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## The New World Indians and Their Hallucinogenic Plants

RICHARD EVANS SCHULTES

*"The passionate desire which . . . leads man to flee from the monotony of everyday life . . . has made him instinctively discover strange substances. He has done so, even where Nature has been most niggardly in producing them and where the products seem very far from possessing the properties which would enable him to satisfy this desire."* (Lewin)

I.

One of the most fascinating aspects of ethnopharmacological research has centered on the study of man's use of hallucinogenic plants.

The utilization of hallucinogens—plants capable of inducing visual, auditory, tactile, taste, olfactory or other hallucinations—has always been connected in primitive societies with religion or magic. Modern sophisticated western culture has now "discovered" hallucinogens and is employing them—sometimes with cultish zeal—far differently from the almost reverential way characteristic of man who lives closer to nature in primitive societies.

Even though aborigines employ direct palliatives or remedies to treat their ailments, the psychic effects of drugs are far more important to them than the purely physical. This outlook is understandable, since most primitive societies attribute sickness and death to supernatural forces. Witchcraft—communion with the spirit world—is the prime tool in treating disease. Consequently, aboriginal doctors value the unearthly effects of hallucinogenic plants that are able to take them beyond the prosaic confines of the worldly environment to exciting realms of indescribably ethereal wonder. What better way to diagnose disease and discover its cure than for the doctor to be transported for communion with the causative forces? Thus, the hallucinogens are his "medicines" *par excellence* and early won an unshakable place in magic and religious practices which, even though often indistinguishable, are the basis of his medical practices. And most, probably all, of the hallucinogens, attracted great reverence, even rose to the rank of divinity, since man could explain these extraordinary properties only by assuming that a divine power dwelled within these most favoured of plants.

Of the many thousands of species of plants on the earth—variously estimated at from 250,000 to 800,000—only a few have been used as hallucinogens. Even a cursory survey of plant hallucinogens indicates how widely and unpredictably the known hallucinogenic plants occur in the Plant Kingdom, concentrated in the fungi and the angiosperms. It likewise hints at how tantalizingly rich in potentially psychoactive substances must be the plant world ". . . into whose silent growth and creative abundance man has not yet fully penetrated."

There must be many more species of plants with hallucinogenically active constituents than we now know. Even experimentally minded aborigines have not exhausted this field. But how many species has man used? The number seems to be fewer than one hundred. During the past half century, ethnobotanical investigation has uncovered a heartening array of such plants still employed in aboriginal societies, and there can be no doubt that an appreciable number undiscovered by modern science still lurk unheeded by the civilized world in its frantic rush. Fully half a dozen "new" hallucinogens have been discovered, even in the decade just passed.

Primitive societies of the New World utilize many more plants with vision-inducing properties than do those of the Old World—even though the floras of the two hemispheres would seem to be more or less comparably well supplied with species possessing psychoactive constituents. Fully sixty species are known to be employed hallucinogenically by Indians of the New World as compared with fewer than a dozen in primitive Old World societies.

There is an urgency for research into hallucinogenic plants amongst aboriginal peoples. Civilization is on an ever more accelerated march, penetrating most regions of the world still held by primitive societies. The consequent divorcement of aboriginal peoples from dependence upon their vegetal environment for the necessities and amenities of life has been set in motion; nothing will now check it. The resulting disintegration of knowledge of plants and their properties is frightening. Our challenge must be to salvage native botanical lore—especially that relating to folk medicine in its broadest sense—before it



Fig. 1. Flowering head of the peyote cactus (*Lophophora Williamsii*). Photograph by R. E. Schultes.

becomes forever entombed with the cultures that gave it birth.

A survey of the New World hallucinogens might be made from the botanical, chemical or geographical viewpoint. For the purposes of this short summary, the geographical viewpoint seems to offer the easiest way of accommodating all of the hallucinogens used in North, Central and South America. The following hallucinogens will be considered: sweet calomel, mescal bean, peyote; *gí-i-wa*; *teonanacatl*; *ololiuqui*, *sinicuichi*; *yerba de la virgen*; *zacatechichi*; *toloache* and other *Datura* species; *ayahuasca*, *caapi*, *yajé*; *yakce*, *epená*, *nyakwana*, *paricá*; *yopo*; *vilea*; *huilca*; *yurema*; *rapé dos indios*; *cimora*; *San Pedro*; *keule*; *taglli*; *taique*; *tupa*; *latuéc*; and several other psychoactive plants.

## II.

**Acorus:** There is some evidence that the Indians of northern Canada chewed the root of *Acorus Calamus*—*flag root* or *sweet calomel*—for medicinal and stimulant purposes but that excessive doses of this aroid induced strong visual hallucinations. The hallucinogenic principle has been reported to be *asarone* and  $\beta$ -*asarone*.

**Sophora:** *Sophora secundiflora*, a leguminous shrub of the drier areas of the American Southwest and

northern Mexico, yields the *mescal beans* formerly employed as an oracular and divinatory medium for visions in initiation rites in the ceremonial Red Bean Dance of the Plains Indians. Historical reports of mescal beans go back to 1539, but archaeological remains dating back earlier than 1000 A.D. suggest ritualistic use. Its utilization as an hallucinogen died out with the arrival in the United States of the much safer peyote cactus, since mescal beans, which contain the quinolizidine alkaloid, *cytisine*, can cause death by asphyxiation.

**Lophophora:** *Peyote*, or *Lophophora Williamsii*, one of the most ancient sacred hallucinogens of Mexico, is still in use in Mexico and the United States. This cactus is a small, grey-green, spineless, napiform plant containing up to 30 phenylethylamine and isoquinoline alkaloids, one of which—*mescaline*—induces visual hallucinations.

*Peyote* was first described by Hernández who, shortly after the Conquest of Mexico, studied the folk medicine of the Aztec and wrote about the strange properties of *Peyotl zacatecensis*. Many other early chroniclers detailed the strange effects of this cactus, saying that it "causes those devouring it to be able to foresee and predict things . . . or to discern who has stolen from them . . .; and other things of like nature . . ." *Peyote* rites persist to the present time in northern Mexico, where the Tarahumares, Huichols and other Indians sacramentally eat the dried discoidal tops of the plant—the so-called "mescal buttons"—which have been ceremonially gathered. Known to the Indians of the United States at the time of the Civil War, *peyote* was adopted as a sacred plant, central element of a *peyote* cult indigenous to the Plains Indians, in the 1880's. The new religion spread fast and now, organized into the Native American Church, claims 250,000 believers in many tribes in the United States and Canada.

The mescal buttons are virtually indestructible and can be shipped long distances from the rather limited area of the plant's growth in central and northern Mexico and the Rio Grande Valley in Texas.

The visual hallucinations induced by the ingestion of *peyote* are so unearthly that they are responsible for the Indian beliefs in the supernatural, even divine, powers of this cactus; they have likewise greatly interested the modern scientist. Characterized by the most bizarre series of visions in indescribably rich colours, they continue in a kaleidoscopic motion for long periods of time, often synchronized with auditory, tactile and other hallucinations. The intoxication seldom has unpleasant after-effects and normal use of this narcotic, which is not addictive, is apparently not physically nor socially harmful. The

peyote religion of the American Indians teaches the highest moral concepts and has become an integral part of Indian life.

Peyote is considered by all Indians who use it a supernatural stimulant and medicine, as well as a sacrament, and is employed in cross-country running and hunting and in the treatment of a great variety of bodily ills.

**Ariocarpus, Epithelanthus, Pachycereus:** Sundry Mexican cactus genera are known to contain alkaloids which are potentially hallucinogenic but only several have been reported as actually employed by natives for their narcotic properties.

The Tarahumare Indians of northern Mexico use *Ariocarpus fissuratus*, called *sunamí* and *peyote cimarrón*, asserting that it is stronger than *Lophophora Williamsii*. Anhalonine has been isolated from an indeterminate species of *Ariocarpus*.

These same Indians likewise value *Epithelantha micromeris* as a narcotic. It is said "to make the eyes large and clear to see sorcerers, to prolong life and to give speed to runners." Chemical studies apparently have not yet been carried out on this cactus.

The gigantic *Pachycereus pectin-aboriginum*, called *cawé* by the Tarahumares, is employed as a narcotic, but whether or not it has truly hallucinogenic properties has not been established. Carnegine has been reported from this species, and an allied species, *P. marginatus*, contains pilocereine.

**Ipomoea, Rivea:** The Aztecs ingested for purposes of divination and in magico-religious ceremonies a small lentil-like seed which they called *ololiuqui*. It came from a vine with cordate leaves known as *coaxihuitl* or "snake plant."

Although the use of this narcotic persists to modern times, it has only recently been definitively identified as a member of the Morning Glory Family or Convolvulaceae: *Rivea corymbosa*. A second Mexican morning glory, *Ipomoea violacea*, has likewise recently been found utilized in the same way.

A number of references to *ololiuqui* and several illustrations in the early Spanish literature indicated that it was convolvulaceous. Hernández, who studied Aztec medicine between 1570 and 1575, wrote that "... it will not be wrong to refrain from telling where it grows, for it matters little that this plant be here described or that Spaniards be made acquainted with it." Another early record, dated 1629, reported that "... when it is drunk, this seed deprives of his senses him who has taken it, for it is very powerful." Still another referred to *ololiuqui* which "... deprives those who use it of their reason. The natives communicate ... with the devil ... when they become intoxicated with *ololiuqui*, and they are de-



Fig. 2. Capsules and seeds of *Rivea corymbosa*, the narcotic *ololiuqui* of the Aztecs. Drawn by G. W. Dillon.

ceived by the various hallucinations which they attribute to the deity which they say resides in the seeds ... " And, in 1634, one chronicler reported the confession of an Indian who said, "I have believed in dreams, in magic herbs, in peyote, and in *ololiuqui*, in the owl, etc."

A more medically oriented document from early Mexico stated that for treating "... a serious fever, the medicine man advised the patient to take *ololiuqui*. The patient refused. Finally, however, the medicine man persuaded all members of the family ... to drink *ololiuqui* to help the patient ... All became drunk ... and when they regained their senses, the sick man began to rage in agony, calling the doctor a knave and witch. With this, the patient died. It is not without concern that Christian priests see the facility with which the devil works amongst these people, even after they have been ... accepted into the church."

*Ololiuqui* was used also as a magic potion. Aztec priests, before making sacrifices "... took a large quantity of poisonous insects ... burned them ... and beat their ashes together ... with the foot of the *ocotl*, tobacco, *ololiuqui* and some live insects ...

rubbed themselves with this diabolical mixture and ... became fearless to every danger." One report actually ascribed analgesic properties to ololiuqui, saying that it was able "... to benumb the flesh, being applied in the manner of an em plaster ... and for that it did appease and benumb the pain, they held it for an effect of health and a divine virtue."

Botanists first suggested that ololiuqui belonged to the Convolvulaceae in 1854, and later Mexican botanists reiterated this belief, even though no toxic principle was known in the morning glories.

In 1911, it was first suggested that ololiuqui was not convolvulaceous, but solanaceous. In 1915, an American ethnobotanist definitely identified ololiuqui as *Datura meteloides*—obviously an hallucinogen—but disregarded the very definite indications and illustrations in the early literature that a "vine-like" plant was involved. This "identification" gained wide acceptance, despite the opinion of several that a morning glory was the source plant. It was not until 1939 that botanical specimens employed as a divinatory hallucinogen were collected in Oaxaca and the utilization of a morning glory was authenticated.

Little interest in this discovery was evidenced until 1955, when psychologists found that seeds of *Rivea corymbosa* were, in reality, psychoactive. Early phytochemical studies on this plant, however, failed to disclose any biodynamic constituents. It was not until the discoverer of LSD—Hofmann—investigated *Rivea corymbosa* that lysergic acid derivatives were isolated from this species. Previously, these potent principles were known only from the ergot fungus, *Claviceps purpurea*. Their discovery in one of the most advanced families of the higher plants was, to say the least, surprising.

Now these organic constituents are known not only from *Rivea corymbosa* but also from *Ipomoea violacea*, the other convolvulaceous species employed in Oaxaca as an hallucinogen. The lysergic acid derivatives responsible for the psychotomimetic activity of these morning glories are: ergine and isoergine. Chanoclavine, elymoclavine and lysergol, all present in the seeds of *Rivea corymbosa*, seem not to be involved in the intoxication produced by the plant itself. Seeds of *Ipomoea violacea* lack lysergol but have another compound, ergometrine, which is absent in *Rivea* seeds.

The seeds of *Ipomoea violacea* have been identified as the *tlitliltzin* of the ancient Aztecs: this term is a Nahuatl word for "black," with a reverential suffix added. The seeds of *Ipomoea violacea* differ from those of *Rivea corymbosa* in another respect, in being jet black. An old chronicler wrote of "ololiu-

qui, peyote and *tlitliltzin*," ascribing to all three the same properties.

Recent phytochemical studies have indicated that sundry species of the Convolvulaceae contain these indole derivatives. Various species of *Argyrea*, *Convolvulus*, *Ipomoea* and *Stictocardia* have been reported as containing these bases; and a number of horticultural derivatives of *Ipomoea violacea* are known to contain them in sufficient concentration to intoxicate, a fact which certain fringe groups in European and American society were not long in discovering and in utilizing. The abuse of the hallucinogenic employment of convolvulaceous seeds became so serious at one time that law enforcement agencies in Europe and the United States were forced to take steps towards controlling their non-horticultural use.

**Cytisus:** Yaqui medicine-men in northern Mexico employ *Cytisus canariensis*, a leguminous shrub native to the Canary Islands and introduced into Mexico. Known also as *Genista canariensis*, this plant is rich in cytisine, a highly toxic quinolizidine alkaloid commonly found in the Leguminosae.

**Calea:** One of the most recently discovered hallucinogens involves *Calea Zacatechichi*, a popular Mexican folk-medicine, an inconspicuous composite shrub ranging from central Mexico to Costa Rica.

Although there seems to be no magico-religious cult connected with this plant, the Chontal Indians of Oaxaca, believing in the visions they see in dreams, take a tea and smoke cigarettes of the dried leaves of *Calea Zacatechichi* whilst lying down quietly. It is valued as "a clarifier of the senses" by the Chontal medicine-men who call the leaf *thle-pela-kanó* or "leaf of god."

Preliminary chemical examination has disclosed the presence of an alkaloid, still uncharacterized, in this shrub.

**Salvia, Coleus:** It is surprising to find members of the Mint Family utilized as hallucinogens in Mexico.

In Oaxaca, the Mazatec value the crushed leaves of *Salvia divinorum*, known as *hierba de la Virgen* or *hierba de la Pastora*, in divinatory rites when other more potent hallucinogens are not available. It has been suggested that *Salvia divinorum* may represent the *pipiltzintzintli* of the ancient Aztecs.

A toxic constituent has still not been found in this mint, even though investigators have experimentally substantiated its psychotomimetic effects.

The leaves of two other labiates—*Coleus pumila* and *C. Blumei*, both native to southeast Asia—are similarly employed by the Mazatec Indians of Oaxaca for inducing visions. Chemical studies of these two species, at least on the basis of Mexican material of

reputed hallucinogenic properties, have not been carried out, and no psychoactive principle is known from the genus.

**Heimia:** An interesting and still poorly understood Mexican hallucinogen is the lythraceous *Heimia salicifolia*, known by its Aztec name *sinicuichi*. This narcotic is an interesting auditory hallucinogen, but it does not induce visual hallucinations.

The leaves, slightly wilted, are crushed in water, and the juice is set in the sun to ferment. The resulting drink is mildly intoxicating, causing giddiness, drowsy euphoria, a darkening of the surroundings, a shrinking of the world around, altered time and space perception, forgetfulness, auditory hallucinations and removal from a state of reality. Sounds seem to come distorted from a great distance. The natives hold *sinicuichi* to be sacred, endowed with supernatural powers: that it helps them recall vividly events of many years earlier, that it permits them even to remember prenatal events.

Five quinolizidine alkaloids have been found in *Heimia salicifolia*. The major psychoactive alkaloid appears to be cryogenine, which has been shown experimentally to "mimic qualitatively and semi-qualitatively the action of the total alkaloid extract" of the plant.

**Rhynchosia:** A number of species of the leguminous genus *Rhynchosia*—especially *R. phaseoloides* and *R. pyramidalis*—are called *piule* in southern Mexico, a kind of generic term signifying narcotics and sometimes applied to the hallucinogenic morning glory seeds. The red-and-black beans of *Rhynchosia* are equated together with hallucinogenic mushrooms on the slopes of Mt. Popocatepetl and are said sometimes to be ingested with the fungi.

There is vague evidence that, in southern Mexico, *Rhynchosia* seeds may be employed as a divinatory narcotic. The Indians recognize them as toxic. Although there seem to be no definite indications in the literature of their narcotic use in pre-Conquest times, they may be represented, together with mushrooms, falling from the hand of the Aztec god of rain, in the Tepantitla fresco dating from 300-400 A.D.

The chemistry of *Rhynchosia* seeds is not well known. An unidentified alkaloid has been reported in *Rhynchosia pyramidalis*.

**Erythrina:** In some parts of Mexico, seeds of several species of the leguminous *Erythrina* may have been used locally as hallucinogens. They resemble those of *Sophora secundiflora*, are sometimes sold in native market places mixed together; and they are both called *colorines*. The seeds of several species of *Erythrina* contain toxic indole or isoquinoline derivatives.

**Lycoperdon:** The Mixtecs of Oaxaca employ several puffballs as hallucinogens. One species, *Lycoperdon marginatum*, characterized by a strong odour of excrement, is known in Mixtec as *gí-i-sawa* or "fungus of secondary quality." The other and more active species, *Lycoperdon mixtecorum*, is called *gí-i-wa* or "fungus of first quality." They do not appear to be so important as the hallucinogenic mushrooms are amongst the neighbouring Mazatec.

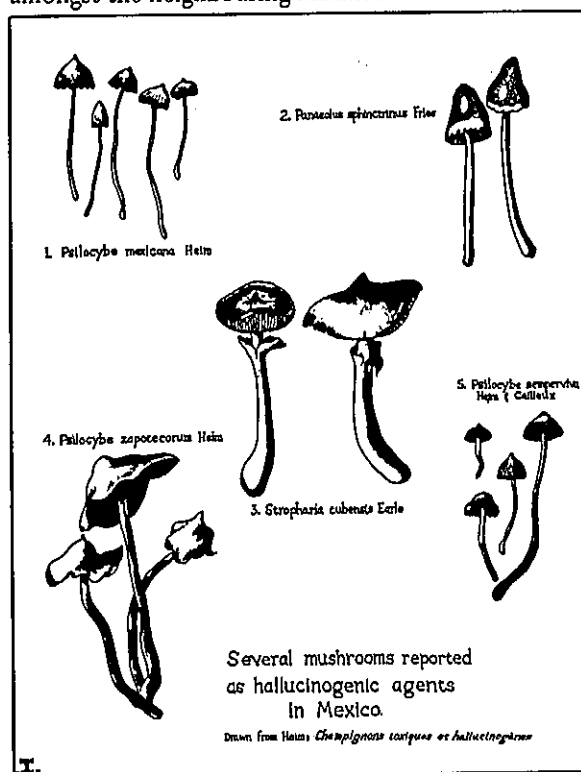


Fig. 3. Hallucinogenic mushrooms of Mexico. Drawn by I. Brady.

After ingestion of one or two specimens, one experiences a state of half-sleep and hears voices and echoes. The voices respond to questions posed to them. These puffballs may not produce visual hallucinations, but they definitely are auditory hallucinogens, if the reports of the natives are to be accepted. As yet, there is no chemical basis on which an evaluation of the reported effects of these fungi can be made; no psychoactive constituent has been reported from the puffballs.

**Conocybe, Panaeolus, Psilocybe, Stropharia:** The conquerors of Mexico found the Aztecs and other Indians using hallucinogenic mushrooms in religious and divinatory rites and in witchcraft. The sacred mushrooms—known by the Aztecs as *teonanacatl* ("flesh of the gods")—permitted them to commune with the spirit world.

The early Spanish chroniclers made many references to these "diabolic mushrooms" and described their effects and the rites surrounding their employment in great detail. European persecution drove the cult into hiding in the hinterlands, and no evidence that the narcotic use of mushrooms had persisted was uncovered until about 30 years ago. Modern botanists even postulated that teonanacatl was peyote: that, since the dried crown of the cactus resembled a dried mushroom, early writers had confused the two or had been deliberately duped by the Aztecs.

Finally, in the late 1930's, several investigators found an active mushroom cult amongst the Mazatecs in Oaxaca and collected *Panaeolus sphinctrinus* and *Stropharia cubensis* as the active mushrooms. Later work has established that more than two dozen species in at least four genera are hallucinogenically employed in six or more Mexican tribes. Further-

more, it now appears that mushroom worship is very ancient and was once spread over a much wider area. Archaeological "mushroom stones," excavated in great numbers from highland Mayan sites in Guatemala, are dated at 1000 B.C. They consist of a stipe with a human or animal face crowned with an umbrella-like top. They indicate the probability of a sophisticated mushroom cult at least 3000 years ago.

While there are many species known to be employed—and many more known to possess the hallucinogenic constituents but apparently not used—the most important in Oaxacan mushroom rites are apparently *Psilocybe aztecorum*, *P. caerulescens*, *P. mexicana*, *P. zapotecorum* and *Stropharia cubensis*. All contain an extraordinarily psychoactive indolic compound with a phosphorylated hydroxyl group—psilocybine—and sometimes also the unstable derivative psilocine. Psilocybine is the only natural indole with a phosphoric acid radical known from the Plant Kingdom. It has been isolated from various species of *Conocybe*, *Panaeolus*, *Psilocybe* and *Stropharia* and appears to be restricted to the mushrooms.

It is interesting to note that early Jesuit missionaries in the Peruvian Amazon reported that the Yurimagua Indians prepared an intoxicating beverage from a "tree fungus." *Psilocybe yungensis* has been suggested as a possible identification of this mushroom, but no evidence points to its use in the region at the present time.

**Datura:** One of the most ancient narcotics in both the Old and New Worlds is *Datura*. Several species of this solanaceous genus—especially *D. innoxia* (*D. meteloides*) and *D. Stramonium*—have been valued as hallucinogens in religious, divinatory, curative and other magic rites in Mexico and other parts of North America.

In the dry American Southwest, many tribes have utilized *Datura innoxia* ceremonially, with a noticeable concentration in California, Arizona and New Mexico. The Zuñis, for example, employ it extensively not only as a narcotic but also as an anaesthetic and in the treatment of wounds and bruises. The rain-priests put the powdered root into the eyes when they commune with the spirits of the dead who intercede for rain. The Zuñis hold that this plant had a divine origin. In Mexico, this and other species of *Datura* are called *toloache* and still retain their ancient ritualistic uses for divination, prophecy and in treating disease.

Even in the American Northeast, the Algonquins and other tribes employed what is thought to have been *Datura Stramonium*—the jimson weed—as the chief ingredient in an inebriating medicine called *wysocean* that was given to youths undergoing



Fig. 4. Mushroom stone of the last pre-classic Maya period, 500 B.C. to 200 A.D.

initiation rites. The adolescents "... become stark, staring mad, in which raving condition they are kept eighteen to twenty days. Thus, they unlive their former lives and commence men by forgetting that they have ever been boys."

All of the South American representatives of *Datura* are arborescent and belong to the subgenus *Brugmansia*, sometimes treated as a distinct genus. They are all native to the Andean highlands—*D. arborea*, *D. aurea*, *D. candida*, *D. dolichocarpa*, *D. sanguinea*, *D. vulcanicola*—or to the warmer lowlands—*D. suaveolens*. They are handsome trees, well known in horticulture, but they appear to be chromosomally aberrant cultigens unknown as wild plants. Their classification has long been and still remains uncertain: usually considered to represent six or seven species, the tree *Daturas* have recently been thought to comprise three or four species and a number of cultivars.

In South America, the preparation and use of *Datura* differ widely. It is most frequently taken in the form of pulverized seeds, sometimes dropped into beverages. The intoxication, fraught with grave dangers because of the extreme toxicity of the alkaloids, is marked by an initial state of violence so furious that the partaker must be restrained until a deep, disturbed sleep overtakes him. The visual hallucinations are interpreted as spirit visitations.

Amongst the Ecuadorian Jívaro, for example, *Datura* is employed to correct refractory children in the belief that ancestral spirits carry out the admonishing. The Chibcha of Colombia anciently gave women and slaves potions of *D. aurea* to induce stupor prior to their being buried alive with departed husbands or masters. The Inca are also known to have valued *Datura* as an intoxicant. It is still important in many areas from Colombia to Chile, along the Pacific Coast of northern South America and in certain parts of the Amazon. The Kamsá and Ingano tribes of Sibundoy in the southern Colombian highlands use *Datura* extensively: they even preserve for use and propagate vegetatively highly atrophied, named clones of several species. There is even a report of witch-doctors of the Ecuadorian highlands taking lessons recently from Jívaro medicine-men to re-introduce its use into the populous and now civilized Andean tribes.

Accurate identification of the species used by the tribes for special purposes leaves much to be desired, but since most species are known to contain similar tropane alkaloids—hyoscyamine, nor-hyoscyamine and scopolamine, varying usually but in relative concentrations—this problem is not so serious as in the case of certain other narcotics.



Fig. 5. *Datura sanguinea* in flower and fruit. Bogotá, Colombia. Photograph by R. E. Schultes.

What may represent possibly an extreme variant of an indeterminate species of tree-*Datura* has been described as a distinct genus: *Methysticodendron Amesianum*. Native to the high, mountain-girt Sibundoy Valley in southern Colombia, where it is one of the most valued hallucinogens of the Kamsá and Ingano, this plant appears to be a strict endemic known only in cultivation. Like the tree-*Daturas*, it contains the tropane alkaloids—with up to 80% of the total alkaloid content comprising scopolamine.

**Brunfelsia:** Evidence for the narcotic use of the solanaceous genus *Brunfelsia* is quite real but not yet corroborated by a good body of evidence and field observation. Several species may have been employed in the Amazon as hallucinogens, and one species is known to be added to the narcotic *Banisteriopsis* drink by the Jívaro in Ecuador. *Brunfelsia Tastevini* is reputedly utilized by the Kachinawa Indians of the Brazilian Amazon to prepare an hallucinogenic drink, but this report needs confirmation. Several vernacular names likewise seem to indicate former use of *Brunfelsia* as an intoxicant.

We know that chemical constituents in *Brunfelsia* are psychoactive, so there is no reason why these plants could not have been employed as vision-inducing intoxicants.

**Latua:** A century ago, a spiny shrub or small tree of Chile, now called *Latua pubiflora*, the only member of an endemic solanaceous genus, was identified as a virulent poison inducing delirium and visual hallucinations. It was employed by local Indian witch-doctors, who knew the shrub as *latué* or *árbol*



Fig. 6. *Datura vulcanicola* in flower. Volcán de Puracé, Departamento del Cauca, Colombia. Photograph by R. E. Schultes.

*de los brujos*, to cause permanent insanity.

Phytochemical studies indicate the possible presence of tropane alkaloids.

**Banisteriopsis:** In 1851, the British plant explorer Spruce discovered a bizarre hallucinogen in use amongst the Tukano of the upper Rio Negro basin in Brazil. Known as *caapi*, the drug was taken in magico-religious rites. Spruce identified it as a new malpighiaceae species, now known botanically as *Banisteriopsis Caapi*. Several years later he encountered the hallucinogen *ayahuasca* in Ecuador and surmised correctly that it was from the same plant. At about the same time, in 1858, Villavicencio, in his *Geografía del Ecuador*, wrote that the Zaparo, Angaitero, Mazan and other tribes of Amazonian Ecuador took the drug to foresee the future, discover the truth, help deliberate war, attack and defense, learn the source of hexing, welcome foreign visitors, ascertain the love of their women.

Probably no hallucinogenic preparation has been so fraught with confusion, primarily because of careless research or even guesswork. Known by a number of local native names, the intoxicating drink prepared from *Banisteriopsis Caapi*, or the now more recently described *B. inebrians*, is called *ayahuasca*, *caapi*, *yajé*, *natém pinde* or other epithets. It is employed in the western half of the Amazon basin, especially near the foothills of the Andes, and by

natives living in the rain-forests on the western slopes and Pacific coast of Colombia and Ecuador. In some areas, a cold water infusion is prepared from the bark; in other localities, the bark is subjected to long boiling in manufacturing the drink. While *Banisteriopsis Caapi* is normally employed as a drink, it may also be used as a snuff. Harmala alkaloids typical of this species have been reported from a snuff prepared from "a vine" said to be also the source of an intoxicating drink.

It has been proposed that the apocynaceous *Prestonia amazonica* (*Haemadictyon amazonicum*) was the source of *yajé*, whilst *ayahuasca* and *caapi* were derived from malpighiaceae species. This idea, widely established in ethnological and chemical literature, has been shown to be erroneous by recent studies.

To this day, the natives of the northwest Amazon use *Banisteriopsis* for prophetic, divinatory and magic purposes and to fortify the bravery of male adolescents about to undergo the painful *yuruparí* ceremony of initiation. The narcosis may be violent and with unpleasant after-effects, but these effects may be due to certain admixtures or to the boiling of the bark of the *Banisteriopsis* liana. Usually the intoxication—especially when a cold water infusion of the bark is taken with no admixtures—has no unpleasant after-effects; the intoxication itself is characterized by a pleasant euphoria, followed by visual hallucinations in colour but initially very often more or less tinged with blue or purple. In excessive doses, it brings on frighteningly nightmarish visions and a feeling of extremely reckless abandon, although consciousness is not lost nor is the use of the limbs unduly affected.

The bark of *Banisteriopsis Caapi* and *B. inebrians* have  $\beta$ -carboline alkaloids such as harmine, harmaline, d-tetrahydroharmine as the active constituents.

A variety of plant materials are occasionally added to the drink prepared basically from bark of *Banisteriopsis Caapi* or *B. inebrians*. These include plants definitely known to be toxic or narcotic, such as *Datura suaveolens* or species of *Brunfelsia*. Tobacco is said also to be employed as an admixture. The Tukanos of the Río Vaupés utilize five or six "vines," as yet botanically unidentified, as additives. Perhaps the most interesting are the leaves of another species of *Banisteriopsis*, *B. Rusbyana* and of *Psychotria viridis*, added to heighten and lengthen the hallucinations. Analysis of leaf material of these two additives has indicated the presence of the highly hallucinogenic N,N-dimethyltryptamine, thus substantiating the natives' assertion that the addition of these leaves increases the psychotomimetic activity of the narcotic drink.

**Tetrapteris:** The Makú Indians in the northwesternmost sector of the Brazilian Amazon prepare an hallucinogenic drink from the malpighiaceae vine *Tetrapteris methystica*. A cold water infusion of the bark with nothing added has a yellowish hue and induces an intoxication characterized by visual hallucinations very similar to that of the *Banisteriopsis* preparations.

The Indians of this area called the drink *caapi*, the name applied also to the *Banisteriopsis* drink. Several earlier writers mentioned more than one "kind" of *caapi* in the region. This *Tetrapteris* preparation may represent the *caapipinima* ("painted *caapi*") reported from the Rio Uaupés of Brazil.

No chemical studies have been made of this species, but it is probable that the active constituents are the same or similar to those of the related species of *Banisteriopsis*.

**Anadenanthera:** In the Orinoco Valley of Colombia and Venezuela and adjacent parts of Brazil, a snuff called *yopo* or *ñopo* is prepared from the beans of the leguminous tree *Anadenanthera peregrina*. This species has also been called *Piptadenia peregrina*. Von Humboldt, Spruce and other explorers encountered the snuff and were impressed with its hallucinogenic potency.

This same snuff represents probably the ancient *cohoba* encountered in use in Hispaniola by Columbus' second voyage in 1496 but now apparently no longer employed in the West Indies due to the near-extinction of aborigines in these islands.

The beans of the tree—an inhabitant normally of open savannah-like areas—are roasted, crushed and mixed with ashes or calcined shells, but there is some variation in preparation from tribe to tribe. The powder is blown into the nostrils through bamboo tubes or snuffed individually through bird-bone tubes. The intoxication is often characterized by fury, followed by an hallucinogenic trance and an eventual stupor.

Five indoles have been isolated from these beans, including N,N-dimethyltryptamine and the related bufotenine.

Indirect evidence suggests that another species, *Anadenanthera colubrina*, may once have been valued as the source of narcotic snuffs known as *vilca* or *huilca* in southern Peru and Bolivia, and known as *cébil* in northern Argentina. Closely related botanically to *Anadenanthera peregrina*, this species has a very similar chemical composition and may well have been the source of these southern hallucinogenic snuffs.

**Mimosa:** An infusion of the roots of the leguminous *Mimosa hostilis* and possibly other species forms

the centre of the ancient Yurema Cult of the Karirí, Pankarurú and other Indians of the State of Pernambuco in eastern Brazil. This "miraculous drink," said to induce glorious visions of the spirit world, was taken by priests, warriors and strong young men and enabled them to "catch a glimpse of the clashing rocks that destroy souls of the dead journeying to their goal or to see the Thunderbird shooting lightning from a huge tuft on his head and producing claps of thunder by running about." An early report of yurema dates from 1788, and another, from 1843, asserted that it was taken "to pass the night navigating through the depths of slumber."

The active principle in the root of *Mimosa hostilis* has been identified as N,N-dimethyltryptamine, the same constituent largely responsible for the psychoactive effects of the seeds of the related *Anadenanthera peregrina*.

**Olmedioperebea:** A narcotic snuff of the Pariana regions of the central Amazon of Brazil, known locally as *rapé dos indios* ("Indian snuff") is reputedly prepared from fruits of the moraceous jungle tree *Olmedioperebea sclerophylla*. Nothing is known of its chemical constituents.

**Virola:** Hallucinogenic snuffs—known as *epená*, *nyakwana*, *paricá* or *yakee*—are prepared in northwestern Brazil and adjacent Colombia and Venezuela from the red bark-resin of the myristicaceous genus *Virola*. At least three species are employed: *Virola calophylla* and *V. calophylloidea* in Colombia, *V. theiodora* in Brazil.

The most intense use of this snuff centres amongst the Waiká Indians of the uppermost sources of the



Fig. 7. *Banisteriopsis Caapi* cultivated by Barasana Indians. Río Piraparaná, Comisaria del Vaupés, Colombia. Photograph by R. E. Schultes.

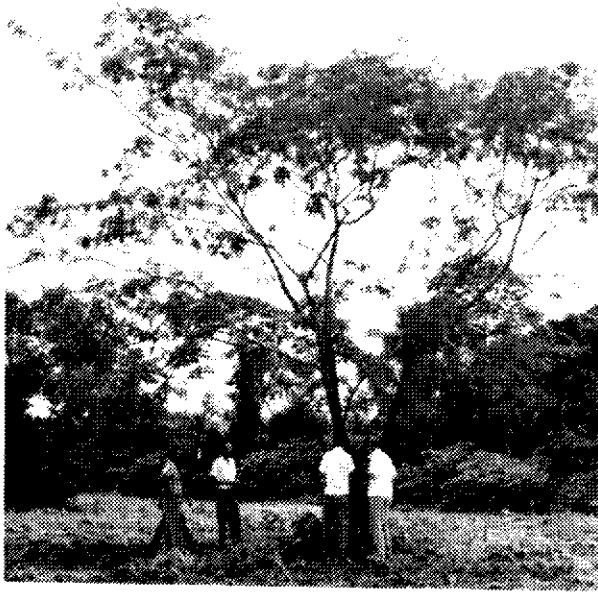


Fig. 8. Tree of *Anadenanthera peregrina* in the campos or open grasslands near Bôa Vista, Rio Branco, Brazil. Photograph by R. E. Schultes.

Orinoco in Venezuela and along the northern tributaries of the Rio Negro in Brazil. Unlike the various Colombian tribes, where only witch-doctors take it, the intoxicant is employed amongst the Waiká by essentially all adult males, either individually at any time or ritually in excess at endocannibalistic ceremonies.

The method of preparing the snuff varies slightly, according to the tribe. In Colombia, the Indians usually strip the bark from jungle trees, scrape off the soft inner bark with its resinous exudation. This fresh tissue is kneaded and squeezed in water which is strained and boiled to a thick syrup. When the syrup is sun dried, it is pulverized, sifted and mixed with ashes of the bark of a wild species of cacao. Some Waiká in Brazil hang this soft inner bark material over the fire to dry slowly. When snuff is needed, they crush and pulverize this resin-containing tissue, add to it the pulverized leaves of the acanthaceous *Justicia pectoralis* var. *stenophylla* and bark ashes of the beautiful leguminous forest tree *Elizabetha princeps*. Still other groups of Waiká collect from freshly felled

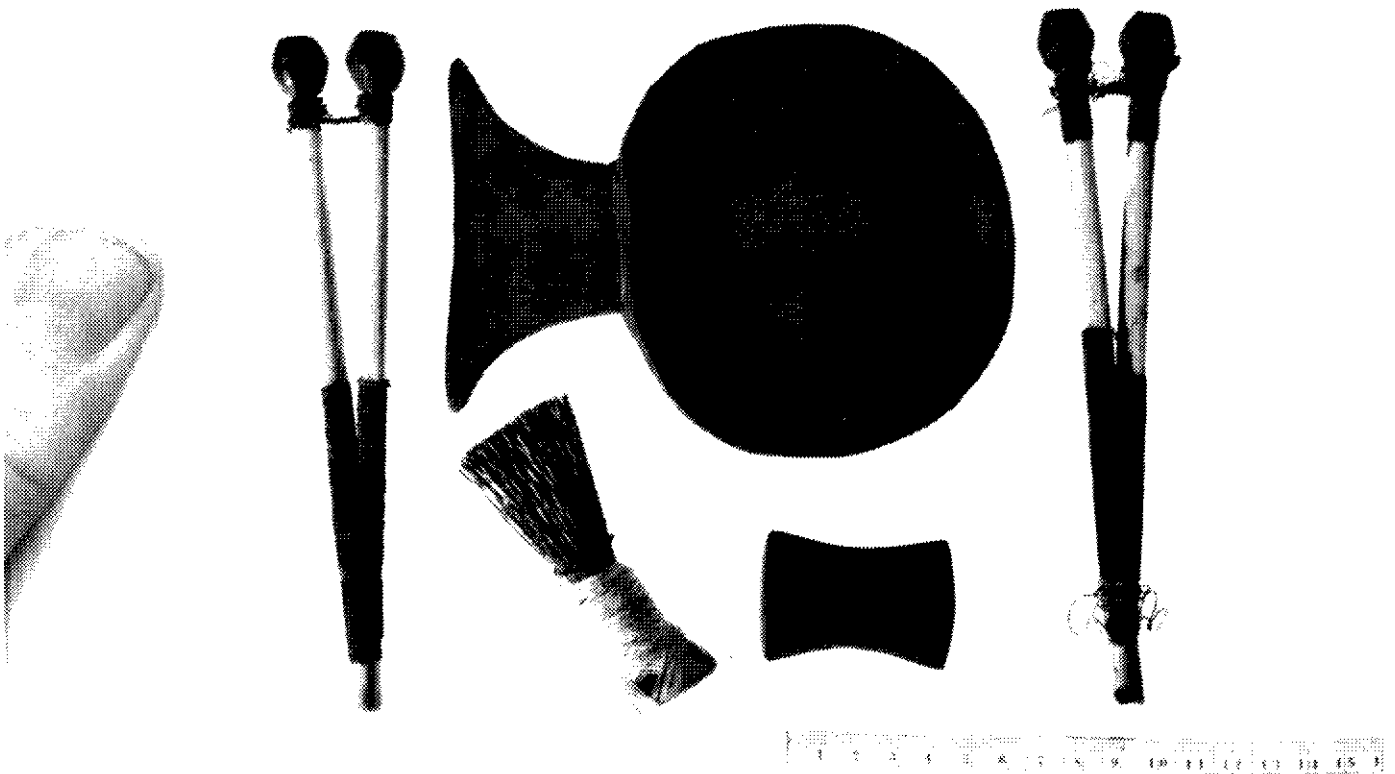


Fig. 9. Snuffing tubes of bird bones and tray mortar and pestle for grinding roasted seeds of *Anadenanthera peregrina* and mixing with lime to prepare yopo snuff. Rio Orinoco, Venezuela. Courtesy Botanical Museum of Harvard University.

*Viola* trees in the forest the resin itself, boil the resin down to a thick paste which, after sun-drying, is crushed, pulverized and utilized with no admixtures. The snuff made in this third way appears to be the most active.

Recent studies have indicated that the resins of a number of species of *Viola* possess tryptamines. The Waiká snuff prepared solely from resin of *Viola theiodora* contains several active tryptamines with the extremely psychoactive 5-methoxy, N,N-dimethyl-tryptamine in especially high concentrations.

*Viola* intoxication varies but usually includes initial excitability, numbness of the limbs, muscular incoordination, nausea, visual hallucinations and, finally, a deep disturbed sleep. Macroscopia—seeing things greatly enlarged—is frequent and enters into Waiká beliefs about *hikura*, the spirit dwelling in the *Viola* tree.

The Witoto, Bora and Muinane tribes of Amazonian Colombia utilize the resin of a *Viola*—possibly *V. theiodora*—orally as an hallucinogen. Small pellets of the boiled resin are rolled in a “salt”



Fig. 10. Makuna apprentice witch-doctor about to inhale snuff made from *Viola* resin through the bird-bone snuffing tube. Río Popeyaká, Comisaría del Amazonas, Colombia. Photograph by R. E. Schultes.

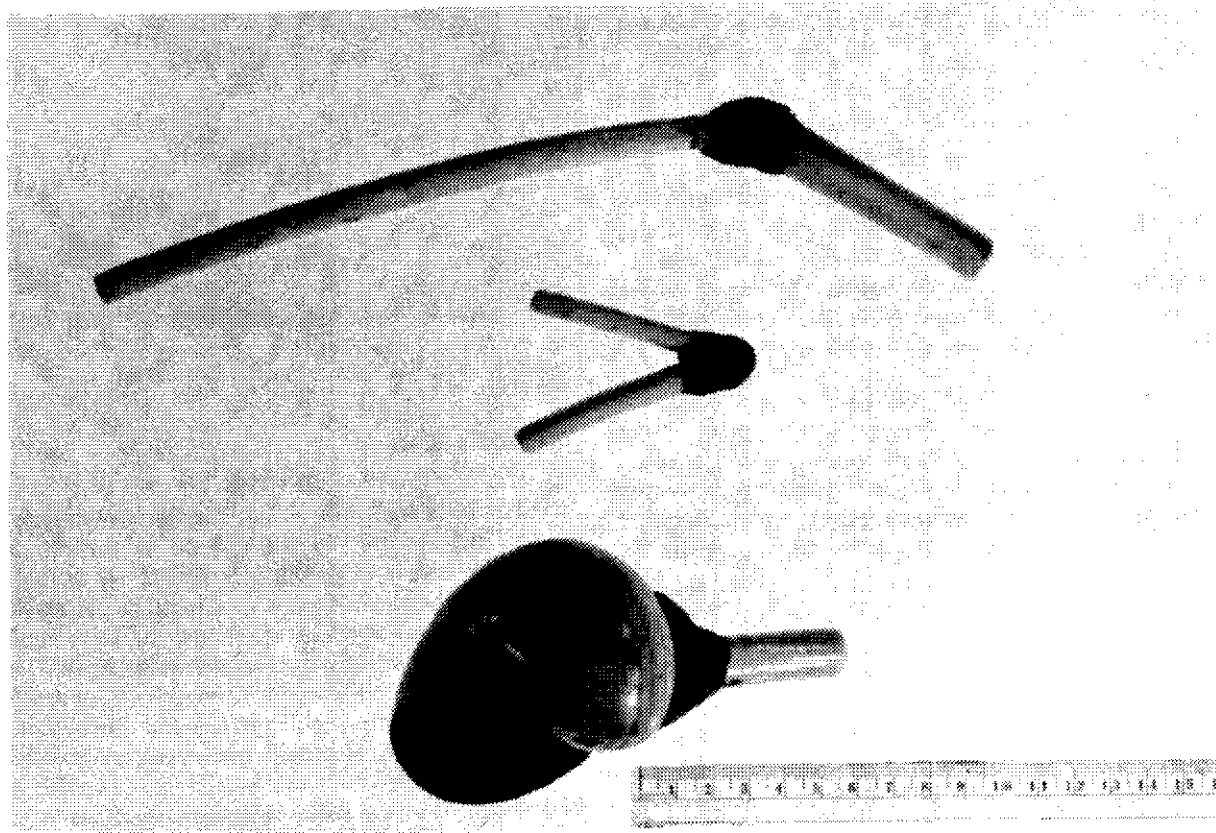


Fig. 11. Snuffing tubes and snail-shell snuff-box of the Makuna Indians, Río Piraparaná, Colombia. Courtesy Botanical Museum of Harvard University.

left upon evaporation of the filtrate of bark ashes of the Icycythidaceous *Gustavia Poeppigiana* and ingested to bring on a rapid intoxication, during which the witch-doctors see and speak with "the little people." There are indirect suggestions, still to be corroborated by ethnobotanical field studies, that Venezuelan Indians may smoke *Virola sebifera* as an intoxicant.

**Trichocereus:** Several species of the South American cactus genus *Trichocereus* possess the hallucinogenic alkaloid mescaline. The large, columnar *T. Pachanoi* or *San Pedro* of the dry Andes of Ecuador and Peru is employed in magic and folk-medicine in northern Peru, where, together with another cactus, *Neoraimundia macrostibas* and *Isotoma longiflora*, *Pedilanthus titimaloides* and a species of *Datura*, it is the base of an hallucinogenic drink called *cimora*. The drink is taken by witch-doctors for diagnosis of disease, divination and "to make oneself owner of another's identity."

**Lobelia:** *Lobelia Tupa*, a tall polymorphic herb of the Andean highlands, known as *tupa* or *tabaco del diablo*, is widely recognized as toxic. The Mapuche Indians of Chile reputedly smoke the leaves of this campanulaceous species for their narcotic effect, but whether or not this effect is hallucinogenic is not yet known.

The leaves of *tupa* contain the piperidine alkaloid lobeline and the di-keto- and di-hydroxy-derivatives lobelamidine and neolobelamidine.

**Gomortega:** The Mapuche Indians of Chile may once have valued *Gomortega Keule*, known locally as *keule* or *hualhual*, as a narcotic, possibly as an hallucinogen. A very strict endemic belonging to the very small ranalean family Gomortegaceae, this tree has fruits that are reputedly intoxicating.

**Coriaria:** *Coriaria thymifolia*, long known in the Andes as toxic, has recently been reported as an hallucinogen, giving the sensation of flight. The fruits of this shrub, belonging to the Coriariaceae, are eaten for inebriation in Ecuador, where the plant is called *shanshi*. The effects are due apparently to catecholic derivatives.

**Pernettya:** The fruit of *Pernettya furiens*, known in Chile as *huedhued* or *hierba loca*, cause mental confusion and madness, even permanent insanity, and have a narcotic effect similar to that of *Datura*. This species seems not to have been chemically investigated, but its activity might be attributed to andromedotoxine or to arbutine, both present in many species of *Pernettya*.

In Ecuador, *Pernettya parvifolia*—locally called *taglli*—is known to be toxic, and its fruits, ingested,

induce hallucinations and other psychic and motor alterations.

**Desfontainia:** The leaves of *Desfontainia spinosa* var. *Hookeri* are used in southern Chile as a narcotic and as a folk medicine under the name *taique*. Chemical studies apparently have not been carried out on this anomalous plant of the Desfontainiaceae, a family related to the Loganiaceae.

**Lochroma:** There are vague reports that several species of the solanaceous *Lochroma* may occasionally be utilized in the Colombian Andes for hallucinatory purposes. Further field work, however, must be done to substantiate these reports.



Fig. 12. Waiká Indian under the influence of *Virola* snuff. Maturacá, Rio Cauaburi, Brazil. Photograph by R. E. Schultes.

### III.

It has been said that an outstanding characteristic of the present century will be the increasing use, abuse and misuse in sophisticated cultures of hallucinogenic substances. Drugs—and perhaps even hallucinogenic drugs—are here probably to stay in our western civilization, for better or for worse. One way of understanding them more thoroughly and sympathetically is to know their history and their roles in primitive societies. If for no other reason—and there are many others—we should strive to further our knowledge of native hallucinogens while there is still time to see and appreciate how man living intimately with his vegetal environment has evolved over thousands of years with his sacred hallucinogens.