

"NATURAL HIGHS" IN AN HISTORICAL AND BIOLOGICAL CONTEXT

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ABSTRACT

Historical and contemporary patterns of substance use and abuse are recognized, and the error in believing psychoactive natural substances to be reasonably safe is pointed out. The plethora of literature on drug-induced ecstasies among diverse peoples produces over-confidence in the safety of inducing altered states by means of natural chemicals. Given the current level of experimentation, the lack of a context for use, and the lack of knowledge of the toxicity of many plant sources presents a very real problem. Documented evidence of recent changes in patterns of experimentation with diverse drugs, many from natural sources, suggests that the naive user may *experience an unwarranted level of confidence*. Diverse genera and species of plants that produce psychoactive effects are presented. Many of these are now in use and others will undoubtedly be the subject of uncontrolled experimentation in the future. Educators, researchers, legislators, physicians, and therapists should be aware of chemicals from natural sources, and the categories of experience that they provoke.

Chemical, biological, and legal definitions of substances of abuse from botanical sources are fraught with complications, particularly from an historical and cultural perspective [1]. Substance use and abuse is socially ritualized in many societies. In North America and much of Europe, the use of caffeine in the form of coffee or tea is not only condoned, but is made ceremonial, with its own hours, settings, and functions in society. High tea in England is a serious occasion; the coffee break in North America is built into the social and economic structure of the country. The cocktail party is woven into the American social and literary fabric, and is a political reality as well. The use of alcohol is so ingrained in our American expectations, for example, that many are surprised to learn that the Moslem world has historically surrounded this drug with strong taboos. (Our own period of prohibition is all but forgotten, except for a few entries in textbooks.)

CULTURAL RELATIVITY IN DEFINING DRUG ABUSE

It may be useful to reflect that the drugs themselves are the same as they always were; it's the interpretation and the emphasis—among, for example, educators, researchers, clinicians, and politicians—that changes with the times.

Only a few years ago, it was important to a young man's social standing that he learn the proper use of tobacco: the correct stance in the fraternity "smoker," the proper inspection and sensing of a fine cigar. Four decades ago men were expected to retire to the library or smoking room after dinner, to avoid offending women by smoking. (Now that women smoke, such behavior would be considered sexist and discriminatory.) Leading matinee idols posed with cigarettes and alcoholic drinks in their hands. Alcohol was considered an aphrodisiac, as was tobacco. (This dates back to the reports of Columbus regarding the lusty women of the New World who smoked "Tobacs" [2]. Coffee had a mystique of its own, especially when imbibed in large quantities. Coffee houses were frowned upon in that it was believed coffee promoted impotency in men who frequented these "cafes" [2]. This did nothing to put an end to the popularity of the brew.

Not one of these substances of abuse has disappeared or been prohibited, but national attitudes have changed dramatically, as have patterns of use. The estimated 500,000 hard core heroin users in the United States remain as they were fifteen years ago, despite the per capita increase in the population. Such a statistic reveals an actual decrease in heroin use during that time period. The popular perception is that there has been an increase [3].

The reality of substance abuse legislation is that it has not been based upon biological realities [4, 5]. The evidence that alcohol and tobacco are implicated in several kinds of cancer is well documented. In his annual report for 1986, the Surgeon General of the United States produced irrefutable evidence implicating tobacco in a host of diseases, and named it "the number one chemical addiction in the United States" and the one most costly to the health of the nation, and yet no legislation regulating its use has been passed. Alcoholism is now being diagnosed in age groups that include elementary school students, and yet alcohol is readily available in most grocery stores and is treated much as any other food item, except for the age requirement for purchase. This easy availability of tobacco and alcohol continues despite statistics from the National Institute on Drug Abuse (NIDA) showing 113.1 million Americans who regularly use alcohol with 12.1 million showing symptoms of alcoholism [3]. This change is an 8.5 percent increase since 1980. NIDA also lists 60.3 million cigarette smokers in the United States in 1986. NIDA reports a *decrease* in marijuana smokers from 20 million in 1982 to 18.2 million in 1986. Alcohol and tobacco seem familiar—safer than other drugs—to Americans; it is difficult for us to imagine any individual being imprisoned for using them.

By contrast, the peoples of North Africa, India, and much of the Middle East have much longer cultural histories involving marijuana in various forms than America has with alcohol and tobacco. The Vedic people of North India revered marijuana as a sacred thing to be used before reading holy writings. In North Africa, under the name "kif," marijuana is used at social gatherings among families and between tribes to create a sense of community, to promote relaxation, and to facilitate narration of the oral traditions of these peoples [2]. The same practice in North America could bring imprisonment under Federal and State statutes; the substance is considered a national menace.

The American Cancer Society predicts that 320,000 Americans will die of diseases linked to smoking in 1986, while 98,000 will die from alcohol abuse. The American reality is that even though we have more than enough data demonstrating the role of alcohol in homicides and disease and the specific life-threatening hazards of tobacco, it would seem quite extraordinary for a political figure to suggest that we imprison those who abuse either of these two drugs.

On the basis of these comparisons we can make certain statements about our national attitudes *vis a vis* drug use and abuse:

1. We are a nation that has accepted certain patterns of substance abuse and legislated against others.
2. Our laws relate more to historical social and behavioral patterns than they do to biological realities.
3. Nicotine (from tobacco) is "the most addictive substance known to mankind" [3].
4. Patterns of substance abuse have had many historical changes that are unrelated to the properties of the substance.

The social costs of these illogical and biologically unrealistic attitudes are high. For example, every taxpayer must contribute a part of his or her earnings to support the growth of tobacco or the subsidy of land able to be used to grow tobacco. In addition, the costs of hospitalization of patients for diseases related to alcohol and tobacco are too high for most individuals, and must therefore be borne by every American. At the same time, in the absence of equivalent data on marijuana's dangers (although these must not be negated or underestimated), we spend enormous sums in the courts prosecuting those who use marijuana; we spend billions of dollars attempting to eradicate the weed; our incarceration of marijuana users is an additional tax burden of considerable magnitude; and a large portion of the cost of law enforcement, estimated at 1.8 billion dollars per year in the United States [3], is spent on identifying and arresting those who supply and/or use this drug. Yet, a national household survey of drug abuse (Department of Health and Human Services release, October, 1986) indicates that "overall marijuana use has decreased slightly since 1982." There were six million current, reported regular users in this survey.

AN HISTORICAL EXAMPLE

Besides the changing social attitudes toward drugs, another factor that affects drug use is marketing, or the distribution infrastructure that develops around certain drugs. The effects of marketing on the use and abuse of drugs is perhaps best exemplified by the peculiar history of wormwood oil, or artemesia, which when distilled and added to alcohol, was sold as "absinthe." Wormwood was the popular name for *Artemesia absinthium*, which had been used as a vermifuge for centuries. A review of the history and eventual prohibition of absinthe reveals the typical pattern of contradictory opinions that frequently surrounds such a psychoactive plant product [6].

Oil of wormwood had numerous historical uses in medicine as a "stomachic" and to wean children. Hamlet's cry, "Wormwood," is that of a child betrayed by a mother who has turned against him. In Shakespeare's England this cry was contextually understood; it is lost on most contemporary audiences who know nothing of the bitterness of wormwood or the aversion therapy of the Renaissance wetnurse.

By 1772, Dr. John Hill in his gigantic compendium of medical botany reported that artemesia flowers in brandy formed a decoction that would cure and prevent gout and the gravel (gallstones). In 1780 the astrobotanist Nicholas Culpeper extolled the virtues of artemesia and made long lists of diseases that could be cured by this plant product, including melancholy, dull-wittedness, the pox (syphilis), conditions of the spleen and liver, the scab, etc. An even greater claim was made: In July, 1760, when it was rumored that plague had broken out in St. Thomas' Hospital, London, the frightened populace ran to Covent Garden, where purveyors of herbs were to be found, and bought out all of the *Artemesia absinthium* as a preventative against the plague [2].

Toward the end of the nineteenth century a physician by the name of Dr. Ordinaire sold his particular distillate of the oil of the *Artemesia absinthium* and other plant flavorings to the firm of Pernod. Mixed with 70 percent to 80 percent alcohol, the beverage quickly became the rage of European society and was promoted by artists, actors, and physicians. It was not known until 1975, when Dr. Gosselin and his associates in Baltimore discovered the chemical composition of the ingredient thujone, a terpene similar in structure to the tetrahydracannabinols of *Cannabis* (marijuana), that this ingredient caused neural blockage and broken neural synapses.

However, by 1868 the *American Journal of Pharmacy* pointed out the differences between the stupor of alcohol and the "ignoble poison, destroying life and brutalizing its votaries while making driveling idiots of them." While the dangers of alcohol in such concentration were grossly underestimated, the campaign against absinthe had begun. The greatest poster artists of Paris had created a market by showing prominent figures consuming absinthe, strong soldiers fortifying themselves with the distillate, and habitués of the cafés

enjoying the beverage while flirting with attractive women. A more sober portrayal is seen in the faces of the prostitutes painted by Lefebvre, Lunois, Degas, and Lautrec, whose canvases of the absinthe drinkers revealed sullen countenances. Ironically, absinthe was cited as the curse of Lautrec's death at age thirty-seven.

The ever-militant novelist Marie Corelli wrote a novel of French life entitled *Wormwood* in 1890. In her book, Corelli wrote of the horrors of absinthe:

Absinthe mania pervades all classes, rich and poor alike. Everyone knows that in Paris the men have certain hours set apart for the indulgence of this fatal craze . . . and in a very short time the love of hideous poison clings so closely to their blood and system that it becomes an absolute necessity of existence.

Although an "introductory note" to a novel, this powerful statement was widely read. By 1908, Switzerland banned the manufacture and consumption of absinthe. The United States followed in 1912 and France in 1915. Spain produced absinthe until 1939. It is now banned entirely in the western world. Millions of dollars had been made on the beverage, and now its reputation as "a comfort for the heart and brain" changed almost overnight to that of a liquor that was dangerous, addictive, and contemptible.

The point of the story is that by aggressive marketing, a plant whose properties had been known since the Renaissance became Europe's most popularly accepted recreational drug. With adverse publicity, it just as rapidly lost its market and is virtually unknown today.

FAILURE OF CURRENT SOCIAL POLICY TO CONTAIN DRUG ABUSE

In a review and evaluation of the 111 years of drug laws and drug enforcement, Brecher found that drug use has generally not been reduced [5]. Brecher's conclusion is that the extent of substance abuse will not decrease until there is a perceptible change in public attitudes, and that education is the main hope for change. In the same vein, Weil and Rosen suggested that parents should examine their own drug use patterns, including alcohol, tobacco, caffeine, and tranquilizers [7]. In addition to providing positive role models, they suggested that increased communication, a climate of trust, and careful distinction between use and abuse provided hope of protecting children against drug abuse.

The foregoing observations serve to set the stage for the assertion that we define substance use and abuse not in terms of biological realities, but rather in terms of social conditioning. The cultural teachings about acceptable patterns of behavior combine with the individual's perceived needs and personal belief systems to produce a set of attitudes about substance use and abuse.

THE MYTH OF THE NATURAL HIGH

Having taught classes in medicinal and narcotic plants for more than twenty years, I have had the opportunity to discuss substance abuse with students, law enforcement agencies, medical figures, and educators. I find it intriguing that the people in these discussions who use drugs believe that the closer the drug is to its natural state, the safer it is. Admittedly, the people participating in these discussions may be a non-representative group, but my impression that they prefer "natural" drugs is corroborated by surveys among high school and college students indicating a decided preference for "natural highs."

The current positive attitudes towards the use of "magic mushrooms" provide us with an interesting example. Psychoactive mushrooms have been known for their efficacy as entheogens and psychotogens for several centuries; thus their popularity cannot be attributed to novelty. The role of mushroom use in popular literature has undoubtedly contributed to experimentation. In *Alice in Wonderland*, Lewis Carroll based Alice's perceptual alterations in part on Cooke's *The British Fungi*, with its accounts of bizarre behavior among the Chuckchees and Koryaks of Siberia who used *Amanita muscaria*, the fly agaric mushroom.

Having imprinted the joy of Alice's altered states on the minds of children, we have set the stage for similar imaginative thought. The literature of childhood is fraught with images of giants, gnomes, trolls, magical flight, changes in size relationships, and simultaneous states of existence. When the literature of children is outgrown, it is replaced by so-called "adult" literature, most of which leaves the imagination unstimulated.

There is reason to believe that all healthy humans, however old they are, experience a desire to transcend their daily realities or experience altered states [7]. In many non-Western cultures the imagination void is filled by theatrical events that are logical extensions of the visions of childhood. Psychoactive substances—such as the vision-provoking yagé of the Amazon basin, the kif of North Africa, the *Psilocybe* mushrooms of Mexico, the iboga (*Tabernanthe iboga*) of equatorial Africa, or mescal buttons (*Lophophora Williamsii*) among the mescaleros of the southwestern United States—are used in many parts of the world as an aid in transforming reality.

University students schooled in anthropology, folklore, medical biology, psychology, and sociology read and discuss accounts of altered states of consciousness in the context of the cultures and histories of diverse peoples. It is evident that the deliberate use of plant substances to transcend the mundane human condition is as much a part of major civilizations as is food or medicine.

Patterns of substance use are discussed in many books on altered states of consciousness. The daily use of quids or bolas of coca leaves among the "coqueros" of highland Peru contrasts markedly to the occasional ceremonial use of ayahuasca (yagé), the hallucinogenic-beverage used in the Amazon.

Social taboos connected with such rituals include age, gender, frequency, mode of administration, amounts, and intention.

Given the increased availability of information on the cultural history of substance use and abuse and the number of books that treat the chemical experiences of individuals in Western civilizations, the educated person today knows a great deal about what was known in the sixties as "the psychedelic experience" and is now generally called altered perceptions or altered states of consciousness. An adjunct to this is peer group information about available drugs and their consequences. Members of the peer group swap information about the latest recreational drugs, based upon personal experience, the experiences of others, or reading. (See, for example, issues of *High Times* magazine.) Non-university students tend to rely even more on friends and peer pressure in their choices of substances. Several periodicals discuss drugs in current use and whether or not chemical analysis reveals them to be what they are alleged to be. (The most professional and reliable of these is "Analysis Anonymous," emanating from Palo Alto, California.)

Suffice it to say that there has never been a generation with more information on drugs in any context than the current generation of university students. Often the more gifted the university student, the more experimental he tends to be in his use of psychoactive substances.

The relatively recent introduction of the term "recreational drugs" suggests that frequent drug use is by no means associated only with addicts or disturbed personalities. Drug use patterns, for better or worse, are a part of recreational behavior [1]. In the strictest sense, "re-creation" is precisely what some individuals are attempting to do when they alter their perceptions by using drugs. The addictive personality will tend to carry recreational use further and further, until the substance is used at problematic levels.

Although the "deviance model"—with its implication that only sick people use drugs—has become the most widely accepted explanation for the use of nonprescription psychoactive drugs, Winick believes that the model does not account for changes in attitudes toward drugs, or changes in patterns of use or motives for use [1]. He proposes to collect and integrate data that would lead to a reevaluation of the deviance model, transforming it into a multimodel taxonomy of drug-taking behavior. Until now the model has centered upon negative and dysfunctional aspects of drug use, as though all use of psychoactive substances fit into these categories. The prevailing model is linear, non-dimensional, and does not represent a scientific approach to data analysis. The Winick approach is a sane and scientific approach to data assessment.

COMMON NATURAL HIGHS

A recent survey of substance abuse shows that the use of psychoactive mushrooms as hallucinogens has increased markedly, but that these are used without any regularity or prevalence among University students [8]. While only

an indicator, this evidence suggests that a number of drugs of organic origin (plant-derived) are used experimentally and infrequently; this type of use does not appear to be an inherent social problem. Thus it would be improper to characterize the experimental individual who is not an addictive personality and has no regular pattern of drug use as a substance abuser.

It may be appropriate to segregate addictive personalities from the quite different group that experiments with drugs of plant origin from a base of pure inquiry. The latter group is in danger not so much from the potential for addiction as from the possibility of experimental error. For example, deaths from misidentification of mushrooms occur each year. In a number of instances it can be documented that the individual was seeking a mind-altering mushroom and mistakenly encountered a similar species that was highly toxic. *Amanita muscaria* shows varying degrees of toxicity, but the muscarine (toxic component) does not cause death. However, the alkaloids of the morphologically similar *Amanita pantherina* are responsible for protracted deaths. Antitoxins have been discovered only recently, and they must be administered early in the toxic state; even then they are not always successful.

Datura species provide one of the most dangerous "natural" highs. The tropane alkaloids in the family Solanaceae to which this genus belongs are notorious toxins. Fairly romantic accounts of deliberate *Datura* intoxication appear in chronicles of North American Indians such as the Algonquins on the east coast and the Chumash on the west coast of the United States. The coming-of-age ceremonies of young men involve a protracted period of hallucinations and coma induced by some infusion of *Datura*. All parts of the plant are toxic. The recent books by Carlos Castaneda on Don Juan and the Yaqui way of knowledge involve *Datura* experiences. Such best-sellers spread the message very thoroughly.

My consultations with juvenile authorities and hospitals throughout the Los Angeles area have convinced me that the number of induced *Datura* poisonings is increasing, not from accidents, but by deliberate administration. This is one of the deadliest of genera of Solanaceae, containing atropine, scopolamine, hyoscine, and hyoscyamine. A period of several days of unaccountability is usual among those who survive the experience. Experimenters tend to forget or not know that traditionally, *datura* was taken with the help of a guide who was familiar with dosage levels and would lead the novice through the experience. In addition, experimenters lack a historical context; the contemporary *Datura* experiment is divorced from its historical use. It should be noted that there are no records of native peoples who used *Datura* regularly or for hedonistic purposes. Further, indigenous peoples throughout the world have traditionally had a context for using mind-altering plants that was quite different from the contemporary concept of a "natural high."

Taylor was the first to suggest that substances that alter consciousness are found in use among most peoples of the world [9]. It was Will Durant, the

great chronicler of civilizations, who in his *Life of Ancient Greece* stated, "No civilization has found life tolerable without . . . the things that provide at least some brief escape from reality." The basic concept of transcending the mundane is implicit in this quotation.

Throughout history, psychological and physiological responses to mind-altering plants have not changed; only the judgments of societies are continually shifting.

In my 1979 preface to the revised and enlarged version of my earlier work *Narcotic Plants*, first published in 1972, I provided a summation that I believe is relevant here:

Apart from legal considerations and social approbation, many of the plants discussed in this book are of religious importance, have conditioned the architecture of certain cultures, have determined trade routes that later became highways linking diverse areas, are medicants, have provided the basis for the new discipline of drug therapy, have been the foundation for masterpieces of music and writing, and a number have left the individual debilitated to the degree that he can no longer participate in his society at a meaningful level.

Ethnocentricity has led us to believe that we can make unaided judgments about the propriety of using diverse mind-altering plants or plant products. If we proceeded by information available from scientific bodies, we might have quite a different view of the acceptability of diverse plant substances. As Aaronson and Osmond pointed out in the 1970 book *Psychedelics*, "... many tobacco smokers often have trouble conceptualizing tobacco as a drug, for the term 'drug' has developed very specialized meanings" [10]. We forget that the introduction of coffee, tea, chocolate, and tobacco into Europe all provoked fears of physical degradation and moral depravity and were the subject of heated debates, religious commentary and pamphleteering. Alcohol in the Moslem world is unacceptable on the basis of Koranic injunction, while among Christians and Jews it finds favor in the most sacred ceremonies of these religions. It is apparent that social mores condition legislation to a greater degree than scientific data. The elaborate report on marijuana prepared by the National Academy of Science during the administration of Richard M. Nixon brought this response: "... common sense tells us otherwise." A series of reports prepared under different administrations by that same august body of scholars has had little impact on legislators.

CHANGING PATTERNS OF DRUG ABUSE

There are several dilemmas implicit in evaluating drugs in our society. The ever-changing fashions in stimulants, depressants, and hallucinogens are difficult to monitor. Patterns of substance use and abuse change dramatically in relatively short periods of time. The substances appear in a variety of forms and

concentrations that make it difficult to evaluate the possible dangers. For example, the sniffing of cocaine has been extended to "freebasing," or crack, and "mainlining." In areas where the cocaine plant, *Erythroxylum coca*, is used, the leaves are chewed over long periods of time. Since the leaves are only 1 percent cocaine by dry weight, cocaine in the Andes is totally removed from the experience of the injected concentrated cocaine.

Another pattern that is changing radically is that of opioide use. Heroin addiction has been a social concern since it was introduced as a substitute for morphine. Addicts are often discovered by the track marks on their arms or in other areas resulting from intravenous injection. An increasing number of individuals are burning raw opium or high quality heroin and sniffing the fumes, a ceremony known as "chasing the dragon." The latter form of opioide use leaves no detectable marks, and in Great Britain the experience costs the equivalent of fifteen U.S. dollars. This is in contrast to heroin, a product derived from processing opium, which may cost one hundred dollars per experience. Hence, economics may dictate the drug of preference as well as the mode of use.

Thompson et al. in 1985, pointed out that over 85 percent of university students who had used hallucinogenic drugs had used psychoactive mushrooms (*Psilocybe* and related genera). Over half of the aforementioned had used mushrooms and no other hallucinogens. The studies, conducted in 1982 and 1983 and published in 1985, pointed out that most national surveys fail to distinguish between categories of hallucinogens, summarizing them under the heading "LSD and other hallucinogens." The increase in mushroom use can be attributed to the widespread advertising of mushroom spores and spore kits and the knowledge that in most states the advertising, the spores themselves and transport of spore kits is legal. If, as these researchers concluded, "... the mushroom, not LSD, is the major hallucinogen presently being employed," may we not expect other legal plant hallucinogens (*sensu lato*) to be adopted?

Having asked such a question it would seem appropriate to list some of the plant hallucinogens available as raw plant products or in the form of derivatives. For a subset of these, prevalence rates derived from the Thompson et al. study reveal the following substance abuse percentages of plants or plant products among college students:

Alcohol (diverse plant carbohydrates fermented)	88.2%
Marijuana (resin and leaves of <i>Cannibis</i> spp)	53.8%
Tobacco (<i>Nicotiana tabacum</i> leaves)	50.9%
Cocaine (<i>Erythroxylum coca</i> leaf derivative)	26.5%
Mushrooms (<i>Psilocybe</i> and related genera containing Psilocybin circa 80 species)	14.8%
Peyote (<i>Lophophora diffusa</i> and <i>L. williamsonii</i> and mescaline as a product)	2.1%
Heroin (<i>Papaver somniferum</i> and derivative alkaloids)	0.7%

While this listing may seem complete, patterns of use may not be changing (Emboden and Anglin, 1986 unpublished data); but since "Hallucinogens" are not usually specifically identified in surveys, the shift in lifetime prevalence among university students had not heretofore been noted. If the above may be taken to be characteristic of the 1982-83 respondents, there is evidence of continued interest in experimentation with psychoactive substances as well as diversity in the pattern of use.

POTENTIAL ABUSABLE DRUGS FROM NATURAL SOURCES

As a botanist, I am aware of the other categories of plant materials that represent potential candidates for experimentation in the quest for natural highs. Some of these have been mentioned, however, an extended listing of those plants available as potential "highs" and the chemicals that they contain is presented below in Table 1 and might prove helpful in anticipating and forestalling possibly dangerous experiments. Information on these plants is easily gleaned by any enterprising student interested in drugs, and the materials themselves are available. Legal sanctions are often confused and confusing, in that they may prohibit a chemical that occurs in a plant without proscribing the plant itself, but most of the esoteric plants have not been given any legal notice. The educator, researcher, physician, and therapist should be familiar with these plants, as they are natural products in which the naive user is likely to place unwarranted confidence.

I suggest that given the variance in drug patterns in the past, we may expect more diverse kinds of plant materials to appear as they become available on the licit market. The toxicity of these plants and their potential for abuse should be appraised, and legislation should be written consistently with regard to toxicity levels, potential for addiction, and patterns of use. Comparisons should be made between psychoactive plants with similar chemistry in order to identify potential problems and provide rational solutions.

Regular monitoring of substance use may reveal novel patterns, as in the previously mentioned study by Thompson et al. Systematic and periodic surveys will provide useful information for educators, scientists and legislators.

Table 1. Plant Genera and Species Having Potential for Abuse

<i>Genus and Species</i>	<i>Primary Chemical Constituents</i>	<i>Category of Experience</i>
<i>Acorus calamus</i> "Sweet flag and sweet calomel"	distilled oil contains asarone and beta-asarone	Hallucinations

Table 1. (Cont'd)

<i>Genus and Species</i>	<i>Primary Chemical Constituents</i>	<i>Category of Experience</i>
<i>Actinidia polygama</i> "Chinese cat powder"	Metabilacetone and actinidine	Tranquilizer and Hallucinogen
<i>Alchornea floribunda</i> "Niando"	Yohimbine (tentative)	Stimulant
<i>Amanita muscaria</i> "Fly agaric"	Ibotenic acid, muscinole and muscarine	Hallucinogen and Toxin
<i>Anadenanthera peregrina</i> "Yopo, Cahoba and Parica"	Tryptamines	Hallucinations
<i>Argyreia nervosa</i> "Baby Hawaiian wood rose"	Amides of lysergic acid are in the seed	Hallucinations
<i>Atropa belladonna</i> "Deadly nightshade"	Scopolamine (hyoscyne) and hyoscyamine	Intoxication and narcosis
<i>Banisteriopsis caapi</i> and <i>B. rusbyana</i> "Ayahuasca, Caapi, Yajé"	Harmine, harmaline, d-tetrahydroharmine tryptamines (rusbyana)	Hallucinations and narcosis
<i>Catharanthus roseus</i> "Madagascar periwinkle"	Cytotoxins and Ibogaine-like alkaloids	Hallucinations and liver damage
<i>Coriaria thymifolia</i> "Shanshi"	Coriamyrtine, coriatine, tutine and pseudotutine	Hallucinations and flight sensation
<i>Datura</i> species (numerous) "Tolache, Jimson weed, etc."	Scopolamine, hyoscyamine, and other tropane alkaloids	Hallucinations and narcosis
<i>Duboisia myoperoides</i> and <i>D. hopwoodii</i> "Pituri"	Scopolamine	Hallucinations and narcosis
<i>Erythrina flabelliformis</i> "Colorines"	Erithrinanes, indoles and Isoquinolines	Narcosis and hallucinations
<i>Galbulimima belgraveana</i> "Agara"	Himbacine, ploycyclic piperidine derivatives	Narcosis, stupor and coma
<i>Hyoscyamus niger</i> "Henbane"	Scopolamine, hyoscyamine	Sedation and narcosis
<i>Ipomoea violacea</i> "Morning glory," "Quiebra" "Plata"	Amides of lysergic acid	Hallucinogen

Table 1. (Cont'd)

<i>Genus and Species</i>	<i>Primary Chemical Constituents</i>	<i>Category of Experience</i>
<i>Lagochilus inebrians</i> "Intoxicating mint"	Lagochiline	Narcosis or sedation
<i>Latua pubiflora</i> "Latue"	Scopolamine and hyoscyamine	Hallucination
<i>Leonorus sibiricus</i> "Siberian motherwort"	Leonurine	Euphoriant and hypnotic
<i>Lobelia tupa</i> "Tupa, tabaco del diablo"	Lobeline, lobelanadine and norlobelanidine	Stupor
<i>Lycoperdon</i> <i>mixtecorum</i> , <i>L.</i> <i>marginatum</i> and <i>Calvatia</i> spp.	Mature spores contain an unidentified alkaloid	Narcosis and auditory hallucinations reported
<i>Mandragora vernalis</i> and <i>M. autumnalis</i> "Mandragora, manroot"	Hyoscyamine, scopolamine atropine, cuscohygrine	Hallucinations and a deep stuporous trance
<i>Methysticodendron</i> <i>amesianum</i> "Culebra-borrachera"	Hyoscyamine, norhyoscyamine and scopolamine	Hallucinations and stupor
<i>Mitragyna speciosa</i> "Kutum, kratom, mambog"	Hitragynine and eight analogues	Hallucinations
<i>Myristica fragrans</i> "Nutmeg"	Elemicin and Myristicin	Hallucinations and euphoria
<i>Nymphaea caerulea</i> and <i>N. odorata</i> "Waterlily"	Nupharine, nupharidine, nuciferine, aporphine	Hypnotic
<i>Passiflora incarnata</i> "Passionflower, coanepilli"	Passicol, harmol, harman, harmine, harmalol, harmaline	Hypnotic
<i>Peganum harmala</i> "Syrian rue, zit-el-harmel"	Harmine and related indoles	Visionary hypnotic
<i>Pernettya furens</i> "Hued-hued, hierba loca"	Andromedotoxin	Mental confusion, insanity

Table 1. (Cont'd)

<i>Genus and Species</i>	<i>Primary Chemical Constituents</i>	<i>Category of Experience</i>
<i>Psychotria viridis</i> "Yage" (see also Banisteriopsis)	N-N-dimethyltryptamine	Hallucinations
<i>Rivea corymbosa</i> "Ololiuqui"	Ergine, isoergine	Hallucinations
<i>Senecio hartwegii</i> "Peyote de Tepic"	Pyrrolizidine alkaloids	Delusions and stupor
<i>Sophora secundiflora</i> "Mescal bean, peyote"	Cytisine	Toxic visionary
<i>Tabernanthe iboga</i> "Iboga, iboka"	Beta corbolines	Hallucinations
<i>Tetrapteris methystica</i> "Caapi pinima"	Beta carbolines	Hallucinations
<i>Trichocereus pachanoi</i> "San Pedro"	Mescaline	Hallucinations
<i>Virola calophylla</i> "Epena, parica, yakee"	Tryptamines: N,N-DMT and 5-methoxy-N,N-DMT	Hallucinations

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