

The Search for New Natural Hallucinogens¹

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More than a century ago, in 1855, von Bibra published his "Die narkotischen Genussmittel und der Mensch" (52). This book, the first of its kind, considered 17 plant stimulants and narcotics and urged that chemists should undertake assiduous study of a field so promising for research and so fraught with enigmas.

Half a century later, in 1911, Hartwich, in his "Die menschlichen Genussmittel" (16) discussed at length about 30 vegetal narcotics and stimulants and mentioned many others in passing. He pointed out that von Bibra's pioneer work was out of date, that research on the botanical aspects and on the chemical constituents of these plants had, in 1855, scarcely begun but that, by 1911, these studies were either progressing well or had already been completed.

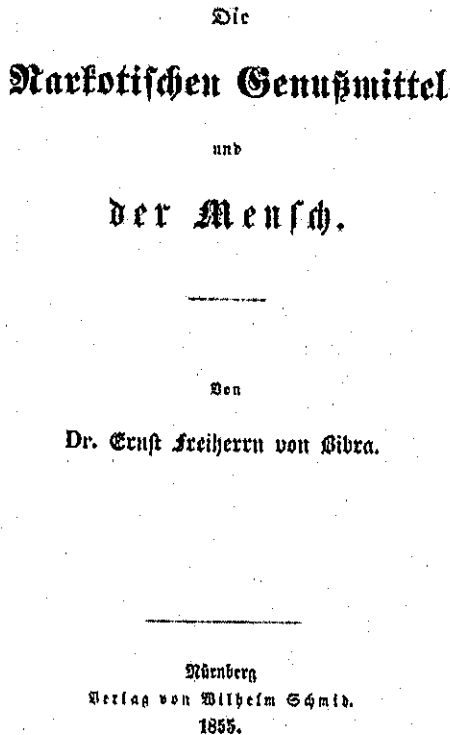


FIG. 1. Title page from von Bibra's little known book "Die narkotischen Genussmittel und der Mensch" of 1855.

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Thirteen years later, in 1924, Lewin's "Phantastica—die betäubenden und erregenden Genussmittel" (24) appeared, later to be translated into other languages. A novel kind of book, basic to what we now call *psychopharmacology*, it presented the total picture of some 28 plants that were employed for their stimulating or narcotic properties in many parts of the world. Lewin emphasized the importance of these plants to research in botany, ethnobotany, chemistry, pharmacology, medicine, psychology, psychiatry as well as to ethnology, history and sociology. "The contents of this book," he humbly understated in the preface, "will provide a starting point from which original research in the above-mentioned departments of science may be pursued." This is exactly what the book has done—and admirably so. Without exaggeration, we may say that it was Lewin's "Phantastica" that led directly to to-day's intensive and extensive interdisciplinary interest in narcotics, especially in those that we have come to call the *hallucinogens*.

Lewin classified the substances that he called by the inclusive German term *Genussmittel* into five categories. *Excitantia* included stimulants in general, mostly the caffeine-bearing plants but, in addition, tobacco and betel. *Inebriantia* covered alcoholic beverages, as well as a number of chemical substances not of vegetal origin. His *Hypnotica*, or soporific agents, contained only one major plant narcotic: *Piper methysticum*. The *Euphorica* was made up of the mental sedatives *Papaver somniferum* and *Erythroxylon Coca*. The largest category of narcotics was his *Phantastica*, agents inducing visual and/or other hallucinations. With our burgeoning interest in this class of substances, there has come a proliferation of terms for the *phantastica*, and we now commonly meet such new names for them as the very exact and appropriate "*hallucinogens*"; the "*psychotomimetics*," "*psychotogens*," "*schizogens*," "*psycholica*;" the etymologically impossible and scientifically unfounded "*psychedelics*"; as well as other epithets. The boundary lines separating Lewin's several categories are not always sharp, but I have always believed this classification to be both convenient and natural. At least, it has implanted its stamp on most successive investigatory work in the narcotics and, consequently, must always be taken into account when this broad subject is under discussion.

Since the publication of Lewin's "Phantastica," interest in the hallucinogens has gradually grown, until now their use, misuse and abuse make daily headlines in the technical, pseudo-technical and popular literature. It would seem, then, that an appropriate time has come to consolidate what we know of these curious plants and to try to evaluate the extent of what still remains for discovery in the botany of the hallucinogens.

The Plant Kingdom has always been man's principal source of the necessities and amenities of life. Inasmuch as his primary necessity is and always has been food, man, we may assume, must, during his million years of existence, have eaten experimentally every conceivable kind of vegetal material. This experimentation must have been especially urgent in periods of famine. Some of the plants that man put into his stomach were outright poisons with which he was physically unable to experiment more than once. There were others, however, which, although they did act in many ways like poisons, induced physical and mental states not at all unpleasant, oftentimes of a startling unreality. Man had then discovered narcotic plants.

It was not long thereafter that man's growing sophistication made it necessary to explain these extraordinary powers possessed by a few of the plants in his environment and to try to understand the reasons for the great differences in physiological activity amongst these plants. In all primitive cultures, this explanation invariably ascribed to the plant some resident divinity or supernatural power thought to be efficacious as an intermediary between man's world of reality and the realm of spiritual unreality (47). As a consequence, all narcotic species everywhere early became associated with and often basic to magical, medical and

religious practices. Even though we as scientists now know that the "resident divinity" or "supernatural power" in these narcotics is a chemical substance, it is of the utmost importance in our search for new natural hallucinogens in primitive cultures to be every mindful of the native's reverence for the supernatural origin of these vision-producing properties. To be unmindful of it might frustrate and doom to failure the most carefully prepared scientific search.

No one really knows how many species of plants there are. There may be as many as 800,000 (45). Estimates for the Angiosperms alone—the most thoroughly studied section of the Plant Kingdom—vary from the usually cited 200,000 to half a million.

Now, in the realm of the food plants, we find that, of this large assemblage of angiosperm species, only about 3000 are known to have been used directly as human food. The number of species that really feed mankind is very small indeed. Only about 150 angiosperm species are important enough to enter the world's commerce. Of these, only 12 or 13 actually stand between the world's population and starvation; and these dozen or so species are all cultivated plants.

When we turn to the narcotics, we find that the number is likewise very small. Probably no more than 60 species are employed in primitive and advanced cultures for their intoxicating effects, and, of these, only about 20 can be considered of major importance. What is even more significant is that so few—coca, opium poppy, hemp, tobacco—are numbered amongst the world's important cultivated plants. At least three of these species—if not all four—are cultigens, unknown in the truly wild state. This bespeaks, amongst other characteristics, a very long association with man and his agricultural practices.

It may likewise be of significance that the New World seems to be very much richer in known narcotic plants than the Old, with the Western Hemisphere claiming at least 40 species employed for hallucinogenic purposes as opposed to half a dozen or so commonly used in the Eastern Hemisphere (46).

But the foregoing statistics naturally relate merely to those plants the narcotic properties of which man has discovered in his trial and error experimentation during human history. Is there any reason to presume that man in a primitive state of culture possesses any peculiar intuition enabling him to uncover more efficiently than his more civilized counterpart those plants that Nature has endowed with physiologically active principles? The longer I consider this question, the more I am convinced that there may exist in the world's flora an appreciable number of such plants still to be found out by the enquiring phytochemist. A search of this kind must be organized along several lines of attack. One of the most productive approaches may well be a random sampling of plants, but this is not the approach that I would like here to develop, even though I hold out extraordinary hopes for it.

It is, rather, the searching out of narcotics still in use by primitive societies but as yet unknown or only poorly known to the scientific world that I wish to consider. My thinking in this essay will try to follow the guide-lines set up by Harshberger, one of the fathers of American economic botany who first used the term "*ethnobotany*," when he wrote (15): "It is of importance . . . to seek out these primitive races and ascertain the plants which they have found available in their economic life, in order that perchance the valuable properties they have utilized in their wild life may fill some vacant niche in our own."

Some of these aboriginal plant uses have been recorded in the literature, but the botanical work basic to their identification has languished. Others have never been reported in the literature, or else they are known from very vague reports and await what is virtual discovery through anthropological and ethnobotanical field work. The value of such an approach was succinctly recognized by Cooper when he wrote (8) that "to judge from the many hints scattered through our sources, there is good probability that more meticulous field research and

more exact scientific identification and analysis of specimens will reveal other aboriginal stimulants and narcotics"

What, then, is the reality of this "good probability" of "other aboriginal stimulants and narcotics"?

If we were to point to one narcotic as the "prototype" of the New World hallucinogens, it would be the peyote cactus, *Lophophora Williamsii*. This plant and its numerous isoquinoline alkaloids have been the topic of many excellent technical papers and of sundry important books. Especially noteworthy amongst the books have been Klüver's "Mescal, the divine plant and its psychological effects" (23), Beringer's "Meskalinrausch" (3), Rouhier's "La plante qui fait les yeux émerveillés, le peyotl" (34), and, more recently, Huxley's "The doors of perception" (22). These have served to put peyote in a place of primacy in modern research into the hallucinogenics. As a consequence, peyote is relatively well known from many aspects amongst the vision-producing narcotics.

There are, nevertheless, in Mexico at least 22 plants that are called "peyote" or that are confused with *Lophophora Williamsii* (36). Some of them bear a resemblance in one or more ways to the peyote cactus. Others may be used together with the peyote cactus or may conceivably have similar physiological effects. I shall mention only a few that have reputed therapeutic or narcotic effects pointing to the presence of alkaloids, glycosides or other physiologically active constituents. Phytochemical studies have been carried out on only a few, and it would seem that here is a promising area for such investigation. A few are members of the Cactaceae, several rather closely allied to *Lophophora*. Amongst those cactuses popularly classed as "peyote" in Mexico are *Ariocarpus fissuralis*, *A. Kotschoubeyanus* and *A. retusus*; *Astrophytum asterias*, *A. capricorne* and *A. myriostigma*; *Aztekium Ritterii*; *Dolichothele longimamma*; *Obregonia Dene-grii*; *Pelecocyphora aselliformis*; and *Salsisia pectinata*. The genera *Ariocarpus*, *Astrophytum* and *Dolichothele* have yielded alkaloids (60). Several species of the crassulaceous genus *Cotyledon* are locally known as "peyote" and one of them—*C. caespitosa*—is said to contain a glycoside and to cause insanity. Numerous species of the Compositae are likewise called "peyote." *Cacalia cordifolia*, thought by Urbina (51) and Safford (35) to have been the *Peyotl Xochimilcensis* of Hernandez (20), is offered for sale in the drug stalls of Jalisco as an aphrodisiac and cure for sterility. Due to the closeness of *Cacalia* to *Senecio*, a genus rich in various active principles, it seems probable that *Cacalia* may possess compounds worthy of study. Several species of *Senecio*—at least six—go under the name "peyote" in Mexico, but apparently none of them has been examined phytochemically. Another interesting plant which the Mexicans call "peyote" is the legume *Rhynchosia longeracemosa*, belonging to a genus well recognized as toxic to man but apparently as yet little examined by chemists. There is some evidence that *Rhynchosia* species were employed as hallucinogens in the ancient Aztec Empire (46).

Before leaving this most interesting family of the Cactaceae, we should recall the explorer Carl Lumholtz's report of the several species of this family that are prized—even worshipped—in the Huichol and Tarahumare country in northern Mexico (26). "High mental qualities," he wrote, "are ascribed to all species of *Mammillaria* and *Echinocactus* . . . for which a regular cult is instituted. The Tarahumares designate several varieties as hikuli, though the name belongs properly only to the kind [*Lophophora Williamsii*] most commonly used by them . . . the eating of them causes a state of ecstasy. They are, therefore, considered demi-gods, who have to be treated with great reverence"

In addition to *Lophophora*, known as "hikuli wanamé," the Tarahumares worship several cactuses. "Mulato" (*Mammillaria micromeris*) is said "to make the eyes large and clear to see sorcerers, to prolong life and to give speed to runners." "Sunami" (*Mammillaria fissurala*) is eaten for its narcotic effects in substitution

for the true peyote cactus. The greatest of all, the "hikuli walula saeliami," meaning "hikuli of great authority", is a very rare cactus that grows in clusters of from eight to 12 inches in diameter. We have no inkling of the identification of this cactus, but Lumholtz's field notes indicate that it must be rich in active principles.

It is of interest that several species of *Mammillaria* have yielded alkaloidal constituents of undetermined identity (60), but the genus, not far removed in relationship from *Lophophora*, should be expected to contain alkaloids.

From far away Peru, a species of the cactaceous genus *Trichocereus* has recently been reported as a narcotic employed by certain medicine-men under the name "huachama" (13). It is interesting in this connection to note that mescaline and other isoquinoline alkaloids have been isolated from the Argentinian *Trichocereus Terscheckii* and other species (60).

A recent report of the use of *Genista canariensis* by Yaqui medicine-men in northern Mexico for the purpose of inducing hallucinations has been experimentally substantiated (10). This genus of legumes, to be sure, is known to be alkaloid-rich (60), but, to the best of my knowledge, its aboriginal use as an hallucinogen has not hitherto been reported. *Genista canariensis* is, of course, an introduced Old World plant, not native to Mexico.

There are a number of narcotics still known to the scientific world only through the vernacular or aboriginal name and little more. The reports may not even help us with a name. It is these reports, nevertheless, that are most tantalizing, if only because we have in the name what might be a good key, but a key that must be utilized before acculturation wipes out the native tongue or before the tribe disappears or is racially absorbed by stronger or more aggressive neighbours (39, 42).



FIG. 2. *Psilocybe yungensis* Singer, an hallucinogenic tree-fungus employed as a narcotic in Mexico. Photograph courtesy R. G. Wasson.

The Yurimagua Indians of the uppermost Amazon basin in Peru were reported by Jesuit missionaries in the late 17th and early 18th Centuries to be drinking a strongly intoxicating beverage prepared from a "tree fungus" (7). Field work in this area has, up to the present, not disclosed any practice of this kind, but it represents a culture trait little likely to disappear spontaneously, and the region is still inhabited by many tribes in relatively primitive conditions of culture. Here most certainly ethnobotanical field work should be concentrated. The tree-fungus

Psilocybe yungensis Singer, first described from Bolivia and later found to be employed as an hallucinogen in southern Mexico, has been suggested (17) as the source of this mysterious Yurimagua intoxicant.

The report of the use amongst the Makusi Indians of the Rupununi in British Guiana of "peppers as a stimulant and excitant" has always fascinated me (33). It should be carefully checked. Even though Roth, a most careful ethnologist, reports it as a *Capsicum*, is it actually a *Capsicum* or some other highly aromatic plant?

And what might be the "marari" of the Mojo, an Arawakan tribe living in eastern Bolivia? "Whenever . . . [the medicine-men] had to interview the spirits, they drank a decoction prepared from a plant called marari, similar to our verbena, which caused for 24 hours a general condition of excitement characterized by insomnia and pain." According to reports, the medicine-man tried to avoid drinking marari "whenever he could operate without the narcotic"—an indication, certainly, of great potency of the drug or of its toxicity. By comparing the marari with "our verbena," the ethnologist Métraux (27) undoubtedly meant *Verbena officinalis*, a well known folk medicine of Europe. The marari could well represent a native Bolivian verbenaceous species, but only direct field work can clear up this enigma.

The Kariri and Pankarurú Indians of eastern Brazil practice the ancient "yurema" cult, during which an old chieftain or other leader would serve a gourdful of yurema-root infusion to a group of warriors kneeling with bowed heads (8). All the celebrants would see "glorious visions of the spirit land, with flowers and birds. They might catch a glimpse of the clashing rocks that destroy the souls of the dead journeying to their goal, or see the Thunderbird shooting lightning from a huge tuft on his head and producing claps of thunder by running about." This yurema rite was formerly much more widespread, known from at least three other tribes of the general region, but we know absolutely nothing about the possible identity of the plant the root of which is said to provide such a potent infusion. There is really no reason why this cannot be investigated, for the yurema rite is still practiced. Again, field work is indicated.

The Pankarurú (or Pankarú) Indians prepare from the seeds of the leguminous *Mimosa hostilis* an intoxicating beverage called "vinho de Jurumena" (14). It is apparently quite a distinct narcotic from the yurema root infusion, although it is likewise an hallucinogen believed to transport the soul to the spirit world. We know all too little about this interesting legume, so closely allied to *Anadenanthera peregrina* (*Piptadenia peregrina*), from which the narcotic yopo snuff of the Orinoco is prepared. Vinho de Jurumena was identified by Gonçalves de Lima who described its role in Pankarurú magico-religious ceremonies. In 1946, an alkaloid was isolated and was called "nigerine," but recent chemical work has established the identity of nigerine and *N,N*-dimethyltryptamine, the same constituent found in *Piptadenia* (28).

A century and a half ago, the traveller St. Hilaire found the Malakí Indians, a tribe also of eastern Brazil, cooking and eating "worms" (8). The "worms," living in bamboo, undoubtedly were larvae. They were consumed to induce fantastic visions and a long and ecstatic sleep. Is this weird effect due to some substance produced in the animal body, or does the larva extract some toxic substance from the plant on which it feeds? Is it correct that it lives on "bamboos," or, if it does, is it possible that it frequents likewise or at certain times other plants? Whatever the source of the active principle, a zoological identification of the larva would be of extreme interest.

And what species might be the source of the magic "woi" plant of the Yekwana Indians of southern Venezuela (1)? We have not even a hint.

Similarly, it would be satisfying to know the plant source of the clear amber-coloured and aromatic resin that is procured from a large forest tree and that forms

part of the sacred accoutrement of every medicine-man of the Tukanoan tribes in the Apaporis and Vaupés Rivers of Amazonian Colombia and Peru (37). In particularly difficult cases of diagnosis of disease, divination or other magic practice, minute amounts of this resin, powdered, are snuffed. Although it is said to induce dizziness, it is not reputed to have hallucinogenic properties. Nevertheless, botanical identification and chemical study of this resin-snuff should be done, if only because of the intriguing fact that it is quite generally referred to as "paricá," the same name that is applied to the highly hallucinogenic snuff prepared from the blood-red resin of the inner bark of several species of the myristicaceous tree-genus *Virola* by the same people in the same part of the Amazon (37).

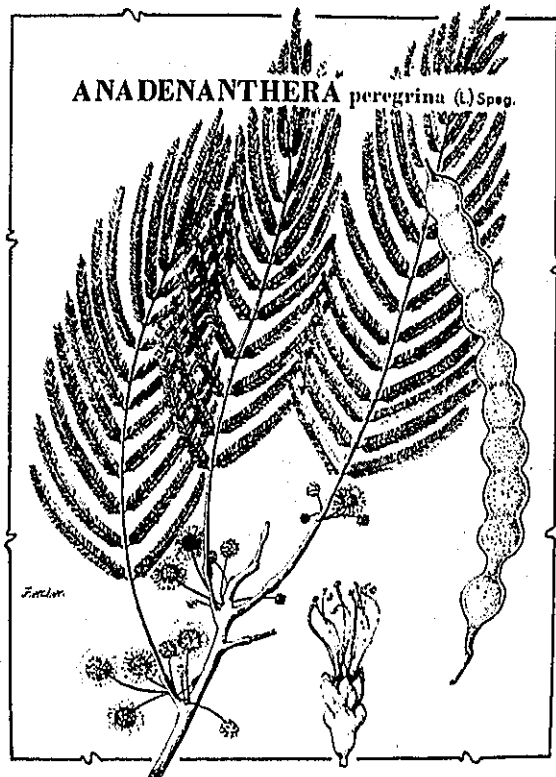


FIG. 3. *Anadenanthera peregrina* (*Piptadenia peregrina*), source of the *yopo* or *niopo* snuff of the natives of the upper reaches of the Orinoco in Venezuela and Colombia.

A most mysterious snuff of which we still know almost nothing is said to be prepared from the fruits of the gigantic moraceous jungle tree *Olmedioperebea sclerophylla* (43, 44, 46). It is reputedly employed in the central part of Brazil, especially along the upper Tapajoz (12), but is known only by the general Portuguese term "rapé dos índios" ("Indian snuff"). So far as I have been able to ascertain, chemical examination of the fruits of this tree has not yielded substance with psychotomimetic effects.

The Tanimuka Indians, who live in complete isolation on the Río Apaporis of Colombia, employ an as yet undetermined plant to prepare a vision-producing drink for the initiation rites of boys into manhood (46). It is used much as is the well known *Banisteriopsis*-drink, but it is certainly not from a malpigiaceous

plant. The bark of the root of an extensive lacticiferous forest liana, without the admixture of any other plant material, is subjected to long boiling to prepare the drink. I was not able to see the vine in my short stay amongst the Tanimukas, but all information pursuant to my questioning were consistent. There is some possibility that this liana, reportedly rich in latex, may represent an apocynaceous species, but the question really cannot be solved until extended field work is carried out amongst these remote Indians.

There still has never been a definitive ethnobotanical or phytochemical investigation of several curious "mints" from the Old World. Mr. R. Gordon Wasson's (58) very recent discovery in the Mazatec Indian country of Oaxaca, Mexico, of the corroborated hallucinogenic use of the native *Salvia divinorum* and the indicated utilization for similar purposes of several introduced Old World species of *Coleus*, has directed our interest strongly towards the possible presence in the Labiatae of active principles—perhaps essential oils with definite intoxicating properties. Wasson has suggested that *Salvia divinorum* represents the "pipilt-



FIG. 4. *Salvia divinorum*, an hallucinogenic member of the Mint Family, employed for purposes of inducing an intoxication for divination in northeastern Oaxaca, Mexico.

zintzintli" of the ancient Aztec. If this be true, it bespeaks a long acquaintance with the narcotic properties of this mint. But the species of *Coleus*—*C. pumila* and *C. Blumei*—are both introductions from the Old World, from the tropical parts of southeastern Asia. Chemical investigations of these two species of *Coleus*, at least on the basis of the reputedly hallucinogenic material growing in southern Mexico, has apparently not been carried out, although other Old World species that have many uses in folk medicine have been studied. In line with this

thinking about the Mint Family, we should not overlook a mint described from Turkestan as *Lagochilus inebrians* (5). All we know of the use of this reputed intoxicant is the brief note appended to the original botanical description of the species: ". . . ist berauschend, wird getossen und mit Honig oder Zucker gemischt." A constituent that has been called lagochiline was reported from the species (48); and another species of this genus has been reported to contain stachydrine, an alkaloid common in the related genus *Stachys* (60).

As with the Labiatae, other families of plants which, until recently, have always seemed bereft of or very poor in physiologically active chemical substances are now demanding our attention. We know that the Convolvulaceae—the family of the sacred narcotic Mexican morning glories *Ipomoea violacea* and *Rivea corymbosa*—has many genera and species that possess alkaloids, both in the Old and the New World representatives. It is very possible that still other species of morning glories may be found to have aboriginal use as hallucinogens in other parts of the world than Mexico.

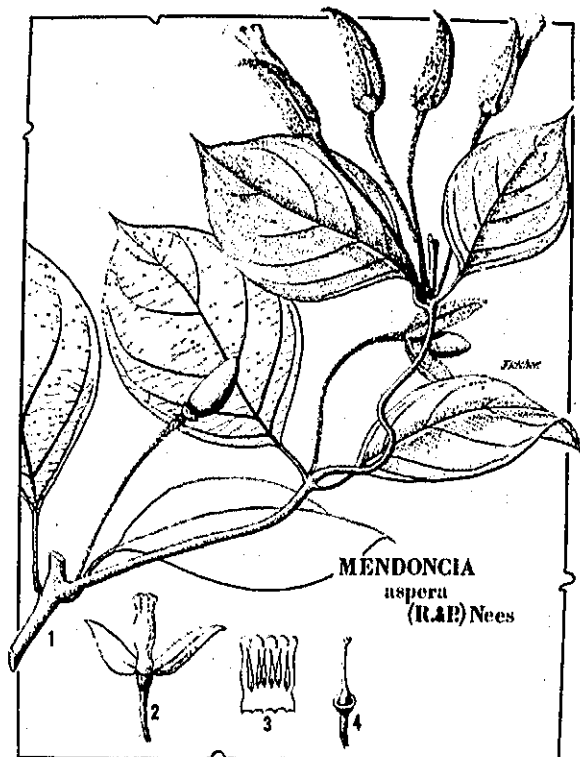


FIG. 5. *Mendoncia aspera*, an acanthaceous species the roots of which are employed as a fish poison by natives of the Vaupés River in Amazonian Colombia.

Another family which, like the Convolvulaceae, was once thought to be relatively poor in physiologically active substances is the Acanthaceae, a family of some 2000 species, mainly tropical, represented in both hemispheres. A number of years ago, a missionary working in the headwaters of the Orinoco in Venezuela handed me a partially rotted, matted roll of plant material which he said was the source of one of the narcotic snuffs of the Guaica Indians. The condition of the material was very poor; but it seemed to represent a species of *Justicia*. This

identification was tentatively corroborated by Dr. E. C. Leonard, the American specialist on the Acanthaceae. I have never been able to visit this region to investigate the problem personally. With the unsatisfactory preservation of the material and the failure of other botanists who had visited the general region to report it (61), I more or less dismissed *Justicia* as a serious contender for inclusion in our list of hallucinogens. I am now, however, convinced that this problem must be investigated thoroughly in the field; for recently, the Brazilian botanist, Prof. João Murça Pires, informed me personally that the Guaicás do indeed employ a species of *Justica*, a species close apparently to *J. pectoralis*, in the preparation of a vision-producing snuff. We know that alkaloids have been reported from several species of *Justicia*, and there has been some question of synonymy of *Justicia* with *Adhatoda*, which is known to contain harman type alkaloids. Since several other genera of the Acanthaceae have been reported as alkaloidal, the family might well bear an intensive phytochemical study. In this connection, I might report here that one of the minor fish poisons that I saw in use amongst the Taiwans of the Río Kananari of Amazonian Colombia is the root of an acanthaceous shrub, the genus of which is as yet phytochemically wholly unknown: *Mendoncia aspera*.

A collection of *Justicia pectoralis* var. *stenophylla* (Schultes & Cabrera 15244) from the Río Apaporis of Colombia bears the Puinave Indian name "ya-ka-yoo", suggestively similar to the Puinave name for the Virola-snuff: "ya'-kee".

In Colombia, along the eastern slopes of the Andes, species of the amarantaceous genera *Alternanthera* and *Iresine* are said to be mixed with the yajé drink prepared from the well known *Banisteriopsis*. These additives are believed by the natives to "strengthen" the intoxicating qualities of the main ingredient of the drink. One of these additives is called "borrachera," a term applied to almost any intoxicating plant in Colombia and Ecuador. Furthermore, the poorly understood drink called "timora" in Peru is thought to be prepared from a species of *Iresine* (38). Undetermined alkaloids have indeed been reported from *Alternanthera* but not, apparently, from *Iresine*. Here is a situation in which further ethnobotanical study might help to orient a promising phytochemical investigation. One of my graduate students, Mr. Homer V. Pinkley, reports (30) that the Kofán Indians of Amazonian Ecuador use a species of the rubiaceous genus *Psychotria* as an additive in the preparation of yajé.

Without any doubt, one of the most fascinating and promising possibilities of adding to our list of hallucinogens has recently been brought to my attention by one of my former graduate students, Prof. Melvin L. Bristol of the University of Hawaii, who spent more than a year in ethnobotanical field work in southern Colombia. It concerns the genus *Brunfelsia* in South America. A tropical New World genus of the Solanaceae, with approximately 25 species, *Brunfelsia* plays an important role in aboriginal folk medicine in equatorial America, and the fluid extract of one species—*B. Hopeana*—is employed medicinally in Brazil as a diuretic and anti-rheumatic. The alkaloids brunfelsine, manacine and mandragorine have been reported for *Brunfelsia Hopeana*. These are atropine type alkaloids, and, in view of the phylogenetic proximity of *Brunfelsia* to *Duboisia*, this might have been expected. The aglycone scopoletine, a coumarine derivative found in a number of plant families, has likewise been isolated from *Brunfelsia*. Consequently, we know full well that this genus does possess constituents of very definite physiological activity.

The evidence for the narcotic use of *Brunfelsia* is quite real but is not yet corroborated by a good body of evidence and observation. It is here that the value of our herbarium search for notes on plant collections indicating physiological activity has been extremely helpful. There are two collections that indicate narcotic use for *Brunfelsia*. One—Tessmann 3243 from Peru—simply reports the plant as "a narcotic." The other—Bristol 1364 from the Colombian Putumayo—indicates that the plant is narcotic and medicinal and is cultivated in Kofán Indian

houseyards. Numerous other collections of *Brunfelsia* from Bolivia, Brazil, Colombia, Ecuador and Peru indicate a broad spectrum of therapeutic uses, ranging from the treatment of "yellow fever" to snake bite. Its commonest use in folk medicine seems to be to relieve "rheumatism." Several collections indicate that *Brunfelsia* is toxic.

My student, Mr. Pinkley, has been living amongst the Kofán Indians now for a year carrying out ethnobotanical investigations with this interesting and poorly known tribe of eastern Ecuador and Colombia. He reports that *Brunfelsia* is grown extensively as an ornamental hedge or border shrub by the Kofáns, who refer to the plant, in addition to their own vernacular name, by the Spanish term "borrachera," a word employed in Colombia and Ecuador for almost any kind

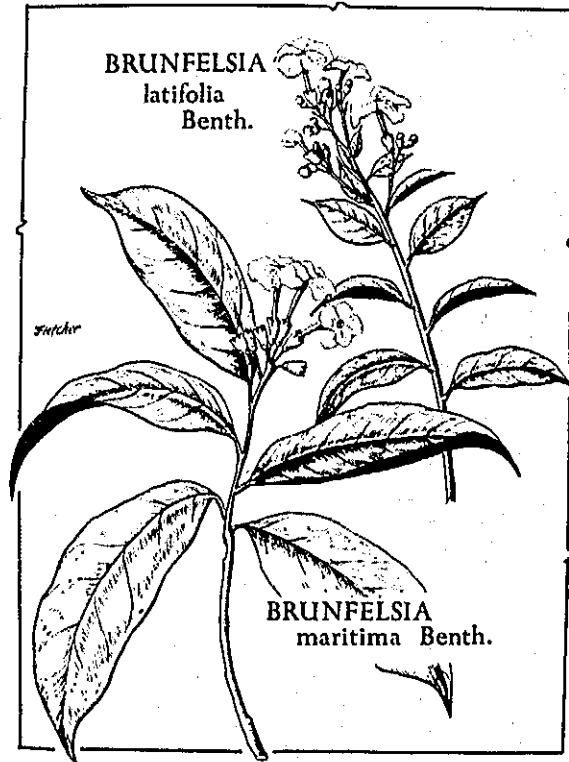


FIG. 6. *Brunfelsia latifolia* and *B. maritima*, solanaceous plants of numerous medicinal uses in tropical America, sources possibly of narcotics in the northwest Amazon of Colombia and Ecuador.

of intoxicating plant, especially the several species of narcotic tree-Daturas. The Kofáns have indicated to Pinkley that they become very cold after taking an infusion of the scraped bark of this *Brunfelsia* borrachera. This characteristic of the intoxication has been reported on herbarium labels of collections from Peru and may well explain the esteem that the plant has as a febrifuge. Pinkley, reporting further that the lowland Quichwas on the Rio Napo of Ecuador utilize the plant medicinally as a remedy for rheumatism, states: "They take it if they have a burning in the lower part of their back. They place their hands in the area of the kidneys. Upon making a drink from the leaves in hot water, they become extremely chilled after drinking."

A collection of *Brunfelsia maritima* (Schulles & Cabrera 19115) from Mocoa in southern Colombia indicates that the shrub, reputedly toxic, is likewise called "borrachera" in this locality.

Field work in ethnobotany followed by a taxonomic study of *Brunfelsia*, a genus that needs botanical revision and simultaneous phytochemical investigation, might indeed reward us with a clear picture of this possible aboriginal American hallucinogen.

There remain to mention several plants that have been reported, erroneously we believe, in the literature as hallucinogenic narcotics but which cannot be entirely discounted until further ethnobotanical field studies bring us in a greater accumulation of data (38). The two most immediately at hand are both involved with the malpighiaceae narcotic variously known as "ayahuasca," "caapi" and "yajé." It is well established that the source of these hallucinogenic drinks is the genus *Banisteriopsis*. A species of the allied genus *Tetrapteryx*—*T. methystica*—has recently been shown to be also the source of a proven psychotomimetic caapi-drink in Amazonian Brazil. I tried experimentally a drink prepared from this plant and know it to possess narcotic principles, but no material has as yet been studied chemically. On the basis of a Peruvian collection—*Tessmann 5424*—that was a mixture of leaves of *Mascagnia psilophylla* var. *antifebrillis* and samaras of *Banisteriopsis quitensis*, the German specialist Niedenzu suggested that the genus *Mascagnia*, allied to *Banisteriopsis*, must tentatively be considered as a possible source of ayahuasca. This has been taken up in the literature and has, unfortunately, become rather firmly established and accepted, in spite of the tenuous nature of the evidence.

The botanical as well as the chemical literature has been even more sorely plagued by a loosely interpreted and even misquoted note that dates from the days of the explorer Richard Spruce, a century ago. Spruce, when he discovered caapi in northwestern Brazil and identified its source as a species of *Banisteriopsis*, meticulously observed that another kind of caapi known as "caapi-pinima" or "painted caapi" might be "an apocynaceous twiner of the genus *Haemadictyon*", of which he saw only young shoots without flowers. "The leaves," he wrote, "are of a shining green, painted with the strong blood-red veins. It is possibly the same species . . . distributed by Mr. Bentham under the name of *Haemadictyon amazonicum*. It may be the caapi-pinima which gives the nauseous taste to the caapi . . . and it is probably poisonous, but it is not essential to the narcotic effect of *Banisteria* . . ." I have consulted Spruce's unpublished notes at the Royal Botanic Gardens at Kew and find that he stated that the caapi drink is made from the lower parts of the stems of *Banisteriopsis Caapi* "beaten in a mortar with the addition of water and a small quantity of the slender roots of the Apocynac (apparently a *Haemadictyon*) called *caapi-pinima* . . ." "May not the peculiar effects of the caapi," he queried, "be owing rather to the roots of the *Haemadictyon* than to the stems of the *Banisteria*? The Indians, however, consider the latter the prime agent, at the same time admitting that the former is an essential ingredient."

It is quite obvious that Spruce suspected that the presumed apocynaceous vine might play a role in causing the intoxication. But he was not sure. Nor did he make any definite statement, being careful to point out that *Banisteriopsis* alone could produce the hallucinogenic effects.

Recent botanical work has shown that the genus *Haemadictyon* is not distinct from *Prestonia*. *Haemadictyon amazonicum*, therefore, is properly called *Prestonia amazonica*. It is a species known from only one collection, that made by Spruce along the lower Amazon in Brazil, and seems to be a very strict endemic. It was apparently the anthropologist Reinberg who, in 1921, first suggested that the sources of ayahuasca and yajé were different plants, and he suggested tentatively that yajé might be *Prestonia* or a related genus. This suggestion has, unfortunate-

ly, been taken up, its tentative nature has been forgotten, and serious technical papers are now propagating the error. While we know that ayahuasca, caapi and yajé are different local names for the same narcotic drink prepared from the same malpighiaceus plants, we cannot too lightly dismiss from our plans for further ethnobotanical and chemical study the interesting genus *Prestonia*, a tropical American group of some 30 species about which very little is known phytochemically. One species has been reported to contain an undetermined alkaloid. An analysis of the leaves of what has been reported to be *Prestonia amazonica* indicates the presence of N,N-dimethyltryptamine (28); but there is every probability that this analysis, for which no voucher specimen is available, was made on leaves of a species of *Banisteriopsis* mistakenly identified through the vernacular name yajé as *Prestonia amazonica*. It is curious that, with such intensive chemical work on the Apocynaceae (32), so little is yet known about *Prestonia*, and the remote possibility that this reputedly poisonous genus might be one of the hallucinogens make the solution of the problem one of academic and practical urgency.

Up to this point, we have discussed possibilities of finding new hallucinogens primarily from New World cultures. What about the Old World?

As I mentioned in my introductory remarks, the New World seems to be far richer in known hallucinogenic plants than the Old. A botanist would be inclined to doubt that the basic reason for this is a flora poorer in species possessing psychotomimetically active principles. There may be several reasons for this discrepancy, but most certainly one might be that Old World cultures, in general, seem to be less conscious of the "need" for these agents in magico-religious rites and in the practice of primitive medicine; and this notwithstanding the great antiquity and probable original basic significance of narcotics to many Old World religious systems.

It is certain that there must be, in sundry parts of Africa and Asia, an appreciable number of hallucinatory narcotics still to uncover, but I shall discuss only a few potentialities in this paper.

The Hottentots were reported, more than 225 years ago, employing a narcotic which they called "kanna" or "channa" (24). It was chewed and kept in the mouth, much as in the case of coca in South America, but it stimulated and intoxicated them. The intoxication was described in detail as follows. "Their animal spirits were awakened, their eyes sparkled and their faces manifested laughter and gaiety. Thousands of delightful ideas appeared, and a pleasant jollity which enabled them to be amused by the simplest jests. By taking the substance to excess, they lost consciousness and fell into a delirium." As Lewin pointed out, the name kanna designates, at the present time in South Africa, sundry species of the aizoaceous genus *Mesembryanthemum*. While several species of *Mesembryanthemum* are known to be alkaloidal and to cause a state of torpor when ingested, Lewin doubts that they could produce the startling effects described above and suggests that the Hottentot hallucinogen in question might have been *Cannabis sativa*. He does state, however, that other plants—the anacardiaceous *Sclerocarya Caffra*, for one—are used for their intoxicating effects in South Africa. There would seem to be room here for ethnobotanical field studies.

Another Old World genus employed for its narcotic properties is the rubiaceus *Mitragyna*. *Mitragyna speciosa* seems to be the species most commonly used in southeast Asia, especially in Siam, where the leaves are chewed alone or mixed with the betel quid or else prepared for smoking like opium (6). It was first reported as a substitute for opium in 1836 and has cropped up constantly in the literature. The use of this narcotic is said now to be legally proscribed in Siam. So much chemical attention has been given to *Mitragyna* in recent years that the problems and potentialities offered by this genus are well known. It might, however, be extremely helpful if we knew as much about its use amongst the natives.

Passing mention should further be made of several Old World plants known to possess hallucinogenic principles but the use of which by native peoples for intoxication is not well understood. One of these is *Peganum Harmala*, a rather enigmatic plant that has been placed in the Rutaceae, although now it seems more properly located in the Zygophyllaceae. As all of you know, *Peganum Harmala* contains harmine, harmaline and other alkaloids, some of which are definitely hallucinogenic. This and other species of *Peganum* understandably have many uses in folk-medicine. There are statements that *Peganum Harmala* is employed in parts of the Old World as a vision-producing narcotic, but the reports are tenuous and dubious (31). A thorough search of the anthropological literature and substantiation from modern field work in ethnobotany are needed for a clearer understanding of this reputed native hallucinogen of the Orient.

The other is the interesting "iboga" of the wet tropical forests of West Africa, especially of the Congo: It is the apocynaceous *Tabernaemontana Iboga*. Its chemistry is relatively well known, with at least 12 active alkaloids reported from it, the principal one of which—ibogaine—has effects similar to that of cocaine (49). In high doses, it causes nervous excitement, mental confusion, a general state of drunkenness and is a true hallucinogenic agent. While it is known to have many uses as a medicine amongst the primitive peoples of West Africa, there seem to be no ethnobotanical references that clearly report its use as an hallucinogen.

There have been vague references to a member of the Ginger Family, *Kaempferia Galanga* to which the natives of several parts of New Guinea attribute hallucinogenic properties (2, 19). We know, in fact, nothing about the psychotomimetic use of this genus nor of its chemical constituents.

The role of mushrooms in the so-called "mushroom madness" of the Kuma people of the Wagti Valley in New Guinea has been, and still is, puzzling. A species of *Russula* has been suggested as the psychotropic agent that suddenly causes individuals or groups to go berserk. Even though the "natives attributed their extraordinary behaviour to mushrooms," few [several species of *Boletus*, *Russula* and *Heimiella*]—or at least most of them—do not seem to cause physiological effects leading to madness" (18). I am convinced that much more field work must be done in this fascinating part of the world.

Undoubtedly the greatest enigma in the field of the hallucinogens has been the identity of soma. Some 3,500 years ago, a people who called themselves Aryans, who were the first so to style themselves and who had a right to the name, swept down from the north into the Indus Valley. They brought with them the cult of a sacred plant, a plant called "soma." They defied the plant. They worshipped it. They extracted the juice from the plant and drank it. They composed hundreds of hymns to it, and these have come down to us intact.

The Aryans abandoned the original plant soon after they arrived in their new home, and its identity was quickly forgotten. Other plants took its place in the liturgy—plants chosen for reasons other than their psychic effects which, in this case, was non-existent.

Amongst these were numerous species of *Ephedra*, *Periploca* and *Sarcostemma*: the first genus a gymnosperm; the last two asclepiadaceous genera; but all similar in being vine-like, fleshy, leafless or almost leafless desert plants (59).

Western civilization discovered the enigma of soma about a century and a half ago, when it began to learn about the cultural wealth that India had to offer to the world. Since then, many have been the suggestions as to what the original soma was. Upwards of a hundred plants comprise the list of contenders, but none of the suggestions has won acceptance.

For some years now, Mr. Wasson of the Botanical Museum of Harvard University, has devoted full time to a deep study of the historical, literary and ethnobotanical records concerning soma. He has spent several years in the Far East and much time in European university centres and libraries. He is now going

over his material and drawing up his conclusions. In view of his outstanding and widely acclaimed contributions to our knowledge of the sacred Mexican mushrooms, of the narcotic morning glories and of the new hallucinogenic Mexican mint *Salvia divinorum*, we must await the announcement of the results of his research with great anticipation. I am in a position to state that never has this most enigmatic problem been attacked with greater thoroughness and meticulous scholarship, and I believe that, in addition to contributing towards a solution of the same problem, Wasson's work may well stimulate many new lines of study in the long neglected field of Asiatic hallucinogens in general.

It would be appropriate, perhaps, to end with a few words written about the peyote cactus by Robert S. de Ropp in his "Drugs and the mind", realizing that what he expresses is applicable to all the natural hallucinogens. "We can envisage," he says, "that long-forgotten man . . . chewing the nauseous, bitter cactus tops and lying down to rest, then, in a rising tide of astonishment, finding himself ringed on all sides with fantastic visions, with shapes, colors, odors of which he had never even dreamed. Small wonder that, when he found his way back to his tribe, he informed them that a deity dwelt in the cactus and that those who devoured its flesh would behold the world of the gods."

I hope that this very cursory panorama of what yet remain to uncover concerning the sacred vision-producing plants of primitive societies may help to stimulate new work and to hasten current research into this still promising field. For, in reality, it is even more promising now, with what we know of the whole picture, than it was when von Bibra published his plea for increased research in 1855.

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