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The Principal American Hallucinogenic Plants and their Bioactive and Therapeutic Properties

Abstract

The indigenous cultures of the Americas have the most wide spread use of hallucinogenic species of any area of the world. They are employed among native cultures of the Americas for medicinal and sacred purposes, as well as for a variety of other objectives – protection in travel and home life; agricultural and hunting activities; controlling and adjusting social relations amongst individuals, villages and groups; and influencing human welfare before and even after death. The principal families and genera of hallucinogenic plants – *Strophariaceae, Myristicaceae, Leguminosae, Malpighiaceae, Cactaceae, Convolvulaceae* and *Solanaceae* – are reviewed here to illustrate their pre-historical and historical background, and their botanical, biochemical and pharmacological properties. The ethnographic data on indigenous uses of these substances are briefly summarized to illustrate the range of effects obtained with these plants in religious rituals and cultural therapies. Highly developed healing traditions selectively utilize different species of the same genus to obtain specific desired effects provided by the pharmacological variation within and across genera. A number of these plants and their psychoactive compounds have contributed active ingredients employed in modern medicine, particularly in psychiatry.

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Introduction

> "If human consciousness is the most wonderful thing on earth, the attempt to fathom the depths of the psychophysiological action of narcotic and stimulating drugs makes this wonder seem greater still, for with their help man is enabled to transfer the emotions of everyday life, as well as his will and intellect, to unknown regions ..." (LOUIS LEWIN 1931).

Aboriginal societies around the world have discovered and bent psychoactive plants to their magico-religious and medicinal use. More than 200 species and/or varieties of higher plants, as well as numerous species of fungi, have been reported in the literature to have been used for hallucinatory and/or euphoriant effects (SCHULTES & FARNSWORTH 1980). Nowhere, however, has a greater number of species been employed as in the Americas. Especially in Mexico and South America, they are used in health and sickness, peace and war, home life and travel, agricultural and hunting activities. They often control relations amongst individuals, villages and groups. Often they are thought to influence human welfare before and even after death (REICHEL-DOLMATOFF 1975). It has been theorized that primitive ideas of religion had their origin in the unworldly psychic effects of hallucinogenic plants (WASSON 1958).

Of the half million species of plants in the world's flora, only a relatively few have chemical constituents in the plant tissues which are able to have these psychophysiological effects on the human body (STOUT & SCHULTES 1973; SCHULTES & HOFMANN 1980). Several of these compounds have been found to have value in western medicine, particularly in psychiatry (CLARK & DEL GIUDICE 1970; IVERSEN 1978). Most indigenous peoples attribute the extraordinary effects to spiritual power resident in these few plants. Consequently, they are considered sacred and are rarely, if ever, abused in aboriginal societies.

This paper reviews some of the major families of psychoactive plants used in the Americas – *Strophariaceae, Myristicaceae, Leguminosae, Malpighiaceae, Cactaceae, Convolvulaceae* and *Solanaceae*. This illustrates both common uses by human societies and the differential effects of these substances. Their traditional applications in therapeutic, religious and other social contexts are reviewed to illustrate the potentials which humans derive from the use of these plants.

1. Strophariaceae – *Teonanacatl*

The Aztecs called these intoxicating fungi *teonanacatl* ("food of the gods"). The ceremonial use of hallucinogenic mushrooms is known to have existed since very early periods in Mexico and Guatemala. Frescoes from central Mexico, dating back to 300 A.D., have designs that suggest mushroom worship occurred at least two millennia ago (WASSON 1972). Even more remarkable are the archaeological artifacts now known as "mushroom stones" excavated in great numbers from highland Mayan sites in Guatemala; some are dated back to 900 B.C. (BORHEGYI 1960). They consist of an upright stem with an anthropomorphic or animal face and crowned with an umbrella shaped top. They are believed to have been associated with a sacred ball game and associated mushroom ingestion.

There are many early European reports of these uses and even crude illustrations of mushrooms. HERNÁNDEZ (1651), a medical doctor not an ecclesiastic, wrote of three kinds of mushrooms employed as intoxicants and worshipped. An early Spanish report – as usual, exaggerated – on the use of these mushrooms wrote that "They had another way of drunkenness ... and it was with ... small mushrooms ... of such a kind that, eaten raw and being bitter, they drink after them or eat with them a little bees honey, and a while later they would see a thousand visions, especially serpents and as if they were out of their senses, it would seem to them that their legs and bodies were full of worms eating them alive; and thus half rabid they would sally forth ... wanting someone to kill them and with bestial drunkenness ... it happened sometimes that they hanged themselves and also against others were crueler" (WASSON & WASSON 1957).

Although toxic mushrooms were known in ancient Mexico, nothing was known of the contemporary magico-religious ceremonies connected with these fungi until recently when anthropologists and ethnobotanists encountered this use in Oaxaca and identified the species employed (SCHULTES 1939; WASSON & WASSON 1957). This research was done mainly amongst the

Mazatecs, but numerous other groups also employ the mushrooms in this way (SCHULTES 1978; WASSON, COWAN, COWAN & RHODES 1974; WASSON & WASSON 1957). In southern Mexico, the modern magico-religious use of the sacred mushrooms has an aboriginal base overlaid with Christian aspects. The Mazatec Indian ceremony has been most thoroughly studied. More than two dozen species of mushrooms are employed in magico-religious rites in southern Mexico, especially in the State of Oaxaca (GUZMAN 1959; HEIM & WASSON 1958). They belong to several closely related genera, particularly *Panaeolus*, *Psilocybe* and *Stropharia*. The most important species seem to be *Panaeolus sphinctrinus*, *Psilocybe aztecorum*, *P. mexicana*, *P. caerulescens*, *P. Hoogshagenii*, and *Stropharia cubensis*. A species of *Conocybe* has also been reported to be used (GRANIER-DOYEUX 1965; HEIM & WASSON 1958).

Physical Effects. These species have the same active principle – psilocybine – an indole alkaloid with a phosphorylated hydroxyl radical. These fungi also contain a rather unstable alkaloid, psilocine (SCHULTES & HOFMANN 1980). Psylocybine has been employed in modern psychiatry (IVERSEN 1978). A number of physical effects of Strophariaceae are reported, varying as a function of specific species and the mode of ingestion. The following range of typical effects are summarized from STAFFORD (1993). The primary action of psylocybin is through interference with serotonin mechanisms, reflecting effects similar to those of LSD. While initial effects may be indistinguishable from LSD, the shorter duration and other differences are eventually noted by experienced users. Characterizations of psilocybin include that it is "warm", "gentler" and less "forceful" or "coercive" than LSD; such perceptions may be a function of dosage. "Adequate" or "appropriate" dosages vary widely, depending upon the user's previous experience and intents. In general, there is a period of two hours of intensifying experience once effects begin, followed by a period of three or more hours of declining effects. If the mushrooms are orally ingested and kept in the mouth for an extended period of time, effects may begin within ten minutes, but if they are immediately swallowed, the active ingredients are only partially absorbed through the stomach wall, and may take up to an hour before they cross the blood-brain barrier. Initial effects generally include yawning and restlessness, sometimes with stomach discomfort, nausea, a chill, weakness in the legs, and drowsiness. Initial sensations of drowsiness are generally followed within a half hour by a sense of physical harmony and a lightness of the body. In the peak of the experiences, visual and auditory effects are striking. Animals studies and human observations suggest that really toxic levels are beyond what a human could ingest in the raw form of the mushrooms (STAFFORD 1993).

Therapeutic Uses of Psilocybe: María Sabina, Mazatec Wise One

Earlier investigations of ritual mushrooms of the Mazatec of Mexico (e.g., JOHNSON 1939, 1940; SCHULTES 1939) preceded the work of WASSON (WASSON ET AL. 1974; WASSON 1980), which internationally popularized MARÍA SABINA as a healer who used the hallucinogenic mushroom species. While little is known about the ancient pre-Columbian Mesoamerican mushroom healing rites, MARÍA SABINA's life and practice may exemplify many of these traits, particularly the selection and training, the therapies and healing procedures, and the associated theories about the causes of illness. While the studies on MARÍA SABINA are not primarily by anthropologists, there is a wide body of information available. WASSON has provided numerous reports of his visits, studies and analyses, and ESTRADA (1981), a Mazatec, recorded conversations with MARÍA SABINA in the Mazatec language during irregular visits over the span of a year. Another source of information is the recordings made by WASSON and ESTRADA of the chants and songs performed by MARÍA SABINA during healing ceremonies (*veladas*). ESTRADA

(1981), MUNN (1973), WASSON ET AL. (1974) and WASSON (1980) have notes and commentaries which expand upon the recorded texts and their interpretation. Her practices are continued by other contemporary Mazatecs (KRIPPNER & WINKELMAN 1982).

MARÍA SABINA is a *sabia*, a wise one and doctor, the Mazatec *cho^{4}ta^4 chji^{4}ne^4*. Her healing with mushrooms reflects a core of ancient pre-Columbian practices integrated with Roman Catholicism. Central to practice and training are the sacred mushrooms, which are thought to be responsible for healing and giving wisdom. The mushrooms are affectionately referred to by terms meaning "saint(ly) children", "little saints", "little one who springs forth", "little things", "little women", "little nuns" and "children". She also identifies the mushrooms with Christian figures and terms such as "little virgin mother" and in statements that "Jesus and the divine mushrooms being one" (WASSON ET AL. 1967: xiii; ESTRADA 1980). Several different species of mushrooms are used by the Mazatec. The identified species include *Psilocybe mexicana* Heim., *Psilocybe caerulescens* Murril var. mazatecorum Heim, *P. Hoogshagenii* Heim. and *P. Wassonii*; other species of the *Psilocybe*, *Stropharia* and *Conocybe* genera are reportedly used as well. Other psychoactive plants are also employed, including "Hojas de la Pastora" (leaves of the sheperdess) (*Salvia divinorium* Epl. and Játiva, Labiatae) and the "San Pedro" tobacco (*Nicotiana rustica* L., Solanaceae). The *Salvia* is a substitute for the mushrooms when out of season, and the tobacco is used in cleansing rituals.

MARÍA SABINA considers herself to have been selected to be a wise one from birth, but the wisdom and the ability to heal comes from the "language of the mushrooms." The role of the mushrooms are central in the training of the wise one. They provide the "language of the mushrooms,", used to diagnose and heal, and a mystical force which can be used to control the world. It is believed that the wisdom is not taught by humans, but learned directly from the mushrooms when they enter the body and begin to speak. MARÍA SABINA insists that becoming a wise one cannot be learned, although many of her family members had also been wise ones (grandfather, great grandfather, great uncle and great aunt). Other Mazatec shaman replicate that pattern of being self-initiated and taught by the mushrooms.

Learning for the mushroom ceremonies or *veladas* also occurs since early childhood, as MARÍA SABINA reports her observation about age 6, which led her to ingest mushrooms on her own initiative with her sister. She frequently ate the mushroom out of hunger. She felt that they spoke to her, gave her hope, sustenance and visions, and voices with advice. She came to believe that the mushrooms were like God, and that they gave wisdom and cured illness. MARÍA SABINA did not use the mushrooms while she was married because of a prohibition on sexual relations while using the mushrooms. After the death of her first husband, she returned to using the mushrooms to heal herself and her sister, when her sister was gravely ill. The mushrooms ingested provided songs which compelled her to sing and cure. Following the healing of her sister, MARÍA SABINA had a vision in which the mushrooms revealed to her the Principal Ones, who gave her the Book of Wisdom or the Book of Language used to heal. Healing comes from the "language of the mushrooms," which emerges when the mushrooms are consumed. The mushrooms are thought to speak and work through the body of the shaman during the vigil. They also turn into the "Principal Ones", higher sources of spiritual authority, which gave her the "Book" of healing. It is the things in the "Book" that MARÍA SABINA has memorized and uses to heal.

The mushrooms are ingested during the *velada,* or "all night vigil", which is held in the dark in a house removed from other dwellings. Patients come from miles around to participate in the veladas, seeking remedies to illness or solutions to problems. The velada is normally held in response to some family concern – to cure illness or to determine the possibility of recovery, to find lost animals or other objects of value, or to determine the condition of separated family members or loved ones. The ill, their family members, and others gather together within the

room, where they remain for the duration of the ceremony, generally overnight. Some of those present serve as monitors. Those participating in the ceremonies must meet certain prohibitions, including fasting from breakfast on, no alcohol consumption for four days, and also no consumption of eggs nor sexual acts for four days before and after the ceremony. Pregnant women are excluded. The ingestion of the mushrooms by the Wise One and sometimes the patient permits diagnosis of the condition and guidance of the treatment. Incorporated into the indigenous Mazatec practices are Roman Catholic elements, praying to Christ, Mary and the saints while the mushrooms, the "saintly children", are cleansed in the smoke of copal incense. Although they are generally eaten raw, accompanied with a cup of cacao, they may be ground to release the juice, which is then drunk. The mushrooms are ingested in pairs during a night time session. Sometimes the San Pedro tobacco, mixed with lime and garlic, is rubbed on the arms of the sick person or placed in the mouth. Although considered weaker than the mushrooms, it is considered to have a lot of force with which to cure sickness.

Healing occurs during the singing of a *velada*, involving chanting, whistling, humming, percussive artistry, ventriloquistic effects and dancing by the healer, first in pitch darkness, and later by candle light. During the all-night ceremony, the healer chants monophonically most of the night, starting with a moan, low at first, then louder as a humming. When the humming stops, she begins to articulate isolated syllables, each consisting of a consonant followed by a vowel. The syllables – first snapped out in rapid succession – spoken not sung – eventually coalesce into words in Mazatec. The chanting and oracular utterances are accompanied by ritual gestures at the altar, combined with a dance lasting for two hours. The songs and chanting continue intermittently throughout the night while the patients sit in the dark awaiting the personifications of the mushrooms and their healing powers.

The healer's visions reveal the origin of the malady, wounds of the spirit, hexes, or the soul or spirit of the person being robbed, lost or enchanted. The healer deals with illness caused by enemy humans, as well as illness caused by malevolent spirits, driving them from the body. She calms the quarrels and disputes which disrupt the household, clears away bad air, purifies, undoes witchcraft and restores peace. Cures are also directed to physical problems – to cure sick children, fever, chills, yellow skin, toothache, pimples and physical pains – but she finds the cause at the spiritual level. Saints are evoked, herbal remedies advised, pilgrimages directed, evil influences commanded to leave, and healing energies directed to the patient. The patients themselves experience visions, often of a terrifying and overpowering nature. Their vomiting, crying and other emotional reactions illustrate the cathartic nature of their experiences.

Although the principal stated means of curing are the mushrooms and the chants, other therapeutic modalities are combined in the *velada*. MUNN (1973) characterizes the shaman's work and use of language as a "poetic art", suggesting the elicitation and catharsis of feelings. The spontaneous origin of the language of the chants from the point of view of MARÍA SABINA is illustrated in her statements to ESTRADA which indicates that she sees the words fall into her from "above". The mushrooms speak and MARÍA SABINA has the power to translate. Her use of the language in singing and chanting, percussive utterances, alliteration, and repetition of grammatical structures indicate the rhythmic aspects of the chants as procedures for induction of altered states of consciousness are important. The chants also play a role in MARÍA SABINA's self-presentation and self-enhancement, as she allies or associates herself with both indigenous and Christian supernatural figures. The chants' content suggests they also play a therapeutic role in establishing belief in MARÍA SABINA's power, in stating and establishing attitudinal postures, and in encouraging positive motivation and expectation. Her performance as a sacred agent and a woman of many masks, combined with her ventriloquistic performances, indicate the enactment of roles which bring about cathartic experiences in the patients.

Flowering branch of Vorila Theiodora. *Manáus, Brazil. (Photograph: R.E. Schultes)*

2. Myristicaceae – *Paricá, Yakee, Epena, Nyakwana*

There is almost no record of the snuff prepared from myristicaceus plants in the earlier books or scientific papers. Anthropological writers have confused it with tobacco, which in the northwest Amazonia is not normally smoked but snuffed. What seems almost certainly to have been this *Virola* snuff was apparently first noticed and reported by a German anthropologist, from the Yekwana in the Orinoquia of Venezuela in 1909. He described the following: "There is a magical snuff, exclusively used by witch doctors and prepared from the bark of a certain tree which, when pounded up, is boiled in a small earthenware pot, until all the water has evaporated and a sediment remains at the bottom of the pot. The sediment is toasted in the pot ... and

is then finely powdered ... Then the sorcerer blows a little of the powder through a reed into the air. Next he snuffs, whilst, with the same reed, he absorbs the powder into each nostril. The *hakudufha* ... has a strong stimulating effect, for immediately the witch doctor begins singing and yelling wildly, all the while pitching the upper part of his body backwards and forwards" (KOCH-GRUNBERG 1909). Later, a Brazilian botanist wrote that the "Indians of the upper Rio Negro use the dried leaves of this species [*Virola theiodora*] and of *V. cuspidata* in making a snuff powder that they call *paricá*" (DUCKE 1939). It is now certain that the leaves of these species are never used in making the snuff, but this identification of two species of *Virola* as the source is correct.

Virola snuff was first described in detail and identified with citation of voucher specimens in 1954 (SCHULTES 1954b). One of the several hallucinogenic snuffs of the northwest Amazonia has as its source the blood-red resin-like exudate of the inner bark of trees of the genus *Virola*, of the Nutmeg Family or Myristicaceae (SCHULTES & HOFMANN 1979, 1980). Some 25 or more species of *Virola* are found in the tropical forest areas of Central and South America, but only a few are known to have hallucinogenic properties (e.g., *Virola calophylla*, *V. cuspidata*, *V. elongata*, and *V. theiodora* and several others). *Virola* snuffs are employed in a comparatively extensive area in the northwest Amazonia and in the upper Orinoco region of Venezuela, where they are widely used by shaman in the diagnosis and treatment of disease. Many groups in Brazil, Colombia and Venezuela employ this hallucinogen (SCHULTES & HOFMANN 1979). They strip the bark from the tree trunk and scrape off the soft inner bark with its red exudate. The scrapings are kneaded in water which is strained and boiled down to a thick syrup; the syrup is sun-dried, powdered, sifted and mixed with ashes of the bark of a wild species of *Theobroma* or of the leguminous tree *Elizabetha princeps*. In some groups, especially the Waika, the powdered leaves of the highly aromatic leaves of a species of *Justicia* are added to give the snuff a better smell, but this *Justica* powder may also be employed alone as a minor and weaker hallucinogen (SCHULTES & HOLMSTEDT 1968).

The Witotos, Boras and Muiñanes have discovered a novel way to utilize *Virola* (SCHULTES 1969). They prepare from the resin-like exudate small pellets which they ingest. The natives rasp the cambial tissue of the inner bark, roll it into balls and express the red exudate into a pot of water, and boil it for five or six hours, until the mass becomes a thick, brown syrup which is used to make the pellets. Ashes from any of a number of plant materials are put into a funnel of leaves and cold water is poured over the ashes and is allowed to seep through. The resulting watery liquid is then boiled down, until a grayish residue, called a "salt," is left. The little pellets are then rubbed in the "salt", after which they are ingested whole or dissolved in water and drunk. Five or six pellets induce in five or six minutes an intoxication which may last up to two hours. The Makú in the Colombian Amazonia simply drink the resin-like bark exudate with no preparation. There have been suggestions that medicine men in Venezuela dry and smoke the inner bark of a species of *Virola* for its psychoactive effects.

Physical Effects. The active principles in these species of *Virola* are tryptamines (DMT alkaloids), particularly 5-methoxy-N-N-dimethyltryptamine, N-N-dimethyltryptamine, N-monomethyltryptamine and 5-methoxy-N-monomethyltryptamine. These alkaloids are generally not active when orally ingested, unless they are taken with a monoamine oxidase inhibitor. Minute amounts of beta-carboline alkaloids have been located in the resin-like exudate, and they provide the needed monoamine oxidase inhibitor to make the orally ingested pellets effective (SCHULTES & HOFMANN 1980). The effects of DMT may not accurately depict all of the effects of the natural botanical sources. The alkaloids and nasal mode of administration are responsible for violent sneezing and coughing, choking, nausea, vomiting, headaches, excessive discharge from the nostrils and salivation, excited jumping, sweating, loss of motor coordination, a sense

of numbness in the limbs, facial twitches, hallucinations, outbursts and somnolence (CHAGNON 1983; EMBODDEN 1972). Feelings of stimulating exhilaration and of powerfulness and confidence apparently are felt by the user, contributing to a boastful and belligerent presentation.

Therapeutic Uses of Virola

There are considerable variations between indigenous South American cultures in the use of *Virola*, and with different effects expected from different plants and species (SCHULTES & HOFMANN 1979; SCHULTES & HOLMSTEDT 1968). Both the specialized shamanic use and regular use by adult males are widely reported patterns in the Colombian Amazon (SCHULTES 1979). Among some groups it is employed primarily by shaman, who use it ritualistically for the diagnosis of diseases and their treatment. In other groups, all adult males consume it, employing it often regularly in excessive amounts in daily life, as well as in annual ceremonies lasting several days. The *Virola* snuffs are also connected with practices of witchcraft and in funeral ceremonies. In addition to its' magico-religious use, the red resinous exudate of the inner bark of the Virola tree is also used as an anti-fungal and dermatological treatment. Many medicine men and the general public also may employ *Virola* in treating stomach and bladder problems, for malarial fevers, for the gums of teething children, for mouth sores, in the treatment of rheumatism and swollen joints, for cuts and wounds, for difficult or delayed child birth, for intestinal worms, as a treatment of hemorrhoids, and for reviving memory and stimulating the brain and intelligence (SCHULTES & RAFFAUF 1990; PLOTKIN & SCHULTES 1990).

CHAGNON (1983; CHAGNON, LEQUESNE & COOK 1971) provides extensive description of the daily use of the snuffs among the Yanomamö (Waika). These are typically based on the *Virola* species, although species of other genera may also be included (e.g., *Anadenanthera, Justicia*; see below). When employed regularly by adult males, the snuff is usually inhaled in the afternoon rather than evening so that it will not cause insomnia at night (PRANCE 1970). This pattern of use also may occur with groups of men from different villages as a part of building and solidifying alliances, and in preparations for intervillage feasts. When used in this regular public context, others in the village often appear unconcerned with or ignore the activities of the participants. The snuff is usually administered by another individual, using a blow pipe. The user may stagger, fall, vomit and sneeze violently upon application, and usually cowers for several minutes before staggering to his feet. The swaying walk becomes steadier and develops into a rhythmic stamping dance accompanied by singing and yells. The singing is designed to attract the spirits into the user's body where they can be controlled. The effects begin to diminish an hour later as he retires to the hammocks in a state of exhaustion. But in the meantime, the user may be very active and even violent. These experiences are "often the occasion for men to relieve the frustrations that have been building up. The Yanomamö attitude seems to be that one is not quite responsible for his act if he is ... high on *ebene* ... timid men use the opportunity to become boisterous and at times violent ... threatening to shoot someone with an arrow or hack someone with a machete" (CHAGNON 1983: 109). According to CHAGNON, these men would be unlikely to make such threats when sober. He suggests that one of the primary functions of the hallucinogenic experiences is to work off pent up antagonisms and frustrations by being fierce and expressing passions they are not ordinarily able to exhibit, and temporarily having a status they cannot normally claim. Under the influence of the snuff, many of the usual avoidance taboos are overlooked, permitting a release of the emotions and strains of everyday life. Antisocial behavior may also extend to personal violence and homicide.

Among the Sanama of the Roraima territory of Brazil the *Virola* snuff is used on one of the nights during a eight day ceremony following a death (PRANCE 1970). The ingestion is self-ad-

ministered by the men of the group, occasionally using a blow pipe blown by others. The groups join together in dancing with weapons, followed by a chest-pounding ceremony engaged in by pairs of men. During this period, those who have grievances against others may seek them out for vengeance through the chest-pounding exchange. The snuff is believed to enable them to withstand the pain. This chest-pounding exchange is followed by squatting together with arms around each others' neck in a extended period of shouting.

3. Leguminosae – *Cébil, Cohoba, Paricá, Yopo*

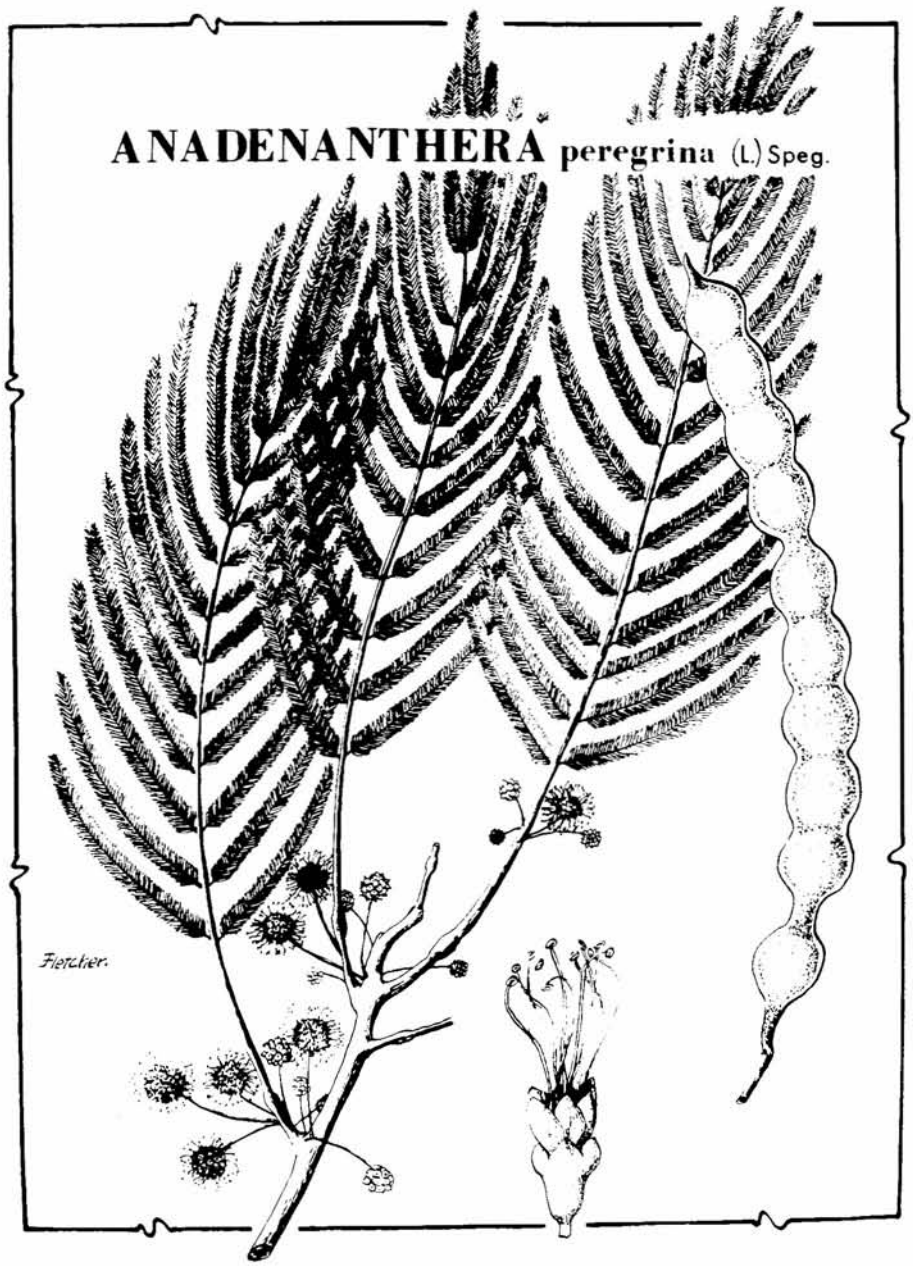
The earliest report of the intoxicating snuff prepared from the seeds of the leguminous *Anadenanthera peregrina* dates from 1496, when it was reported among the Taino of Hispaniola, who knew it as *cohoba*. The Taino Indians of Hispaniola employed *cohoba* to communicate with the spirit world. This early report described effects as "so strong that those who take it lose consciousness; when the stupefying action begins to wane, the arms and legs become loose and the head drops ... and almost immediately they believe that they see the room turn upside-down and men walking with the heads downwards" (SAFFORD 1916). This snuff, no longer used in the Antilles, was apparently introduced from the Orinoquia of Venezuela by the Karib Indians.

The source of *cohoba* was originally thought to have been a strong type of tobacco. It was definitely identified only in 1916. As a result of the late date of its identification, there is much confusion in the earlier literature on the use of this legume (SAFFORD 1916). *Anadenanthera peregrina* (formerly known as *Piptadenia peregrina*) was previously considered to be of the *Niopa* section of the genus *Piptadenia* (ALTSCHUL 1972). This species has been widely used in the northern and central Amazonia. Snuffs prepared from several other species of *Anadenanthera* are still employed in the southern parts of South America, particularly in Argentina.

The center of major utilization of this drug is still in the Orinoco basin, where it is called *yopo*; it is employed to a lesser extent in the central Amazonia of Brazil The *yopo* tree occurs wild in the open plains or grasslands of the upper Orinoco and northwesternmost Amazonia of Brazil and in the llanos of Colombia; it is frequently cultivated in areas where it has obviously been introduced by the natives (SCHULTES & HOFMANN 1979).

Certain groups in northern Argentina still use snuff – known as *cébil* – prepared probably from *Anadenanthera colubrina* var. *Cebil* (CALIFANO 1976). There is evidence of the much earlier use in Argentina of *cébil* (*Anadenanthera colubrina* var. *Cebil*) (CALIFANO 1976). Recent archaeological specimens of botanical snuff material and associated implements, including 612 snuffing kits from 42 sites from southern Chile dating from 320 A.D. to 910 A.D., have indicated the importance of *A. colubrina* var. *Cebil*. This archaeological material was found to have dimethyltryptamine, 5-methoxydimethyltryptamine and bufotenine (TORRES ET AL. 1991). It is of interest and extremely significant that a recently discovered herbarium specimen in the herbarium of the Royal Botanic Gardens, Kew, has a written annotation by the collector, RICHARD SPRUCE, that in Manáos, *paricá* (a vernacular name in Brazil for intoxicating snuffs) was prepared from seeds of the legume *Dimorphandra parviflora*. The collection is dated 1851. No other report of this use of *Dimorphandra parviflora* has been found (SCHULTES & RAFFAUF 1992).

The manner of preparation of the snuff is simple, although there is often some variation. The glossy, black beans – up to 20 or 25 per pod – are toasted and pulverized. The powder is then mixed with the alkaline ashes of the bark of one of several trees, usually of a wild species of *Theobroma*. The earliest report of the preparation of yopo snuff was given by the plant explorer VON HUMBOLDT, who encountered the drug in 1801 (HUMBOLDT 1852-53). The second and more detailed description is that of the British botanist SPRUCE who met with the drug amongst



Anadenanthera peregrina. *(Drawing: John Fletscher)*

the Guayabero Indians of Colombia and Venezuela in 1851 (SPRUCE 1873). According to VON HUMBOLDT, the Maypure Indians of the Orinoco break the long pods, moisten them and allow them to ferment; when the pods turn black, the softened beans are kneaded into small cakes with cassava meal and lime from snail shells, and the cakes are powdered when a supply of the snuff is needed. Chemically, it is of interest that some groups do not add the alkaline admixture to the snuff.

Physical Effects. The psychoactive substances of the snuffs of *Anadenanthera peregrina* have been found in other species of *Anadenanthera* in greater concentrations than in the related genus *Piptadenia* (ALTSCHUL 1972). The primary species used are *A. peregrina*, *A. macrocarpa*, *A. excelsa*, and *A. colubrina* (EMBODDEN 1972). The bioactive constituents of the *Anadenanthera* species are N,Ndimethyltryptamine (DMT) and bufotenine (5-hydroxy-N,N-dimethyltryptamine) (SCHULTES & HOFMANN 1980). The physical effects of *Anadenanthera* vary considerably, depending upon dose, mode of application (nasal, rectal, oral) and additives, none of which have been systematically investigated. A variety of effects reported in various cultural studies are summarized by ALTSCHUL (1972) and SMET (1985). While production of unconsciousness and visions are the frequently reported effects, also reported are enhancement of vision and alertness. It is used to heighten the vision and alertness of humans and hunting dogs. *Anadenanthera* may function as a violent purge. With nasal application, there is often violent sneezing, excessive nasal discharges, and extreme dilation of the pupil. The person may become temporarily unconscious following first inhalation, with a stupefied or intoxicated period lasting for a few minutes. Violent intoxication, contortions, and furious outbursts may follow, with violent singing and yelling in some cases. Those who ingest the *Anadenanthera* snuffs are said to injure themselves and others in their violent movements and dancing. This period of vigorous activity is followed by a long period characterized as a state of unconsciousness or delirium, or a soothing, happy state of well-being. Periods of unconsciousness with vivid dreams may last for hours, with a sense of languor persisting for several days (ALTSCHUL 1972). SMET (1985) reviews research on the variation in effects in terms of routes of administration. With enema applications, the effects are apparently much milder and without significant after-effects attributed to snuff administrations. Laboratory studies on oral administrations of the snuffs have failed to find psychoactive effects, probably due to extensive metabolism in the stomach and intestines. But SMET suggests that ingestion with MAO inhibitors such as beta carbolines should permit effectiveness with oral administration. Absorption through the nasal mucosa introduces active compounds directly into general circulation, avoiding presystemic degradation by acidic gastric juices and enzymes.

STAFFORD (1993) reviews laboratory studies of the effects of DMT (the active ingredient of *Anadenanthera*) which indicate that there are some regular physiological and dosage level effects upon human experience. The visual effects are among the most powerful, along with rushes of thoughts. Intramuscular injection initiates effects within five minutes, inducing an ecstatic state which lasts for a ten to fifteen minute period and returns to a normal state within an hour. Smoked DMT initiates effects almost immediately, but terminates the peak more quickly, and ends within a half hour. The fast acting effects of smoked DMT makes it a particularly dangerous recreational drug, as the ability to speak or act may be suspended. The physical changes include dilation of the pupils, increases in cardiac rate and output, and in some cases, tremors, dizziness or nausea. Negative experiences have been associated with DMT, often seen as a reaction to the rapid onset and intensity of the effects. Archetypal figures and confrontations may emerge and panic reactions may make it a terrifying and hellish experience (STAFFORD 1993).

Therapeutic Uses of Anadenanthera

ALTSCHUL (1972) provides a brief overview of the ethnobotanical, medical, magical and religious use of *Anadenanthera* by culture area, showing that, as with other psychoactive substances, *Anadenanthera* snuffs are used for a variety of purposes. Its predominant use appears to be by males. Its role as a basic aspect of the induction of altered states of consciousness in shamanistic practices is widespread, serving as a means of inducing visions of the spirit world used for divination and diagnosis. There are also a variety of specialized uses, e.g., by all-male groups, to give strength and stamina, by hunters, for foretelling the future and the plans of others, etc. In the Caribbean culture area, it was used for divinatory purposes; to diagnose illnesses and discover their causes; as a purifier; and for invocation to and communication with spirits. In addition to shamanistic and divinatory use, the tribes in the Caquetá area formerly used it as an excitant in preparation for battle, exciting blood-thirstiness, and making even the generally cowardly people fearless in battle. *Anadenanthera* snuffs are employed in cremation ceremonies, ancestral worship, annual harvest festivals, fertility rites, festive gatherings, and mock intervillage battles. It is used in sorcery as a means of inducing spirits to bring sickness and mishaps to enemies (ALTSCHUL 1972).

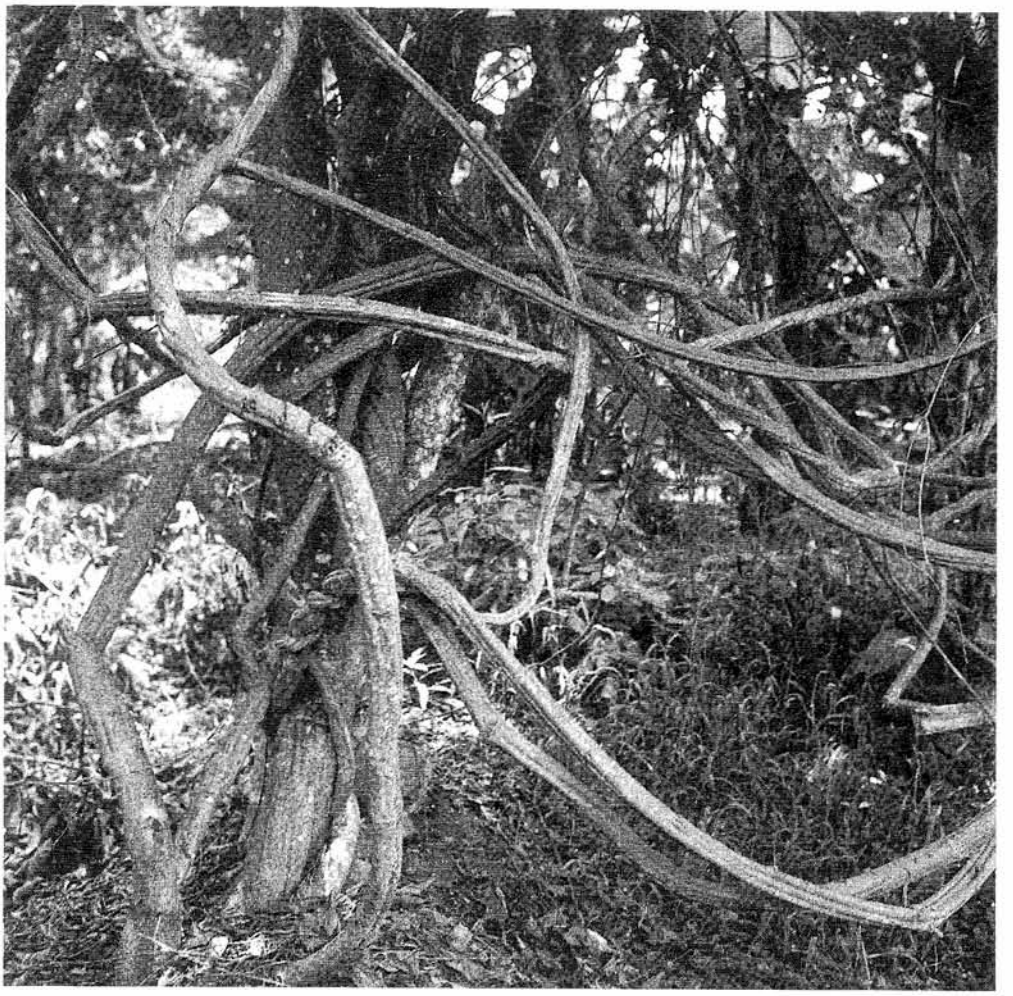
Anadenanthera peregrina is used by the Yanomamö (Waika) groups in a number of villages in the region of the upper Orinoco River of northern Brazil and southern Venezuela (CHAGNON ET AL. 1971). This plant is often mixed with other plants (*Virola, Justicia*, etc.) in snuff powder, and is viewed as preferable to the *Virola* species because of its greater strength (CHAGNON ET AL. 1971; LIZOT 1985). *Anadenanthera's* importance is reflected in the domestication of the tree, and its relationship with respect to trade, alliance and warfare. While not apparently used alone, *Anadenanthera* is sometimes combined with other plants in shamanistic training and healing practices (LIZOT 1985). Many of the activities are the same as described above with respect to the Yanomamö use of *Virola* to call the *hekura* spirits. During shamanic training, it plays a role in the induction of prolonged altered states of consciousness lasting for days, which provides access to the *hekura* spirits and their songs.

Among the Mataco, inhalation of the snuff plays a fundamental role in shamanistic training and healing (CALIFANO 1976). The altered state of consciousness induced permits the novice to establish relations with spirit entities and transform into animal familiars. In healing practices, the snuff is one of the techniques employed in ritual cures. The inhalation of the snuff is believed to provide the healer with special capabilities, including the ability to see internal organs of the patient, as well as the illness causing spirits and magical darts which are lodged in the patient's body. The snuff is also viewed as a vehicle through which the shaman's soul or spirit travels in animal form through the spirit world to determine the human and supernatural causes of illness.

4. Malpighiaceae – *Ayahuasca, Caapi, Natema, Pindé, Yajé*

The most widely employed hallucinogen in the northwestern and southwestern Amazonia – Bolivia, Brazil, Colombia, Ecuador and Peru and along the Pacific coastal area of Colombia and Ecuador – is a drink prepared primarily from the bark of a forest liana of the Malpighia Family or Malpighiaceae (SCHULTES & FARNSWORTH 1980), widely known as *ayahuasca* (*Banisteriopsis caapi*). *Ayahuasca* is a Ketchua word which means "vine of the soul" (SCHULTES & RAFFAUF 1992). There do not seem to be early missionary reports of this hallucinogen, but the basic role of *ayahuasca* experiences in the development of old Andean cultures (Chavin, Moche, etc.) is covered in ANDRITZKY (1989b). The earliest reference to the drug is found in a book on the

geography of Ecuador dated in 1858, which stated that several groups of the Rio Napo area used *ayahuasca* "to foresee and to answer accurately in difficult cases, be it to reply opportunely to ambassadors from other groups in a question of war, to decipher plans of the enemy through the medium of this magic drink and take proper steps for attack and defense, to ascertain when a relative is sick what sorcerer has put on the hex; to carry out a friendly visit to other groups, to welcome foreign travellers; or, at last, to make sure of the love of their womenfolk" (VILLAVICENCIO 1858: 371).



Liana of Banisteriopsiscaapi. *Comsaría del Vaupés, Río Piraparana, Colombia. (Photograph: R.E. Schultes)*

Seven years earlier, in 1851, the British botanist, RICHARD SPRUCE, had discovered the Tukanoan groups of the Rio Vaupés in Amazonian Brazil using a liana called *caapi* as an intoxicant, but his observations were not published until later (SPRUCE 1873). He properly identified *caapi* as a new species, calling it *Banisteria caapi*, now known as *Banisteriopsis caapi*. Later, in 1857, in the Ecuadorean Andes, he encountered the Záparo Indians using a drink called *aya-*

huasca which he considered to be the identical species found in the Vaupés of Brazil (SPRUCE 1873). SPRUCE was so far ahead of his botanical contemporaries that he collected stems of the liana for chemical analysis. The material was not analysed until 1969, and, after more than a century, it gave results comparable with freshly collected material (SCHULTES, HOLMSTEDT & LINDGREN 1969).

LUNA (1986) suggested that *Banisteriopsis* is perhaps the most complex psychoactive plant in terms of its widespread cultural use and botanical additives. He reports the use among some 72 different ethnic groups representing 20 language families in the Amazon basin and other areas of South America.

There are numerous "kinds" of *ayahuasca*, mostly representing slight variants or ecotypes of the same species and recognized with descriptive native names (SCHULTES 1986). The *ayahuasca* plant is frequently cultivated in the gardens of medicine men, but they often prefer bark from older wild lianas, stating that the effects of the latter are stronger and longer-lasting (SCHULTES & HOFMANN 1979).

Occasionally, the *Banisteriopsis* drink is made exclusively from the bark of this plant, but the genus is generally used in combination with other hallucinogenic or potentiating additives. LUNA reports 30 of the plant-teacher additives which have been botanically identified, many of them also highly bioactive. The two most commonly added are the leaves of *Diplopterys cabrerana* and *Psychotria viridis* (SCHULTES & HOFMANN 1980). All of these numerous additives are used to lengthen and heighten the intoxication. A second malpighiaceous plant is employed in the preparation of *caapi* in the northwestern Brazilian Amazonia: *Tetrapterys methystica* (SCHULTES 1954a).

Physical Effects. The active constituents of *Banisteriopsis* are beta carboline alkaloids: harmine, tetrahydroharmine and harmaline (SCHULTES & HOFMANN 1980). It is now known that there is a chemical basis for the use of the two principal additive leaves. They contain N,N-dimethyltryptamine in high concentration as well as other tryptamines. Tryptamines are not active when taken orally, unless there is present a monoamine oxydase inhibitor. The beta carboline alkaloids in the *Banisteriopsis* act as a monoamine oxydase inhibitor. The resulting drink containing the beta-carbolines and the tryptamine – both indole derivatives, is, in effect, far more potent (SCHULTES & HOFMANN 1980). Vomiting is generally associated with the ayahuasca sessions, making the plant widely known as a purgative. The "cleansing" and "purifying" properties attributed to *ayahuasca* and other hallucinogenic plants derive from alkaloids characteristic of many of these species of plants. The alkaloids have emetic and purgative properties, as well as antimicrobial and antihelmintic effects, acting against parasites, protozoa and other infectious conditions (DUKE 1985).

Since the discovery of this intoxicating drink, many explorers in the Amazonia have written about the use of *ayahuasca*. The utilisation and effects reported in various parts of the Amazonia differ widely. The Tukanoan of the Colombian Amazonia divide the effects of the intoxication into three stages. The first is vomiting, diarrhoea, sweating and a sense of flying, at the same time seeing brightly coloured lights, soon replaced by dancing accompanied by a kaleidoscopic series of ayahuasca-images of geometric patterns. The second stage is characterised by disappearance of the geometric figures, followed by sensations of flight and disappearance of space, accompanied by three dimensional forms of monstrous animals. The final stage brings on the deepest of hallucinations – both visual and auditory, the appearance of calmer visions in dull greens or blues eventually changing to brighter coloured visions, a pleasant period of calming musical rhythms, and finally a dreamy phase of peace (REICHEL-DOLMATOFF 1975). The *Banisteriopsis* based drinks take effect very rapidly, especially in comparison to the oral administration of harmaline alone. Effects may begin within a few minutes, and may include

gagging and nausea; its purgative effects (vomiting and severe diarrhea) are widely noted (STAFFORD 1993). STAFFORD also suggests physical responses of increases in blood pressure and cardiac rate, profuse sweating, tremors, pricking feeling in the skin, and a buzzing sound in the ears. Enhanced auditory acuity is also reported. Physical coordination is normally not impaired, but ingestion of large dosages typically causes frenzied agitation, followed by a period of drowsiness, lassitude and withdrawal (STAFFORD 1993). The effects may be enhanced by the dietary restrictions often associated with the use of *Banisteriopsis* based drinks, especially by healers. These include restrictions on salt, pork and sweets, as well as sexual activity.

Therapeutic Uses of Banisteriopsis

Many sources have reported on therapeutic and cultural uses of the plant medicines based upon *Banisteriopsis* (e.g., ANDRITZKY 1989a; DOBKIN DE RIOS 1984, 1992; HARNER 1972, 1973; KENSINGER 1973; LUNA 1986; NARANJO 1983; PAYAGUAJE 1990; REICHEL-DOLMATOFF 1975; see: GROISMAN & SELL this volume for other therapeutic uses of *Banisteriopsis*). LAMB's work (1971, 1985), particularly *Río Tigre and Beyond*, has been characterized as an important contribution concerning *Banisteriopsis* use (LUNA 1986). Medical and religious use of *Banisteriopsis* was widespread among indigenous populations of South America, and provided the source for numerous urban adaptations in the mestizo populations, where the plant preparations are employed for sorcery, healing and prophecy, as well as magico-religious purposes. A wide range of effects are reported, varying by preparation, dosage, admixtures, setting and ceremonial control and intents. The use of *Banisteriopsis* is deeply rooted in indigenous mythologies and philosophies, reflecting its central role in cultural life (SCHULTES & HOFMANN 1979).

HARNER (1973a, 1972) has reported the use of *Banisteriopsis* among the Jívaro of the Ecuadorian Amazon. The *Banisteriopsis* based drinks (*natema*) are used to acquire access to a supernatural dimension which provides the abilities to both heal and bewitch others. HARNER estimates that approximately a quarter of adult Jívaro men become shamans which use the power of *natema*, but that it is rare that women should do so. The power of *Banisteriopsis* enables one to learn healing and bewitching abilities from another shaman, who assists in the acquisition of supernatural forces and spirit helpers. The learning process requires the trainee to remain in bed for ten days after ingestion of the brew and the teacher's power substances, followed by sexual abstinence for 3 months, or for up to a year if they wish to become really effective as a healer or bewitcher. In the practice of healing, *natema* is ingested along with tobacco juice in order to enable the healer to see into the patient's body and diagnose the cause of illness. In the visionary state, the healer can locate the illness causing darts within the patient's body and then suck them out. The visions also enable the healer to see the individual responsible for causing the patient's illness. Bewitching practices involve similar use of *natema* and tobacco juice, along with the casting of darts, or rituals to steal the victim's soul, causing death.

In earlier periods when head-hunting was still a central part of Jívaro culture, *Banisteriopsis* based mixtures combined with tobacco juice were used as part of the purification and protection rituals which a successful headhunter underwent following return with the shrunken trophy head (KARSTEN 1935). Rituals were designed to protect the successful hunter from the vengeance of the murdered enemy's spirit. During a night of singing and dancing, the events surrounding the killing, the victim's family, and the escape are recounted. The following day all of the men, women and older children who wished consumed the drink, along with the man who did the slaying and his wife and daughter. A preliminary fast was required, and only manioc and bananas were eaten afterwards. The slayer and family remained inside the home to experience their

visions, while others settled around the home. The objective was to ascertain that the slayer's future would be favorable with long life, prosperity and luck. He and the other participants also benefitted from the drink's purificatory effects and an enhancement of their strength and ability to carry out their occupations. A third day of rituals involved ingestion of large quantities of tobacco juice.

Among the Tukanoans, this drug is taken in numerous ceremonies, especially in the annual Yurupari Dance, but it may be drunk also for personal reasons to obtain knowledge that exists in the otherworld. The Tukanoans believe that during the intoxication the individual may die and his spirit returns to the original womb, conceived as "an acceleration of time and an anticipation of death. To be within the original womb, they believe that they are beyond the Milky Way, whence came their ancestors in a canoe drawn by an anaconda snake with a man and a woman, the tapioca plant, the coca plant and ayahuasca plants" (REICHEL-DOLMATOFF 1975).

KENSINGER's (1973) description of the Cashinahua of Peru and their use of *Banisteriopsis*, combined with *Psychotria*, provides a somewhat different profile. Only initiated males consume the beverage, with some men never consuming it and others consuming it regularly every couple of weeks. While consumed in a group context, the consumption and intents are an individual issue, with no group leader or formal ceremony. Participants chant their own songs independently, without any coordination of the rhythm of the different chanters. The group context, including physical contact among the participants, are an important part of the modulation of the experiences. But each participant has their own focus of attention, a personal experience and search for knowledge. The *ayahuasca* experiences are viewed as fearful and unpleasant, but seen as a necessary means for finding out information of importance to the individual. One of the primary concerns are issues related to the causes of illness and their cure; healers may also use the *ayahuasca* as a means of dealing with difficult illnesses that do not respond to conventional treatments. While the intents of the users and their experiences are individually oriented, the post-experience discussions are often in group context. Of particular importance are those experiences which effect all of the group, such as those relating to food, illness, travel and death.

DOBKIN DE RIOS (1984) summarizes the many uses of these *Banisteriopsis* based *ayahuasca* combinations reported among indigenous groups in South America, particularly the areas around the confluence of the Amazon and Orinoco rivers. These uses include: acquiring protective spirits; in religious ceremonies; to determine the causes and cures of diseases; to prophecize the future; to determine if wives were unfaithful; to send messages to other groups; to discover enemies and their plans; and in preparation for war or hunting expeditions. *Banisteriopsis* is widely used for establishing contact with the spiritual world and affecting the behavior of spirit entities. LUNA (1986) points to the widespread use of ayahuasca in establishing relations with a special source of knowledge and power for dealing with all aspects of life – diagnosing and curing illness; finding game; contacting distant relatives; in establishing and maintaining relations between villages; in learning myths, art, chants and dances; and gaining direction and guidance throughout life. The plant spirits are viewed as active and intelligent beings which provide direction. Different teachers are associated with a number of specific plants which may be added to the *Banisteriopsis* based *ayahuasca*.

HARNER (1973b) summarizes the common themes in South American use of *Banisteriopsis*-based drinks as involving a number of central elements. One is the sequence of visionary experiences, beginning with positive and pleasing images and sensations of flying, which then turn into horrors, monstrous beings and terrors. The sensation of the soul leaving the body is a central sensation, and a source of the ability to travel to distant places or observe distant events. Frequently reported are experiences of the perpetrations of unsolved crimes. Animal visions, particularly of snakes, jaguars and other predatory creatures, as well as those of demons and

spirits, are predominant. NARANJO's (1973) clinical observations of urban volunteers ingesting the *Banisteriopsis* based drinks indicates similar themes, including: initial pleasant experiences being replaced with negative ones; a sense of one's soul and flying; and animals, particularly serpents and leopards. He suggests that these experiences (and therefore their similarity to those reported among Native American groups) reflect universal shamanistic phenomena rather than culturally specific traditions. The lack of the centrality of such experiences in the uses reported by GROISMAN & SELL (this volume) suggests that some setting effects underlie the previously reported similarities. The indigenous Native American traditions utilizing *Banisteriopsis* have been adopted and adapted by mestizo populations of South America. While some of the uses persist, they generally acquire a different focus; nonetheless they often retain a strong orientation toward the indigenous traditions and symbolism from which they were borrowed (LUNA 1986). The Native American origin of these practices are widely recognized in the urban practices, with connections to these traditions portrayed as a source of their power. In the urbanized traditions, the emphasis on healing remains, but with processes of community integration and adaptation to the pressures of acculturation often becoming important foci of the activities centered around the use of *Banisteriopsis*.

LUNA discusses the Native American roots of *Banisteriopsis* use among urban mestizo groups of the Peruvian Amazon. *Ayahuasca* use is part of a broader healing of *vegetalismo*, referring to knowledge of plants. This is based upon the administration of *Banisteriopsis* and a range of psychoactive plants, including plants of the genera *Brugmansia*, *Psychotria*, *Tetrapterys*, *Diplopterys* and tobacco. The *vegetalistas* specialize in different plant combinations, normally with the *Banisteriopsis* base. An important part of the use of the *Banisteriopsis* beverages is the training and initiation of the practitioners, who follow many of the classic features of shamanistic practices in being instructed in their practices by the plant-teachers. This requires extensive food restrictions and sexual abstinence and segregation from virtually all contact with women. Dietary prohibitions on alcohol, pork, chicken, fats, salt, sugar, condiments, fruit, vegetables and cold beverages are widely reported. Plantains, smoked fish, and some jungle animals, occasionally augmented by rice and manioc, constitute the preferred diet. Violations of these prohibitions are believed to cause illness or even death. Diet is viewed as a tool helping to maintain the altered state of consciousness which permits the plant teachers to instruct, provide knowledge, and enable the initiate to acquire their power. The diet is viewed as a means of making the mind operate differently, providing access to wisdom and lucid dreams. These regimens provide strength, especially against extreme weather conditions.

The training period involves learning songs, chants, and medicinal recipes and enhancing the trainees' artistic and intellectual skills. *Ayahuasqueros* may continue to ingest these plants in group sessions with other practitioners to exchange information, renew their strength, or enhance their visionary powers. Experience with a range of different plant-teacher additives is viewed as part of learning about the various potentials which the plants provide. Tobacco is used as an essential part of the practices. The spirit taught magical chants and songs, receiving phlegm used in healing, and acquiring magical darts for defense and attack are central to the *ayahuasquero's* learning about the plant-teacher spirits and their powers. The chants learned serve many purposes – calling souls and spirits, affecting the actions of the *ayahuasca* or specific plant-teachers, curing specific illnesses, and in love magic. The phlegm and darts are viewed as necessary protectors in a hostile spiritual world into which the initiate enters. They can also be used to harm others through sorcery. The visions produced under the influence of *Banisteriopsis* based mixtures are a source of information about the causes of illness and spiritual forces involved in sickness and well-being. Extensive cultural and psychoanalytic analysis of such visions is provided by LUNA & AMARINGO (1991).

DOBKIN DE RIOS (1984, 1992) also discusses the urban adaptations of mestizo healers using *ayahuasca*. The illnesses treated are diverse, but with a focus upon those characterized as magical illnesses and culture-bound syndromes. Principal illnesses reported by DOBKIN DE RIOS include: *susto* (fear), caused by an intense experience of fear interpreted as causing the loss of the person's soul; *daño* (harm), caused by sorcery of others who have feelings of envy or desire for vengeance; *mal de ojo* (evil eye), caused by envy, evil intentions or a glance; and *pulsario*, a painful abdominal ball believed to be caused by repressed emotions such as anger or sorrow. Illness treated by *Banisteriopsis*-based mixtures are broad – dysfunctions in social or sexual relations, emotional problems, vices and excesses, bad luck, as well as psychological, somatic and physical problems (LUNA 1986). It is also employed as a preventative against all sorts of diseases.

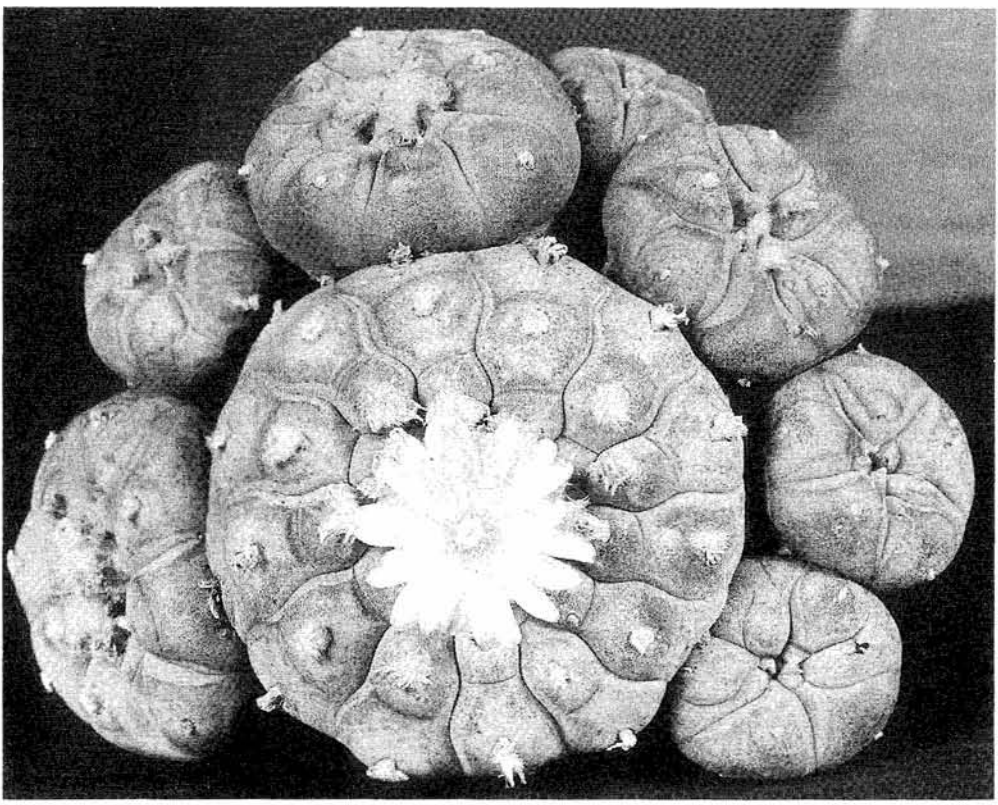
The urban *ayahuasquero* uses the *Banisteriopsis*-based mixtures to diagnose the cause of illness through analysis of the visionary experiences which are induced. These visions might reveal causes embodied in animal forms, the hate felt by others towards the patient, or a person carrying out harmful rituals against the patient. The determination of the cause then permits the *ayahuasquero* to effect a cure through neutralizing the influences which caused the illness. These treatments normally include many of the widely practiced healing techniques found throughout the Amazon basin and many other parts of the world: singing, chanting, recitations, whistling, blowing smoke and sucking on afflicted parts of the patient's body. Treatment sessions may be repeated, but DOBKIN DE RIOS reports that most treatments are for relatively short periods of time. Sessions may be repeated several times over the next month or so, but there is very little or no follow-up by the *ayahuasqueros*.

Sessions are usually held in the night, with participants joining together in the evening before the ceremony begins. The ceremony may also be attended by those who do not ingest the *ayahuasca*, particularly the wives of men attending. Following opening ceremonies, the *ayahuasca* is ingested while participants wait in darkness for the visions to appear. The *ayahuasquero* then channels the experiences through chants and whistling, which are followed by periods of silence, alternated with chanting. As the effects fade, discussion and commentary about the experiences ensue. These discussions are followed by departure for home or sleep at the site of the ceremony until the morning. Sex is usually prohibited for some time before and after the ceremonies.

ANDRITZKY (1989a) notes two Amazonian patterns of *Banisteriopsis* use, one involving ingestion by the healer in treatments of individual clients and the other involving the communal consumption by adult group members. These are similar to the urban-rural differences noted by LUNA (1986). Urban use is generally under the administration of healing professionals, who attract groups of strangers seeking therapeutic intervention, while the rural settings are focused upon small kin groups. In individual healing sessions, the healers ingest *Banisteriopsis*, while the patients usually refrain. However, the interaction between healer and patient, as well as other ritual factors, serve to evoke visions and personal unconscious material. In addition to the interactions between healer and patient, there are "healing activities [which] provide the entire community access to transcendental experiences which clearly have integrative and cohesive social functions" (ANDRITZKY 1989a: 77). He suggests that the adult members of the community ingest hallucinogenic *ayahuasca* in rituals which strengthen social cohesion and identity. The article by GROISMAN & SELL (this volume) illustrates similar uses of *Banisteriopsis* to reinforce numerous aspects of spiritual, personal and social life created within a religious community focused around its use for healing and personal transformation.

ANDRITZKY (1989a) further suggests that the *ayahuasqueros* help people deal with the problems of acculturation. Their rituals mediate between the Euro-American and indigenous worlds, creating a synthesis of the traditional and the new through the use of emotionally

relevant images of culture change from the indigenous point of view. The treatment and practices are a method of symbolic confrontation with psycho- and sociotherapeutic effects. *Ayahuasca* apparently gives the user conscious access to the process of symbolization. The effects of *Banisteriopsis* are shaped by songs and long stories about the mythological worlds which serve to structure visions and evoke culture specific patterns of experience. These prepare the patients for the experiences, and enables them to appreciate the collective motifs rather than being flooded with unconscious personal material. The use of stories and their interpretations allow the healer to control the level of anxiety and the depth of regression of the individual. These and other factors contribute to the powerful set and setting effects which characterize experiences induced by *Banisteriopsis*.



Lophophora williamsii. *Mexico and Texas. (Photograph: R.E. Schultes)*

5. Cactaceae – *Peyote (Lophophora Williamsii)* and *San Pedro (Trichocereus* spp.)

A number of different genera of the Cactaceae family are used as central aspects of healing practices and magico-religious ritual (e.g., *Lophophora, Trichocereus, Coryphantha, Epithelantha, Mammillarian, Pachycereus*; see SCHULTES & HOFMANN [1979]). The most important of these psychoactive Cactaceae is the small, fleshy, spineless cactus known as peyote (*Lophophora Williamsii*), the plant used in ancient Mexico and found today in the deserts of northern

Mexico and across the Rio Grande in Texas. The limited coverage of peyote in this section is in recognition of the coverage provided in the article here by ANDERSON. A number of "false peyotes" (e.g., species of *Pachycereus*, *Ariocarpus*, *Coryphantha*, *Mammillaria* and *Epithelantha*), are cacti substituted in cases of the lack of access to *Lophophora Williamsii*, particularly among the Tarahuamara of Mexico. The genera *Trichocereus* provided the basis for ancient pre-Columbian Peruvian traditions of healing which have survived in the hills (DAVIS 1983), as well as in a transformed, almost commercial urban method of mestizo curing practice (SHARON 1978).

Peyote – Lophophora Williamsii

The great antiquity of the ceremonial use of peyote and plants with similar properties in Mexico and southern Texas has been documented by archaeological remains spanning about 8000 years of intermittent occupation in association with two other psychoactive plants – the hallucinogenic mescal bean (*Sophora secundiflora*) and the toxic Mexican buckeye (*Ungnadia speciosa*). Peyote was one of the earliest hallucinogens known to the Spanish conquerors of Mexico. One of the most extensive Spanish reports states that the Indians ate peyote to "see visions, either frightful or laughable ... [that] this intoxication lasts two or three days and then ceases, it sustains them and gives them courage to fight and not feel fear nor hunger nor thirst; and they say it protects them from all danger ... [when they] eat peyote, they lose their senses, see visions of terrifying sights like the devil and they are able to prophecy the future" (SAHAGUN 1938). Another and more reliable early report is that of HERNANDEZ (1651). He was the physician of the King of Spain, and studied medicinal plants of the Mexican Indians, writing an authoritative book based on several years of field work amongst the Aztecs. A relatively extensive amount of post-conquest references usually condemned the religious use of the cactus, which the ecclesiastical authorities failed to extirpate (ANDERSON 1980; LA BARRE 1959; ROUHIER 1927).

In modern Mexico, the peyote cult exists amongst the Huichol, Tarahumara and other groups (LUMHOLTZ 1902; MYERHOFF 1974). The Huichols make an annual ceremonial peyote hunt to the deserts, and enough peyote is collected and the heads are dried for use throughout the year (FURST 1972). In the mid 19th century, Native Americans of the U.S. adopted peyote as a sacramental element in a new hybrid Christian and aboriginal cult (LA BARRE 1959). It rapidly spread amongst the Kiowa, Comanche and other groups in the United States and even into Canada. The rapid spread of the peyote cult encountered fierce opposition from missionary groups, but eventually the cult was legally organized as the Native American Church. The broad appeal of this sacred plant as a "medicine" in ancient Mexico and its rapid spread in the modern United States attests to its powerful effects (ANDERSON 1980; HARTWICH 1911; LA BARRE 1959).

The peyote ceremony in the United States may vary from group to group, although it does follow some more or less standardized forms. It consists of an all-night ritual which ends at dawn with a communal meal. It is often carried out in a teepee or special permanent building, with singing, chanting, meditation, prayers and frequently a short "sermon" by the leader who is known as the "road-man." Extensive description of the ceremonial activities and variations among Native American groups are available in a number of sources (e.g., ABERLE 1966; ANDERSON 1980; LA BARRE 1959; STEWART 1987; WEIDMAN 1990).

Physical Effects. The effects of *Lophophora Williamsii* are primarily due to the action of the alkaloid mescaline, along with thirty or more phenylethylamine and isoquinoline alkaloids

whose effects have not been fully determined. The effects of eating peyote buttons with its many alkaloids is, naturally, very different from those resulting from the effects of mescaline alone, as all or most of the alkaloids which occur in the plant are undoubtedly in other ways physiologically active (SCHULTES & HOFMANN 1980). Mescaline has been employed in psychiatry, especially in psychiatric research (CLARK & DEL GIUDICE 1970; IVERSEN 1978; KLUVER 1928), and some of the isolated effects of many alkaloids have been explored in humans. The effects of peyote as experienced during the ceremony are quite variable, as the amount of consumption of peyote varies markedly; some worshippers may consume as many as twenty-five or thirty peyote buttons. The intoxication has two phases: a period of contentment and hypersensitivity followed by nervous calm and muscular relaxation. This is often accompanied by hyper-cerebrality and visions which seem to occur in a kind of sequence from geometric figures to familiar scenes and faces to unfamiliar scenes and objects. The effects are characterised by a kaleidoscopically moving series of the most brilliantly coloured visions, often accompanied by auditory hallucinations. More extensive coverage of the physical properties are provided here in the article by ANDERSON.

Therapeutic Effects of Peyote

A major reason for the rapid accepatance of peyote amongst Native Americans of the U.S. may be found in their belief of the cactus as a "medicine", in their understanding of "medicine" (SCHULTES 1938). The therapeutic effects of peyote are widely attested to both by the groups which use them, as well as outside observers of their communities. The Native American Church is credited with reducing alcoholism amongst Native Americans in the United States. ABERLE's (1966) study of the Peyote Religion among the Navajo characterizes it as having a polyvalent character, serving many different purposes for different individuals and groups – religious, miraculous curing, transcendence, knowledge, incentive to work, release from guilt, temperance for alcohol, and other reasons. The majority of cases have initial recourse to peyote to be cured or when a family member is sick. They stay or return later for healing, for maintaining good health and mind, for "relief from feelings of aimlessness and helplessness, to over come misfortunes, for future guidance and future good fortune, to access knowledge about causes of illness or misfortune, to foretell future occurrences, and to provide security against witches and ghosts. And so peyotism appeals to the person who seeks only a cure after a crises, to the disorganized and unhappy, to the alienated and marginal, to the philosopher, to the mystic, and to the person who seeks guidance and a sense of purpose and sustaining motive in the situation that faces Navahos today" (ABERLE 1966: 194).

The reasons why people continue with the Peyote Church are quite diverse, but must be seen as centrally related both to the personal and social aspects of the experiences. The personal experiences involve the "revelations of the utmost importance for the individual", "a feeling of *personal significance* ... one's self, one's aims, one's relationships, and one's ethics have become matters for reflection and have somehow taken on a new dimension of meaning." (ABERLE 1966: 8) "[M]any Navahos who have felt unhappy and lost have gained a feeling of purpose in life and a remarkable serenity through their membership in the Native American Church, their participation in its meetings, and their use of peyote" (ABERLE 1966: viii). ABERLE analyzes peyotism as an adaptation to conditions created by the contact situation and the degraded status which resulted. Peyotism provided internal peace and harmony instead of competition and conflict, and a reference group with close relations which met needs for approval and esteem. Peyotism offers status, an assertion of self-worth, and a means of countering the effects of prejudice by providing validation of their separate identity. "It is an effort at personal integration,

achieved through a ritual and symbol system which is self-consciously *not* that of the dominant culture, and *not* that of the peyotist's native culture" (ABERLE 1966: 340). Peyotism is able to provide an alternative because it rejects dominant society values – emphasis on acculturation and assimilation; assumption of non-western inferiority; emphasis on materialism; and an emphasis on learning rather than insight. Peyotism also provides an adaptation to the dominant society. The Church provides an ethical code which fosters adjustment between Indian values of collectivism and those of individualism of the broader society. ABERLE characterized the Peyote Religion as a blending of White/Christian and Indian aspects in a new ethical code, the Peyote Road, which involves brotherly love, care of family, self reliance, and avoidance of alcohol. Actually, the Peyote Church has been credited as an important factor towards the control of alcoholism amongst the believers.

The "False Peyotes". A number of species of Cactaceae are employed by the Tarahumara and Huichol as substitutes when peyote is not available. One such plant is *Pachycereus pecten-aboriginum*, which contains a number of alkaloids (BYE 1979; GIBSON & NOBEL 1986). *Ariocarpus fissuratus* (living rock, peyote cimarrón) and *A. retusus* is a similar plant used among the Huichols and Tarahumara (STAFFORD 1993). Species of *Coryphantha, Mammillaria* and *Epithelantha* are used in a similar fashion among the Tarahumara because of their similar psychoactive effects (SALMON 1991; SCHULTES & HOFMANN 1979; BYE 1979). There are also additional uses, including serving as stimulants and protectants for the famous Tarahumara runners. In addition to typical shamanic uses (diagnosis of illness, identification of sorcerers), these false peyotes are also used to deal with a range of physical illnesses.

San Pedro – Trichocereus spp.

A columnar cactus known as *San Pedro* in Peru was classified as *Trichocereus pachanoi* in 1920. It's contemporary and historical use is covered by SHARON (1978), DAVIS (1983) and by JORALEMON & SHARON (1993); the latter also provides a review of a range of studies by other anthropologists. Their findings are summarized here. The use of the *San Pedro* cactus has pre-Hispanic roots which are found in ancient Peruvian civilizations. Archaeological evidence suggest its use over three thousand years ago. Its representation is found in association with the principal Chavin diety, an anthropomorphized being combining the characteristics of a serpent and an eagle. The *San Pedro* cactus is found also in association with other animals (hummingbird, jaguar) which still have important associations with contemporary practices of the *curanderos* (healers).

At the time of Spanish contact with the indigenous cultures of Peru, there was widespread ritual use of *San Pedro* in the Andean area. Historical records indicate that these practices continued during the colonial era, although they were subjected to efforts by the Catholic church to eradicate the practices as a form of devil worship. In spite of the persecution, the practices persisted and now form part of the traditional folk healing practices of the mestizo culture of Peru. Their congruences with archaeological findings and early historical accounts suggests that the same basic ideology and use of this plant has persisted over the centuries.

The contemporary use of *San Pedro* is based in the profession of the *curandero*, whose activities involve a syncretic blend of pre-Hispanic and Catholic elements. The practices center on the use of *Trichocereus*-based extracts within ritual complexes. The plants are viewed as having their action through the spirits within them, who communicate with and carry out the directions of the *curandero*. The plants activate an inner power of the *curandero*, enabling one to project an inner psychic force, to control the spirits, and to interact with the natural and supernatural

energy fields, the vital essence of the world. As SHARON relates the words of the *curandero* EDUARDO: "San Pedro cactus is experienced as the catalyst that enables the curandero to transcend the limitations placed on ordinary mortals: to activate all his senses; to project his spirit or soul; to ascend or descend into supernatural realms; to identify and do battle with the sources of illness, witchcraft and misfortune; to confront and vanquish ferocious animals and demons of disease and sorcerers who direct them; to 'jump over' barriers of time, place and matter; to divine the past, present and future – in short, to attain 'vision' to 'see'" (SHARON 1978: 45). The spiritual forces inherent in the cactus are also used to activate other power objects which are used in curing and other activities.

The *San Pedro* cactus is prepared by slicing the cactus and boiling the pieces in water for up to seven hours. Other plants, including *Datura*, may be added. Ingestion of the *San Pedro* is preceded by a diet avoiding animal fat, grease, salt, plants which "entangle" (e.g., vine climbing legumes) and hot peppers. Ingestion through the nostril is viewed as the preferable mode of administration because it provides effects upon motor nerves (olfactory papillae) which transmit signals directly to the brain. Tobacco is also used with *San Pedro* because of it's reputed ability to reinforce the effects of the *San Pedro*, and to clear the mind, facilitate visions, enhance the imagination and to improve sight.

Physical Effects. Ten or more of the species of *Trichocerus* contain mescaline (average .01% fresh), with *T. peruvianus* reported to contain as much as ten times greater concentrations (STAFFORD 1993). *Trichocereus pachanoi* contains the alkaloid mescaline, as well as seven other alkaloids, the precise effects of which are not known (AGURELL 1969). The experiential effects of *San Pedro* are reported by SHARON as involving a sequence of events beginning with a sense of dizziness and a drowsy dreamy state of lethargy. This may be followed by nausea and vomiting, as well as automatic dancing and writhing of the body. This is increasingly replaced by concentration and a clearing of the facilities and enhancement of vision. It may induce a sense of slight numbness, tranquility detachment and relief. This sets the state of inner focus which permits the emergence of the sixth sense, a power of inner vision, and a sense of the supernatural power of the mind. It is also thought to act upon the intellectual aspects of the nervous system and enhance operations of the subconscious mind, conceptualized as the superior part of the human from which valuations and memories arise. The cactus is considered to have general healing properties, cleansing the stomach, kidneys, liver and blood. Further coverage of the physical properties of mescaline are provided by ANDERSON (1980; see his article in this volume).

Therapeutic Milieu of San Pedro Curanderos

The use of *San Pedro* takes place in an all night healing session in which the dramatic enactments of the *curandero* and the manipulation of many sacred power objects of their altars play a central role in the ritual processes designed to solve the problems which the patients present. The healing session has two parts, a ceremony and a curing session, which are described in detail by SHARON (1978). During the initial ceremony, lasting approximately two hours from 10 P.M. until midnight, the *curandero* sings, prays, whistles and engages in a series of rituals. These rituals activate aspects of the altar, and include the *curandero*, assistants and patients imbibing a combination of *San Pedro* and tobacco through the nostrils. This period is designed to invoke and balance spiritual forces and to focus the *curandero's* visions on the patient's problems. At the end of this ceremonial period, participants drink a cup of the *San Pedro* infusion. Then each of the patients has an interaction with the *curandero* in front of the altar to

diagnose the patient's problem. *San Pedro* permits the emergence of the visionary power of the *curandero*, who visualizes the aspects of the patient's life which represent the causes of the problems. Symbolic manifestations in the visions permit determination of causes and means of symbolic and spiritual manipulations necessary for cure. The ensuing rituals are designed to shape, control and balance the spiritual and natural forces which affect the patient's life. The *San Pedro* cactus serves as the source of the balancing influences, mediated by the symbolic processes of the ritual and the integration of psychological, social and cosmological levels of meaning. The cosmological level is seen as operating primarily at the unconscious level, which is manipulated through the symbolic interaction among the forces represented in the sacred objects on the *curandero's* altar. This permits the synchronization of the different aspects of the individual's psyche and the biological bases of the organism, providing a psychosomatic integration.

JORALEMON & SHARON (1993) further characterize the therapeutic process as one in which the *curandero's* ritual and it's transformative rhetoric manages the patient's concerns with respect to those who may have malicious intents toward the patient. The use of the *San Pedro* cactus in healing is centrally concerned with socially constructed illness centering on witchcraft and the causation of illness through resentment and envy. The client, bewitched through the envy or revenge seeking motives of others, joins with the *curandero* in visualizing the nature of the curses and the means of overcoming the resultant illnesses and problems. Many of these problems can be seen as the results of the tensions between the various cultures in Peru, the ancient Indian roots, the mestizo formations, and the modern Western influences. EDUARDO characterized the role of the *curandero* as a "shock-absorber" between the ancient ancestral traditions and the adaptations demanded by the current social conditions. The *curandero* provides a means of creating a smooth transition between traditions, between the past and the future. These mediations are placed in the context of ancient symbolism of humans and nature which represent deeply embedded aspects of the subconscious mind. These ritual processes provide a dialogue for empowering the patient, transforming individual personality and social relations, and altering the nature of their daily experiences and lives.

6. Convolvulaceae – *Ololiuqui, Badoh Negro*

Early Spanish chroniclers of conquered Mexico wrote about seeds of a morning glory and illustrated the plant as a sacred element worshipped by the Aztecs and known as *ololiuqui*. The source was a vine with cordate leaves, small brown seeds and a tuberous root called *coaxihuitl* ("snake plant"). Amongst the Aztecs and other groups of southern Mexico, *ololiuqui* was used as a magic potion and analgesic. One early Spanish report stated that the Indian priests smeared themselves with an unction of *ololiuqui* seeds mixed with live insects, ashes of burned insects, tobacco, and pine resin before making sacrifices on mountain tops. This same report listed many medicinal uses of *ololiuqui* and specified its pain-killing properties. The priests, after eating *ololiuqui* seeds, could commune with their gods and receive messages from them while experiencing "a delirium during which a thousand visions and satanic hallucinations appeared to them" (SCHULTES 1941). The *ololiuqui* had a wide range of applications – eliminating fear, depriving people of their senses, and healing the sick.

For nearly four centuries the botanical identity of ololiuqui was not known. It was identified as *Turbina corymbosa* (then known as *Ipomoea sidaefolia*) of the Convolvulaceae or Morning Glory Family in the latter part of the 19th Century, but authentic ethnobotanical collections were not available until 1930, when the plant was collected amongst the Mazatecs of Oaxaca (SCHULTES 1941). Notwithstanding the fact that *ololiuqui* had been correctly identified, a later

"identification" was offered in 1911 and 1915 (HARTWICH 1911; SAFFORD 1915). Partly because the Morning Glory Family at that time had no known active chemical constituents and since the flowers of morning glories superficially resemble many flowers of the Nightshade Family or Solanaceae, *ololiuqui* was erroneously identified as a solanaceous plant, *Datura meteloides* (SAFFORD 1915). Long standing difficulties in the classification of the different morning glories have led to numerous terms being used in identification of the plants. While most of the literature was published under the genus *Rivea*, *Turbina* is now considered the most appropriate generic epithet. The Mazatec, Zapotec, Chinantec and Chantin of the southern part of Mexico similarly employ the large, black seeds of another morning glory called *badoh negro – Ipomoea violacea* (Syn. *I. rubrocaerulea*) (SCHULTES & HOFMANN 1980). The seeds of *Turbina corymbosa* are round and brown, those of *Ipomoea violacea* are angular and black. There are a number of species of *Ipomoea*, but not all are psychoactive; reputed psychoactive varieties include "Heavenly Blue, Pearly Gates, Flying Saucers, Wedding Bells, Blue Star, Summer Skies, and Badoh Negro (Mexican variety)" (GOTTLIEB 1973: 37).

Physical Effects. The seeds (and to a lesser extent the leaves, stalks and roots) of both *Turbina* and *Ipomoea* species contain ergoline alkaloids (ergine – d-lysergic acid amide; isoergine – d-isolysergic acid amide; and chanoclavine and elymoclavine), substances which are closely related chemically to d-lysergic acid (LSD). These ergoline alkaloids have a long history as sources of poisoning of whole villages in Europe when rye milled into flour for bread-making was infected with ergot, a fungus (*Claviceps purpurea*) (SCHULTES & HOFMANN 1979, 1980). The concentrations of active principles are greater in *Ipomoea* than *Turbina* (HOFMANN 1963), but would nonetheless require a minimum of nearly 9 grams of seeds (at least 400) to provide 5mg of the alkaloids (ISBELL & GORODETZKY 1966). The concentrations are very low, and effects generally far less potent than LSD. There is a range of effects attributed to the ergoline alkaloids, based upon physiological, experiential and clinical assessments. OSMOND's (1955) self-experimentation suggested different effects than that obtained with LSD and mescaline, with relatively minor effects of short duration (3 hours). OSMOND characterized the experience as one of "marked anergia and irritable apathy, combined with alert thought processes and increased hypnagogic phenomena ... an unusual placidity combined with a capacity for constructive action when required" (OSMOND 1955: 535). "After about four hours this is replaced by a period of alert, calm, relaxed well-being lasting many hours" (p. 537). The extent to which this reflects dosage dependent phenomena was not addressed other than to point out that at lower dosages, few effects were noted. ISBELL & GORODETZKY (1966) describe the subjective and clinical effects (under fasting) of crude extracts of the alkaloids of *Ipomoea*. These effects were compared with: placebo conditions; the synthetic versions of the alkaloids of *Ipomoea* (d-lysergic acid amide, d-isolysergic acid amide, ergonovine, chanoclavine, elymoclavine and lysergol); and LSD-25. The extracts and synthetic alkaloids contrasted with LSD-25 in lacking the latter's effects of increasing temperature, blood pressure and pupillary size. They also lacked the typical effects of LSD such as nervousness, perceptual distortion, hallucinations and euphoria. Subjective effects of the extracts and synthetic alkaloids were similar, and included sleepiness, nausea and headache. ISBELL & GORODETZKY characterized the plant extracts and synthetic alkaloids as being "sedative" in their effects rather than psychomimetic.

Therapeutic Uses of Convolvulaceae

In Zapotec, Chatino and Chinantec villages of northern Oaxaca the morning glory species are still used to deal with a range of troubles and difficulties (WASSON 1963). FIELDS (1969) char-

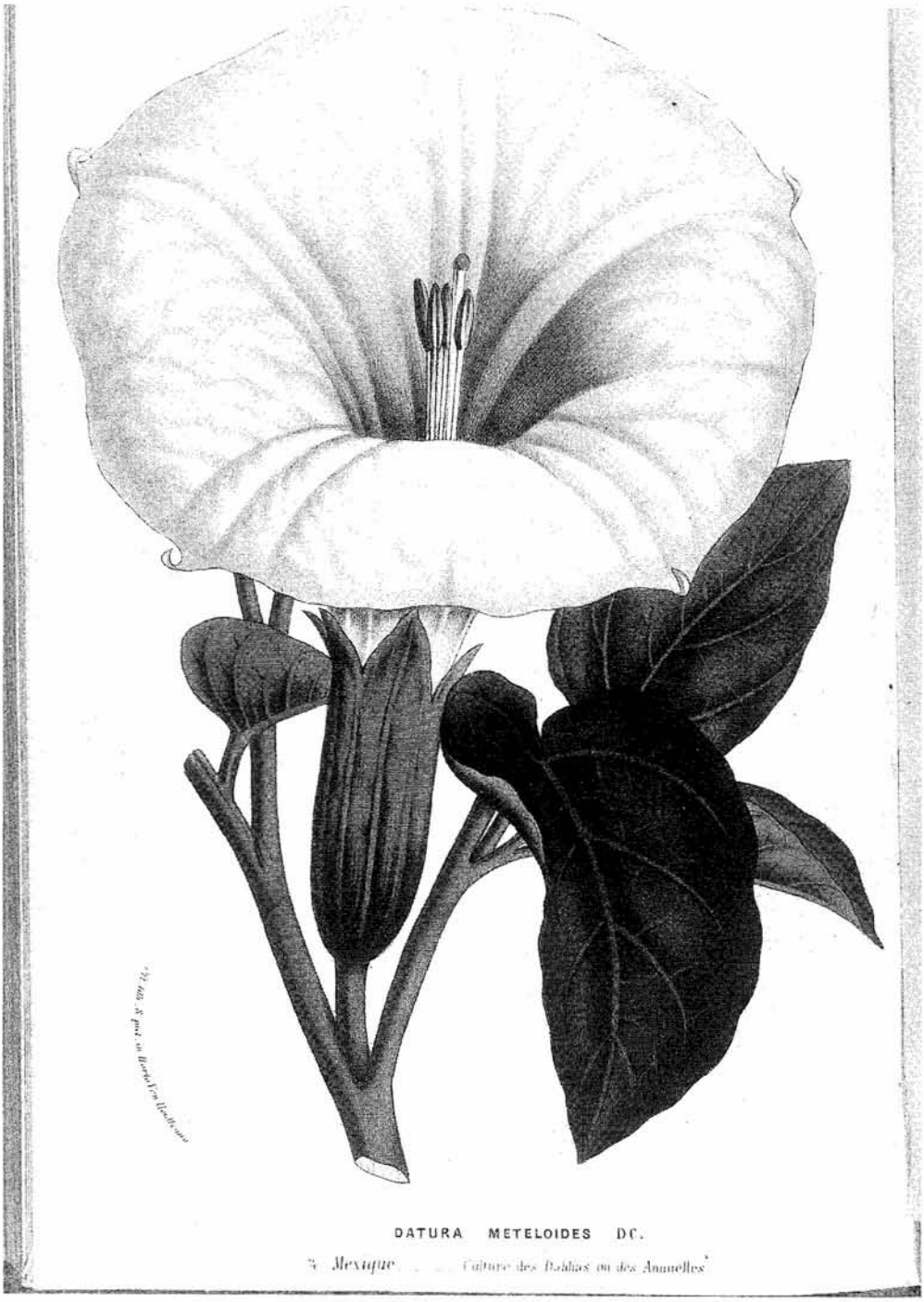
acterized the morning glory (*Turbina*) as probably the most widely used substance for divination in Oaxaca. The ritual use of morning glory seeds begins with the procedures for collecting the seeds, preceded with a vow to take the seeds, and a request to the Virgin Mary that the seeds be effective. Preparation of the seeds also include a series of rituals. They are ground and placed in water to soak and the strained liquid is drunk. If ingested whole, the seeds apparently have no effect. The drink is usually taken by a single individual, sometimes mixed with alcohol or other beverages. In some practices, the seed paste is then spread on the veins of the arms and on the top of the head. Among the Zapotec, the ingestion usually involves having a child serve the beverage to the patient. After drinking the beverage, the patient lies down and remains if the experience proceeds well. He is usually kept in a quiet secluded place, supervised by the healer. Once the effects begin, they appear only dimly aware of what is going on about them, apparently focusing upon the internal images of people and events. Visions of the plant or spirits provide information on the location of objects, causes of illness, and means of treatment. The patient speaks deliriously about these experiences throughout the session. The healers interpretation of what the patient says provides the basis for diagnosis of the problems.

The use of the morning glories among the groups of Oaxaca usually involves a "sucking ritual" designed to protect the patient from the negative effects of the plant. The healer uses a "manner of kissing while sucking with water and sometimes mescal in her mouth" (FIELDS, 1969; 207), covering the fingers, arms, shoulder, forehead and head of the patient. This is the final stage of the healing ritual, which may be repeated four and 12 hours later. Failure to complete the ritual in this fashion is believed to lead to madness or prevent the person from returning from the condition caused by the psychoactive substances. Excessive use, as well as the failure to complete properly the ritual procedures associated with the traditional treatment practices, are reported to cause serious complications: loss of one's faculties, insanity, and failure to return from the induced stupor.

The infusions from the seeds are also used to deal with a number of other circumstances and conditions (FIELDS 1969). The most common usages are in objective divination to find lost objects or causes of death and problems, and in diagnostic divination to discover causes of illness and their cures. Treatment of illness with morning glory infusions includes a number of culture bound syndromes: *espanto*, conditions caused by fright and fear; *mal ojo* (evil eye); *munia*, illness caused by anger; and *nagualismo*, conditions related to one's animal alter ego (FIELDS 1969). There are also reported uses of the seeds in practices associated with witchcraft and causing illness. A number of uses are reported related to reproductive concerns. Seed infusions are employed as a contraceptive, as well as to stimulate and facilitate labor. The infusions are viewed as giving the woman strength in labor and lessening physiological pain. Two of the alkaloids found in the morning glory seeds of *Turbina* have been employed in modern medicine in cases of difficult child-birth – one as a stimulant to smooth muscle, the other as a strong vasoconstrictor to stem excessive loss of blood (SCHULTES 1941). The other parts of the plant also have medicinal uses (MORTON 1981; FIELDS 1969). Fevers, carbuncles and swollen limbs are treated with a decoction of the leaves employed in a bath. Paralysis of limbs is treated with a heated alcohol mixture with the leaves and seeds. Rheumatic pains are relieved by the analgesic effects reported of the poultice and ointments prepared from the seeds. Teas prepared from the leaves are used to relieve urinary retention and blockages.

7. Solanaceae

There is widespread use of solanaceous plants in the Americas, with a large number of species utilized (e.g., *Datura*, *Brugmansia*, *Nicotiana*, *Brunfelsia*, *Cestrum*, *Iochroma*, *Latua*, and



Datura inoxia (= D. meteloides). *Mexico and Southwestern United States.*

Solandra) (SCHULTES & HOFMANN 1979). In addition to the near universal use of *Nicotiana* among indigenous Native American groups (e.g., see WILBERT 1988), there was also widespread employment of species of *Datura* and *Brugmansia* in religious rituals and healing.

Datura: Jimson Weed, Thorn Apple, Toloache, Torna-loco

In Mexico and the American Southwest, a number of species of Datura (exclusive of *Brugmansia*) are employed in many groups as important sacred plants in magico-religious ceremonies (SCHULTES & FARNSWORTH 1980). The genus *Datura* is rich in hyoscyamine, atropine and scopolamine, which are important in modern pharmacology (SCHULTES & FARNSWORTH 1980; SCHULTES & HOFMANN 1980). Amongst the species most commonly employed are *Datura discolor* and *D. Wrightii*. The favorite species apparently is *toloache*, *Datura inoxia* (formerly known as *D. meteloides*) (BARCLAY 1959). An early report on the use of *Datura* in Mexico is that of Hernández who listed many therapeutic applications of *toloatzin*, but with the warning that excessive use could drive a patient to madness characterised by "various and vain imaginations" (HERNANDEZ 1651). The *Badianus Manuscript* of Mexico – the first herbal of the New World, written in 1552 – lists and ilustrates several species of *Datura* for their analgesic properties (SAFFORD 1921; EMMART 1940).

A Mexican species, *Datura ceratocaula*, is a fleshy plant with rather thick, forking stems that grows in marshes; it is known as *torna-loco* ("causing insanity"), a name indicating its extreme potency as an intoxicant. The ancient Mexicans called it "sister of *ololiuqui*," and priests about to employ it as a holy medicine addressed it reverently before taking it (SAFFORD 1922). In Mexico, *toloache* (*toloatzin* in Nahuatl) is thought by some modern Indians to be inhabited by malevolent spirits, yet numerous species are employed to possibly placate the bad spirits. The modern Tarahumaras commonly add *Datura* leaves to fermented maize chicha to make it more potent in diagnosing disease and inducing visions (SCHULTES & HOFMANN 1979). Native Americans of the Southwest (e.g., Zunis, Yumans and Yokuts), as well as the Algonquins in the eastern woodlands, have used *Datura* as an ingredient of certain hallucinogenic preparations (SCHULTES & HOFMANN 1980; SCHULTES & HOLMSTEDT 1968). More extensive coverage of the physiological and therapeutic uses of *Datura* is found in JACOBS (this volume).

Brugmansia: Borrachero, Campanilla, Chamico, Guamuco, Huanto, Maicoa, Tonga

In the Andes and westernmost Amazonia several species of *Brugmansia* are employed in native societies as hallucinogens. These trees, formerly included in the genus *Datura*, are now considered to represent a distinct genus. Their chemical constitution is very similar to that of the species of *Datura*, consisting mainly of scopolamine but also with norscopolamine, atropine, noratropine and several other minor and related alkaloids (LOCKWOOD 1973). In addition to their use as hallucinogens, they have been employed in the treatment of a wide range of illness, including the treatment of rheumatic pains.

Indigenous groups in the northern Andes of Colombia, Ecuador and Peru and on the Amazonian slopes of the Andes employ as hallucinogens and folk medicines *Brugmansia aurea*, *B. dolichocarpa*, *B. sanguinea* and *B. suaveolens* (SCHULTES & FARNSWORTH 1980; SCHULTES & HOFMANN 1979). Perhaps the area where *Brugmansia* use is most active is the high, mountain-girt valley of Sibundoy, 8,000 feet above sea level and inhabited by two Indian groups, the Kamsá and Ingano (BRISTOL 1969). In this valley, *Brugmansia aurea* has eight or nine curiously atrophied "races" or strains, some of them the property of specific medicine-men, all of them

Brugmansia aurea *cv. Quinde, cultivated in Sibundoy, Colombia. (Photograph: R.E. Schultes)*

vegetatively reproduced as cultivars (BRISTOL 1969). These cultivars obviously vary in their chemical constitution, as some are much more intoxicating than others. The principal morphological differences are in the amount of malformation of the leaves, which varies from none or very little to deep and irregular tooth-like erosion; in these nine atrophied cultivars all the flowers are normal (SCHULTES & HOFMANN 1979, 1980). All of these cultivars have distinguishing names in Sibundoy – *buyés, dientes, ocre, biangán, amarón, salamán, guinde, andrés* and *munchira*. There has not been a viable explanation of the cause of these atrophied cultigens or the reason for their extreme concentration in the Sibundoy Valley. One theory suggests that they are the result of viral infection, but there is no plausible reason why such infection should be so localised (SCHULTES & HOFMANN 1980).

Having different effects, these atrophied cultivars have naturally a variety of different uses. *Buyés*, for example, is applied to lessen rheumatic pains; *biangán* is employed mainly by hunters (the leaves and flowers given to dogs is believed to sharpen their sight); the leaf of *amarón*

is valued as a suppurant; the rarest cultivar, *salamán*, with bizarrely atrophied leaves, is employed mainly as an hallucinogen; *munchira* is valued in treating erisipelas (SCHULTES & HOFMANN 1979, 1980).

There is one extremely curious cultivar which is so atrophied that it has been described as a separate genus and species: *Methysticodendron Amesianum* (SCHULTES 1955). There is still uncertainty as to whether it represents an extremely advanced atrophied cultivar or a distinct generic concept. Not only are the leaves reduced usually to a very narrow sliver, but there are several major differences in floral structure; in addition, its concentration of scopolamine is measurably higher than in any *Brugmansia* (THEILKUHL 1957). Only shamans take this hallucinogen in Sibundoy, seeing fearful visions of snakes and jaguars. Uncomfortable syndromes and after effects following its use have undoubtedly contributed to the limitation of use of *Methysticodendron* (THEILKUHL 1957).

From many viewpoints, *Brugmansias* do not induce an enjoyable intoxication, as does peyote, the sacred mushrooms or *ayahuasca*. They are considered to be plants of the gods, but since the gods want to make life a bit less enjoyable they contrive to give him these solanaceous hallucinogens as "an ever-present reminder that it is not always easy to attain an audience with the gods" (SCHULTES & HOFMANN 1979).

Methods of using *Brugmansia* drugs vary widely over an extensive area in the Andes and westernmost Amazon where the several species are cultivated. The leaves may be made into tea, taken warm or cold; they may be dried and powdered for use in food or drink; and they may be used as an additive to the *Banisteriopsis* or *ayahuasca* drink. The roots are often highly valued instead of the leaves, and sometimes the fresh bark is added to various chichas or slightly fermented beverages (SCHULTES & HOFMANN 1979). Its use in shamanistic circles usually concerns the widespread beliefs that normal life is an illusion and that the powers behind daily life are supernatural and hold the reins to real life. In some groups, the drug is used in adolescent contexts so that a boy may acquire an eternal "soul" or, amongst the Jivaros, an *aratam wakani*, the instrument which will permit him to communicate with ancestors and supernatural forces (HARNER 1973).

8. Conclusions

The indigenous cultures of the Americas have engaged in the most wide spread use of hallucinogenic species of any group of people in the world. Their cultures have attributed spiritual power to these plants, and used their sacred power in important social rituals. The ethnographic data on indigenous use of these plants illustrate a wide range of effects obtained in religious activities, social rituals and cultural therapies. Systematic differences also appear to exist between genera in use patterns, particularly the ways in which the solanaceous plants and the various snuffs are employed. The psychoactive compounds of these plants have contributed active ingredients employed in modern medicine, particularly in psychiatry. The traditions which have institutionalized the use of these plants represent a still largely untapped potential for human healing.

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