial ceremonies of Pele-worship."

Kāwika Winter's thesis (2004, 239) provides a quote from H.E.P. Kekahuna's unpublished papers, housed in the Hawai'i state archives:

> The most highly esteemed liquor of ancient Hawai'i was the 'awa drink, favorite beverage of the gods, priests, and chiefs, and a first and most essential of the offerings to deity…. There are approximately two dozen Hawaiian varieties, some of which are known by different names in different localities, each of which shares its name with the drink it produces.
>
> The most sacred of these varieties were the 'Awa hiwa, with dark green somewhat long stem internodes, dark at each node when mature; and the 'Awa mō'ī, with dark stems and internodes not quite as long as those of the 'Awa hiwa. The drink from these varieties was especially offered to mighty Volcano-Goddess Pele and other deities. A chant was offered, and then the drink itself. This involved dipping one's finger into the 'Awa and snapping it either upward, backward, or both. The essence of the drink (ke aka, literally the shadow) was first offered to the gods, whereupon it was the duty of the priests (kahuna-s) to ceremonially consume the remaining substance (ke kino, the body; ka 'i'o, the flesh).
>
> The great chiefs, for their pleasure, also imbibed the sacred 'Awa, permitting only the use of non-sacred varieties to the humble commoner, unless a kahuna used a sacred variety to treat a sickness.

The reverence for Hiwa in old Hawai'i is evident in this portion of a chant recorded by N.B. Emerson and quoted by Handy and Handy (1991, 512). "This refers to the cup of sacramental *'awa* brewed from the strong, black *'awa* root (*'awa hiwa*) which was drunk sacramentally by the *kumu hula*":

> The day of revealing shall see what it sees:
> A seeing of facts, a sifting of rumors,
> An insight won by the black sacred 'awa,
> A vision like that of a god!

Winter (2004, 51-52) describes a hula prayer for inspiration which contains the line, "He 'ike pū 'awa hiwa." Pukui and Elbert (1986, 96) translated this as "a knowledge from kava offerings." Winter explains that 'awa, especially of the Hiwa variety, was offered to hula deities in return for knowledge and inspiration.

Hiwa has long internodes with few lenticels. The plant has an erect growing habit and may reach heights of eight feet or more in the full sun.

Only one lateral root sample for this variety was analyzed for the 1999 *Economic Botany* paper:

Table 5.3. Hiwa
Kavalactone Analysis of Air-Dried Lateral Roots
(Lebot et al. 1999)
HPLC Analysis by Madis Botanicals, Inc.

Sample Name	**APN17**
Chemotype	462351
Age of Plant (Years)	5.5
Soil Type	Hāmākua
Location (Hawai'i Island)	Hāmākua coast
Shade (1=full sun; 4=full shade)	3.5
Growing Methods	Cultivated, irrigated, fertilized
Damage	Fungi
Lateral Root Size	>2 cm.
Percentage Kavalactones	
Kavalactone	
Desmethoxyyangonin (1)	0.80
Dihydrokavain (2)	2.09
Yangonin (3)	1.78
Kavain (4)	3.26
Dihydromethysticin (5)	1.11
Methysticin (6)	2.19
Total Kavalactones	**11.23**

Scale is in inches.

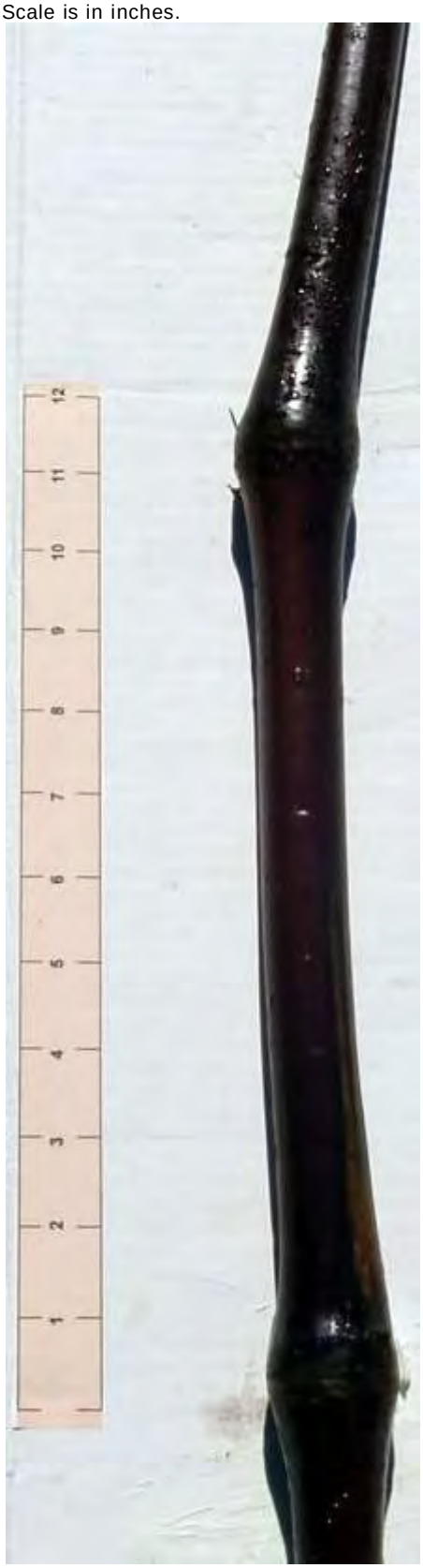


Fig. 5.5. Internodes can be quite long.

Fig. 5.6. Hiwa's growth habit is erect.

Fig. 5.7. The stalk is shiny with few lenticels. The leaf piko is dark.

ʻAwa Honokāne Iki is named after the valley where it was once abundant. The name is not a traditional one found in ethnographies, chants, or oral histories. Honokāne Iki is a valley in the Kohala District on the island of Hawaiʻi, just beyond Pololū and Honokāne Nui valleys.

We know that the valleys between Waipiʻo and Pololū were inhabited by Hawaiians for centuries. After the Kohala Ditch was completed in 1906, much of the stream water was diverted to sugar cultivation. Residents from Pololū to Honopue gave up their homes and farms and moved away (Clark 1985, 149).

This cultivar was also found in the old ʻawa fields of the South Kona district.

With its conspicuous lenticels, long internodes, and erect growing habit, Honokāne Iki is sometimes mistaken for the Nēnē variety. Honokāne Iki has fewer spots than Nēnē has and they are farther apart. Striation may be seen on many of the lower stalks.

Table 5.4. Honokāne Iki
Kavalactone Analysis of Air-Dried Lateral Roots
(Lebot et al. 1999)
HPLC Analysis by Madis Botanicals, Inc.

Sample Name	**APN18**
Chemotype	463251
Age of Plant (Years)	3
Soil Type	Hāmākua
Location (Hawaiʻi Island)	Hāmākua coast
Shade (1=full sun; 4=full shade)	3.5
Growing Methods	Cultivated, irrigated, fertilized
Damage	No damage
Lateral Root Size	>2 cm.
Percentage Kavalactones	
Kavalactone	
Desmethoxyyangonin (1)	0.96
Dihydrokavain (2)	2.30
Yangonin (3)	2.37
Kavain (4)	4.33
Dihydromethysticin (5)	1.39
Methysticin (6)	2.73
Total Kavalactones	**14.08**

Scale is in inches.

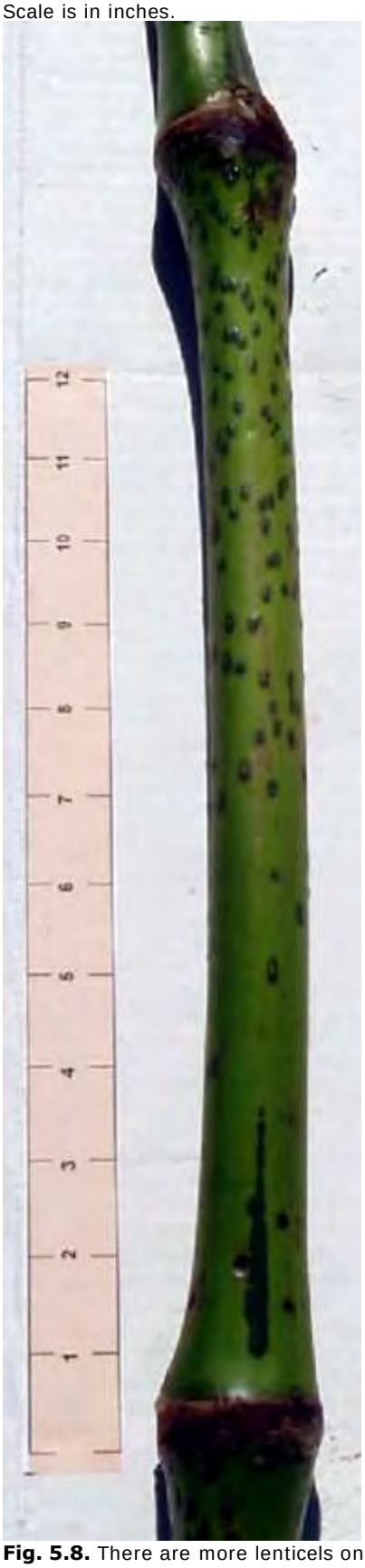


Fig. 5.8. There are more lenticels on the top half of the internode.

Fig. 5.9. Honokāne Iki looks somewhat like ʻawa Nēne but has fewer lenticiels and its stem is brighter. (Photo by Kāwika Winter)

Fig. 5.10. The shorter sample is from the bottom of the stalk, where striation often occurs.

The *Hawaiian Dictionary* describes Kūmakua as "a variety of ʻawa with green internodes of medium length" (Pukui and Elbert 1986, 34). Recently, this cultivar has been called "Puna green."

Kūmakua is a dull green with few lenticels. Young shoots show striation and mottling, but, as they mature, the stalks lose these markings. The plant's growth habit is normal.

A reference to this cultivar is found in the writings of the Reverend Stephen L. Desha, which were translated from the Hawaiian for the book *Kamehameha and His Warrior Kekūhaupiʻo* (2000, 145). Desha says that "*ka ʻawakūmakua*" was among the offerings Kamehameha set before his god, Kūkāʻilimoku, with the body of Kīwalaʻō after the battle of Mokuʻōhai.

Kāwika Winter's master's thesis comments that:

> Athough no records are known to exist about the meaning of this name, it could possibly be a shortened version of the word "kū-ma-kuahiwi," or "stands in the mountains." If this is true, then its name could possibly be an indication of its ecological habitat. It might suggest that this is a variety that is suited for mountainous areas (2004, 86).

Cuttings of this cultivar were collected in 1996 in an abandoned ʻawa field on the slopes of Mauna Loa in upper Kalapana, Puna. It was part of an old planting that extended through several acres of ʻōhiʻa and hāpuʻu forest on state-owned land. The site had other features of Hawaiian gardens, such as rock walls, and could have been considered a historic site.

Around that time, the high prices being paid for ʻawa on the U.S. mainland and in Europe put historic forest plantings at risk from pillagers, who were shipping out large quantities of ʻawa. Their method was to rip out the ʻawa completely without replanting.

That is what ultimately happened to this huge patch, which consisted of Kūmakua and Mahakea varieties and may have been there for hundreds of years. Because access required an hour of forest hiking, the thieves constructed a roadway to the ʻawa with a bulldozer. They completely eliminated the planting and destroyed the historic site.

Table 5.5. Kūmakua
Kavalactone Analysis of Air-Dried Lateral Roots (Lebot et al. 1999)
HPLC Analysis by Madis Botanicals, Inc.

Sample Name	**KAL2**
Chemotype	462351
Age of Plant (Years)	100?
Soil Type	Pāhoa
Location (Hawaiʻi Island)	Puna
Shade (1=full sun; 4=full shade)	3.5
Growing Methods	Not cultivated, not irrigated, not fertilized
Damage	No damage
Lateral Root Size	<0.5 cm.
Percentage Kavalactones	
Kavalactone	
Desmethoxyyangonin (1)	0.73
Dihydrokavain (2)	2.21
Yangonin (3)	1.55
Kavain (4)	3.16
Dihydromethysticin (5)	1.54
Methysticin (6)	2.23
Total Kavalactones	**11.42**

Scale is in inches.

Fig. 5.11. The stem above and at lower right is from an 18-month-old plant.

Fig. 5.12. This is a very old plant from the "wild" patch in Puna. Stalks are covered in algae.

Fig. 5.13. Stems have very few lenticels.

ʻAwa Mahakea was one of the more common ʻawa cultivars surviving in Hawaiian forests. Pukui and Elbert's *Hawaiian Dictionary* defines the "ʻawa mahakea" as "a name for *ʻawa ākea*, *ʻawa mākea* at Kaʻū, Hawaiʻi" (1986, 34).

Its long internodes are a dull green with purple shading at the bottom, sometimes nearly black depending on the age of the stalk and the light conditions. The node is purple and the leaf piko is green. It is known as a fast, strong, erect grower, often producing a large root and stump within a couple of years.

When the Hawaiian cultivars underwent DNA fingerprinting, Mahakea was one of only two Hawaiian cultivars showing distinctive bands for any of the 21 pairs of primers assayed. Mahakea's eleven distinctive bands (out of a total of 1149, or 0.9%) indicate that it varies somewhat genetically from the other Hawaiian cultivars, which, except for the cultivar Papa kea, showed no difference from one another (Lebot et al. 1999, 414).

Vincent Lebot speculates that "cultivar Omoa collected in the Marquesas seems to be related to Oahu 241 from Hawaii" (Lebot 1991, 197). The morphological description of Oʻahu 241 matches that of Mahakea. (At the time that Lebot labeled this accession Oʻahu 241, no attempt was being made to relate the cultivars to their traditional names.) If, as is believed, all Hawaiian ʻawa varieties trace their ancestry back to a single plant that arrived with the early settlers from the Marquesas, it could be interesting to compare Omoa closely with Mahakea—perhaps Omoa was the ancestor of Hawaiʻi's ʻawa varieties.

Five different Mahakea plants of different ages and growing in various conditions were analyzed for the *Economic Botany* paper. In the table below, note the variation in the total kavalactone percentages for the five samples. The table sheds light on the ways the growing environment can affect the total amount of kavalactones that develop.

Roots of old forest ʻawa tend to be lower in kavalactones than roots of cultivated plants that have been fertilized, irrigated, and cared for. Growing in full sun can also increase the amount of kavalactones eventually present in the lateral root. ʻAwa growers have taken note of findings like these and adjusted their growing practices accordingly.

Table 5.6. Mahakea
Kavalactone Analysis of Air-Dried Lateral Roots (Lebot et al. 1999)
HPLC Analysis by Madis Botanicals, Inc.

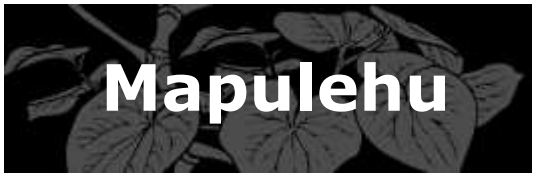
Sample Name	APN7	APN8	KAL1	PONO1	PUUAL
Chemotype	461235	426315	462531	462351	461235
Age of Plant (Years)	5.5	2	100?	30?	2
Soil Type	Hāmākua	Hāmākua	Pāhoa	Pāhoa	Hāmākua
Location (Hawaiʻi Island)	Hāmākua coast	Hāmākua coast	Puna	Puna	Hāmākua coast
Shade (1=full sun; 4=full shade)	1.5	1	3.5	3.5	3
Growing Methods	Cultivated, irrigated, fertilized	Cultivated, irrigated, fertilized	Wild, not irrigated, not fertilized	Wild, not irrigated, not fertilized	Certified organic cultivation, irrigated, fertilized
Damage	No damage	No damage	No damage	No damage	No damage
Lateral Root Size	>2 cm.	>2 cm.	<0.5 cm.	<0.5 cm.	<0.5 cm.
Percentage Kavalactones					
Kavalactone					
Desmethoxyyangonin (1)	1.75	1.38	0.95	0.47	1.35
Dihydrokavain (2)	1.74	2.50	1.46	1.17	1.10
Yangonin (3)	1.40	2.02	1.20	0.87	1.05
Kavain (4)	2.76	3.69	2.13	1.90	1.89
Dihydromethysticin (5)	1.06	1.23	1.35	0.81	0.72
Methysticin (6)	2.01	2.19	2.06	1.71	1.56
Total Kavalactones	**10.72**	**13.01**	**9.15**	**6.93**	**7.67**

Scale is in inches.

Fig. 5.14. Mature stalks have long internodes.

Fig. 5.15. The purple at the bottom of each internode, fading upwards into a dull green, is characteristic of Mahakea.

Fig. 5.16. Lenticels crowd together underneath each node.



The name of this ʻawa is taken from the ahupuaʻa and stream along the southeast coast of Molokaʻi, where the cultivar was found. It is not a traditional Hawaiian name for an ʻawa variety.

Plants were found inland from the Iliʻiliʻōpae Heiau along an historic trail that extends from Pūkoʻo over the mountain and down to the bottom of Wailau Valley. This same cultivar has been found in abundance in Wailau Valley on Molokaʻi's north shore.

Mapulehu is an erect growing ʻawa with long internodes showing few spots. Often there is a dark patch just above the node and growing bud.

Table 5.7. Mapulehu
Kavalactone Analysis of Air-Dried Lateral Roots
(Lebot et al. 1999)
HPLC Analysis by Madis Botanicals, Inc.

Sample Name	PAU6	PAPIO
Chemotype	462351	462531
Age of Plant (Years)	3.2	10
Soil Type	Hāmākua	Hāmākua
Location (Hawaiʻi Island)	Hāmākua coast	Molokaʻi
Shade (1=full sun; 4=full shade)	2	3.5
Growing Methods	Cultivated, irrigated, fertilized	Wild, not irrigated, not fertilized
Damage	Nematodes	No damage
Lateral Root Size	1-2 cm.	<0.5 cm.
Percentage Kavalactones		
Kavalactone		
Desmethoxyyangonin (1)	0.51	0.42
Dihydrokavain (2)	1.30	1.42
Yangonin (3)	1.07	1.18
Kavain (4)	2.36	1.93
Dihydromethysticin (5)	0.61	1.39
Methysticin (6)	1.42	1.91
Total Kavalactones	**7.27**	**8.25**

Scale is in inches.

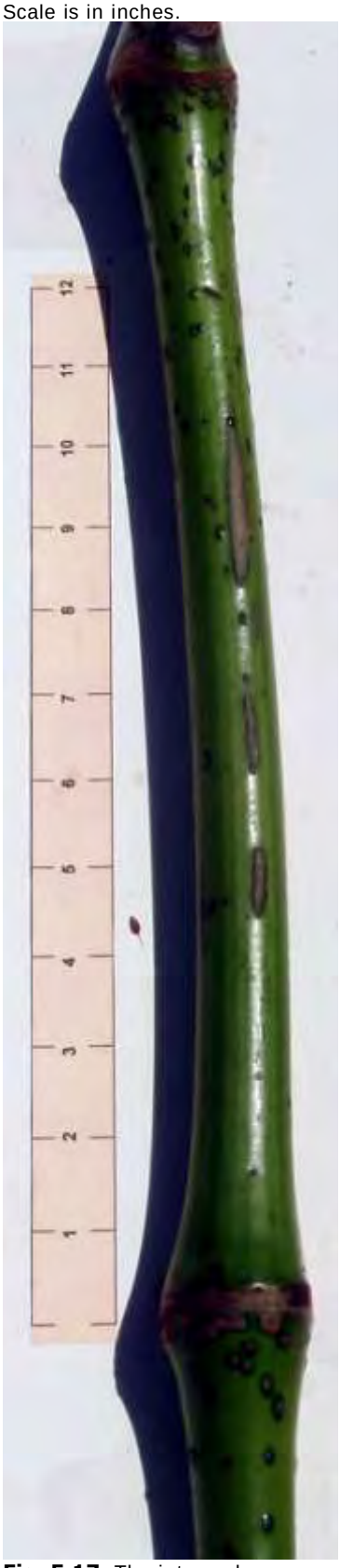


Fig. 5.17. The internodes are long.

Fig. 5.18. The overall growth habit of Mapulehu is erect. (Photo by Harry Brevoort)

Fig. 5.19. The dark triangle just above the node helps identify this cultivar.