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Review Article

Sacred Plants and Their Miraculous or Healing Properties

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The purpose of this article is to study the 'sacred' plants, diverse from those exclusively medicinal but with an unquestionable ethnobotanical value because, added to their healing properties, they develop mystical experiences and altered states of consciousness analogous to the ecstatic trance. *Psychoactive* plants have played an important role in medicine, religion, *ritual* life, and recreation since ancient times and *have been* consumed by many cultures, cults, and groups during religious rituals and ceremonies for centuries. Used in indigenous contexts and acting as divine intermediaries, they provide treatment for physical, psychological, spiritual, and social symptoms, diagnosis and cure of diseases, as well as supernatural experiences focused on religious rituals.

First of all, it will be interesting to analyze their perspectives on ritual, shamanism, and ecstasy techniques, to reexamine the distinction between psychotropic, analgesic, stimulant, and visionary substances, their distinguishing characteristics, the latest research on symbolic beliefs, and the men's bodily reactions and effects produced by the ingestion. The altered states of consciousness (ASCs), induced by the badly called 'hallucinogenic' plants, include bodily sensations, intuitions, visions, dreams, or cognitive impacts with the perception of strange sounds that allow one to get in touch with the deep psyche. People in this condition could activate emotionally arousing experiences that dig *deep* to *unearth* a well of *memories*, to face limitations, respond to the basic emotion of fear, and even intensify physical pain to definitively cure it. Altered states of consciousness differ energetically on the dimensions of (a) arousal versus sedation, (b) pleasure versus pain, and (c) expansion versus contraction [1].

We will later provide some background on the different 'entheogenic' plants, distinguishing their regional use, and finally, by selecting two of the most ecologically representative species, mandrake and peyote, we will identify both basic characteristics and their long and very complex history.

The similarities and differences between the mandrake, an ancestral toxic plant in force since ancient times, usually used in Western culture, and peyote, characteristic of the New World, will show us the strong biological effects produced by their powerful alkaloids in human organisms.

The two have a long history of medicinal purposes, while peyote, widely used both by drug abusers and by peoples of traditional cultures, stands out as a current psychedelic drug much sought after and consumed by Western intellectuals around 1960.

It will be interesting to analyze their true characteristics and the symbolic beliefs that they aroused due to the strange effects that their ingestion produced.

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1. Introduction

Throughout its long history, man has managed countless plants for different uses: food, medicine, ornamental, and shelter, among others. In this endless search for food, hunter-gatherer societies found and were able to explain the characteristics of a whole series of plants whose psychotropic or hallucinogenic effects were so unearthly, so unreal that they early acquired a sacred place in magical, medicinal, and religious rituals. In the history of mankind, hallucinogens have probably been the most important of all the narcotics. Their fantastic effects made them sacred to primitive man and may even have been responsible for suggesting to him the idea of deity. Shamans and witches have then adopted them for divinatory, healing, or spiritual purposes. Indeed, for many indigenous communities, however, hallucinogens continue to be a fundamental part of their worldviews; the experience alters their fundamental conception of reality to understand and interpret their existence and shared their behavioural relation. Learning occurs through this process.

Anthropologists have long studied hallucinogenic plants and the altered states of consciousness they induce in cultural contexts and established the differences between the medicinal plants that have healing properties and the sacred plants that, being curatives, contain psychoactive substances producing the so-called paranormal phenomena. That is, they allow humans to explore their spirituality, the deep states of meditation, and the amplified states of consciousness with rich visionary experiences.

These hallucinogens usually come from plant substances or derivatives, although they occur in many plants and animals, and both can be synthesized in chemical laboratories. They produce great changes in our organism, causing a temporary disturbance and modifying its biochemistry, especially in the brain and the central nervous system (CNS). In a series of chemical reactions, the organized and coordinated activity of the central nervous system (CNS) is affected and can also interact with the brain and influence our psyche, to alter moods, emotions, bodily processes, *feelings*, and behaviours.

1.1. Ritual, shamanism, ecstasy techniques

Considered 'sacred medicines'[2], both for the body, the soul, or the spirit, in many cases, they recover mental, spiritual, emotional, and physical health, give validity to the results and impact the decision, allow self-connection or being in touch with the worthiness and wholeness of oneself for meditation, healing, and divination. In almost all cultures, they were incorporated into the initiation rites marking entrance or acceptance into a group or society and are fundamental to human growth and development. In the field of 'hallucinogenic' ritual, they can assist individuals to connect with both self-knowledge and their integration into their community, culture, and environment. Their sacred nature makes them the source of being and an object of reverence and worship, at the same time giving them a deep symbolic, sacred, and transcendent meaning.

In general, they are manipulated by an expert's hand who fulfils a priestly role in healing rituals and ceremonial contexts: guide, priest, healer, psychopomp, or shaman, or is reserved for those accomplishing the double functions of healer or 'medicine man'[3], who held an infinitely more important position in society than the physician. Indigenous societies believe healing is part of all spiritual experience, and medicine is always combined with prayer. Nowadays, the guides, derived from social sciences such as medicine, anthropology, and psychology, have been trained in close contact with the natives, and, in the opposite case, shamans and healers study Western medicine or psychology to broaden their knowledge and applications.

Shamanism takes on many different forms that vary greatly, and sorcerers and priests can be lined up in various action currents. A group ingests psychoactive substances to achieve effectiveness in the altered states of consciousness — divination, lustral sacrifice, cures, and any intervention in reality. Although they do not always ingest them, their learning had to undergo inexcusably those "great trials of the spirit" (Henri Michaux [4]) such as

the trips to the Underworld, leading periodically as guides isolated individuals or an entire group.

Close to this group, we find the holy men who — like the yogis and other anchorites — achieve intense mystical experiences with ascetic methods to alter consciousness but without narcotics (fasting, silence, solitude, gymnastics, severe forms of mortification, etc.). Probably, these exercises modify the cerebral metabolism as certain psychoactive drugs do.

Another category only postulates the immediate efficacy of the ritual without modifying the officiant's conscience. They stand out for being open to spirituality, not being vocational, nor living a mystical experience with their parishioners.

However, ecstasy techniques always required the consumption of certain drugs, even in the ancient ritual intoxication, although in Dionysian mystical practices it would hardly be difficult to link only wine with mysticism and inebriation, since other trance-inducing techniques were used (like violent dance and music). These rites seek a frenzy that removes inhibitions and social constraints, to return to a natural state, liberating the individual from the self and occupying its space with a spirit that is all the more redemptive the less it resembles lucidity. Under the influence of intoxicating beverages, mentioned in the hymns of all primitive peoples [...] *those Dionysian emotions are awakened and in their elevation, the subjective disappears in the complete self-forgetfulness* [...] [5]. Emotional extremes or strong feelings are prone to orgiastic trance, in the etymological sense ('confusion'). The Greek *thyein* ('give the god what is his') would be the origin of *methyein* ('get drunk'), by a contraction of '*meta thyein*' ('after sacrificing') [6] The sacred is stupefaction and oblivion, a deaf and dumb trance, although physically very vigorous, that ends in a restorative exhaustion.

In trance or possession disorder, attributable to the physiological effects of a substance (blackouts or chaotic behaviour during alcohol intoxication), basically alcoholic beverages and psychoactive nightshades [7], they cause 'drunkenness', that affects the mind and changes functions of the nervous system. It produces alterations in perception, mood, knowing, cognition, or behaviour. These symptoms are accompanied by motor excitation, lack of critical consciousness, and loss of memory (namely, they excite the body and annihilate consciousness as an analytical instance, no less than memory) and, in high doses, produce a mix of disinhibition, lack of self-control, or restraints. It has been supposed that the grapevine (*Vitis vinifera*) comes originally from the Caucasian slopes, from the shores of the Black Sea, and expanded in a wide area from Western Europe to the Trans-Caucasian zone and around the Mediterranean Basin.

In ecstatic intoxication, with drugs rich in phenethylamines or indoles [8], the senses develop spectacularly, creating moods characterized by 'the ascent'. They are distinguished from the ceremonies of possession agents by a very low toxicity and a great visionary activity, which generates an active disposition. Instead of being possessed by the spirit, the subject seeks to possess it and retain the memory (to begin with, the memory of being subjected to altered consciousness). But the essential effect — where it surprisingly coincides with the mystical journey without chemical induction — is a psychic excursion with two successive moments. The first is the magical flight (or the 'ascent'), reviewing unknown or barely suspected horizons, overcoming great distances until it is seen from the outside, as another object in the world. The second, the journey itself, implies beginning by fearing to go mad to end up dying in life, and being reborn purified from the fear of life/death. While the ecstasy would be focused on the phase of rebirth, the ecstatic sequence encompasses the whole and, in favourable cases, resolves into some form of beatific serenity. Using Nietzschean terms, it would be said that witchcraft and possession cults are Dionysian, and those ecstatic are Apollonian [9].

In one case, the shaman's experience is that of a 'self' briefly leaving the body, transforming into a spirit, while in the other, the sorcerer's experience is rather that of a body fleetingly leaving the self, transforming it into something insensible and repairer. To be exact and clarify the gap, it would be convenient to include the pre-Columbian cults in America (documented at least from the X BC), and the explosion of witchcraft in Europe from the fourteenth to the seventeenth century, both phenomena accompanied by the use of precise drugs.

Native Americans have used peyote cacti containing mescaline for religious ceremonies for as long as 5700 years. Thus, in traditional indigenous contexts, it is inconceivable to use these plants for frivolous, merely playful, or escapist purposes.

Their knowledge is protected and transferred with restrictions as traditional cultural expressions. Aboriginal people attribute sickness and health to the working of spirit forces. Consequently, any 'medicine' that can transport man to the spirit world is considered by many aborigines to be better than one with purely physical effects.

On the other hand, in the West, the current advanced industrial societies required drugs which, instead of inducing mystical visions or divinatory trances, provided one type or another of analgesia or stimulation to keep developing scientific and technological research in specific fields of strata and collaborating in the growing technical power over the physical-natural realm. And this is how this type of plant spread in North American and

European society in the 1960s and 1970s, causing a change of mentality and social values in the masses of young people. Due to their incorrect use, they were classified as toxic, cursed, prohibited, and even diabolical substances, since these drugs interfere with the way neurons send, receive, and process signals via neurotransmitters, and this type of experience can be very harmful according to the way of thinking, way of life, diet, state of mind, or one's own brain biochemistry.

2. Materials and Methods

2.1. Elucidating the diversity of designations

Until Lewin's work [10], there was no clear distinction between psychoactive, analgesic, stimulant, and visionary substances. The term 'narcotics' encompassed them all, included generically.

Currently, the psychoactive plants are designated by the following names: master plants, plants of the gods, power plants, magical plants, luminous plants or light plants, visionary plants, awareness plants, hallucinogenic plants, entheogenic plants, psychedelic plants, psychotropic plants, etc.

Being **master plants**, they subtly provide us with teachings and insights about ourselves; therefore, self-knowledge is important by offering us a route to greater happiness and fulfilment, and besides, how to live in harmony with the environment, examining our relation, as human beings, with nature through intuitions, visions, and dreams. In a past regression therapy, patients have been able to access their remote past because they are aware of their own body and feelings, causing the healing of forgotten psychic wounds, as well as a reconfiguration of traumas suffered in childhood. Emotional experiences produce a kind of tunnel memory, boosting deep recalls and reviving them to overcome fear, one of the most powerful emotions. Chronic pain can be exacerbated, to just help reduce feelings of discomfort and manage persistent pain.

The botanist Richard Schultes and the chemist Albert Hoffmann named "**the plants of the gods**" those offered as medicinal and therapeutic proposals. Among them: peyote and various types of fungi, such as the toloache [11], called by the Mexica *tolohuaxíhuitl* or *toloatzin*, from the genus *Datura ferox*, and marijuana, presented in special religious celebrations. About peyote, it will be said: From other mountains, as *from "the times of the first peoples"*, the Huichol pilgrims will come to look for it, the 'Luminous', the 'Divine', on a long walk back to Wirikuta, a region where they will make the world reborn by fire, tobacco, and song.

They also receive other names: **power, visionary, or awareness plants**, since they connect the human being with universal knowledge, with truth and infinite wisdom**,** *relegated* to the darkness of the unconscious. The **teacher plants** are capable of teaching, transforming, and healing their human apprentices and allies. They have the ability to transmit their 'therapeutic knowledge' to the shaman who ingests, or smokes, the plant itself. It is their belief that if they fulfil certain conditions of isolation and follow a prescribed diet, these plants are able to 'teach' them how to diagnose sickness.

Misnamed **'hallucinogenic' plants,** a word derived from the Latin *allucinari,* it means 'to obfuscate, seduce, or deceive, causing one thing to be taken for another'. The concept of vulnerability is incorporated into this definition, which is a predisposition to a pathological state (illness or madness), dysfunction socially inappropriate, and also applied to the random idea of 'hazardous substances'. Currently, the scientific literature rejects these pejorative names and uses with greater consensus the '**entheogenic**' neologism, proposed by North American researcher Carl A. R. Ruck, an American classical philologist known for his contribution to the study of entheogens in the classical world, by Jeremy Bigwood, an American science journalist interested in Central America, by Danny Staples [12], a classical mythologist who studied the role of entheogens in general and in Greek and Biblical mythology in particular, by Jonathan Ott, an ethnobotanic writer, mycologist, and chemist specialized in the study of entheogens and their cultural uses, and by R. Gordon Wasson, vice president of JP Morgan & Co., a pioneer writer studying ethnobotany, focused on ethnomycology, especially on entheogenic mushrooms. This more appropriate term refers to the *ingestion* of psychotropic *substances* that alter states of ordinary consciousness, involving 'mystical' experiences or ecstatic trance. In Greek, *entheos* literally means 'god within', and this expression, including the Greek words *entheos genos*, denotes the action of transforming and means 'generating the sacred' or 'engendering within itself the sacred', 'which shows our inner god'. Utilized when the subject has a divine vision or becomes possessed by a supernatural power, it is also used as an adjective, in the case of **entheogenic plants** or substances, changing the biochemical and pharmacological criteria by anthropological and ethical indicators, incorporating indigenous worldviews.

Other widely adopted terms are: **psychotropic** (from the Greek *psyche*: 'mind' and *tropein*: 'to turn'), or **psychedelic** (from the Greek *psyche*: 'mind' and *delein* 'to manifest'**:** which reveals the mind), the most widely used in the United States, which has acquired popular meanings beyond the drugs or their effects. It was first coined by British psychiatrist Humphrey Osmond in 1957, but it combines two Greek roots incorrectly, with the implication being that psychedelics can develop unused potentials of

the human mind. These substances, chemical agents (natural or synthetic), act on the central nervous system, modifying certain biochemical or physiological processes in the brain, which results in temporary changes in cognition, mood, consciousness state, and behaviour. In this sense, most psychotropic or psychedelic drugs alter the neurotransmission process, stimulating or inhibiting activity.

No one term fully satisfies scientists, but hallucinogens come closest because they distort the senses and usually produce hallucinations - experiences that depart from reality. The actual causes of such hallucinations are chemical substances in the plants. These substances are true narcotics. Contrary to popular opinion, not all narcotics are dangerous and addictive. Strictly and etymologically speaking, a narcotic is any substance that has a depressive effect, whether slight or great, on the central nervous system. Narcotics that induce hallucinations are variously called hallucinogens (hallucination generators), psychotomimetics (psychosis mimickers), psychotaraxics (mind disturbers), and psychedelics (mind manifesters).

Fig. 2. Ninhursag, goddess of fertility, the 'Lord of Land'

2.2. Going deeper into the Historical vision

Fig. 1. Enki, god of Sumerian mythology, punishes consumed men

Throughout history, many remote cultures and civilizations, from the Aztecs, Olmecs, Mayans, and Incas to the Minoans, Persians, and Greeks, among many others, turned to this type of plant as a means of connecting with the divine realm and as a way of knowing. All over the world, hallucinogenic plants are used as holy mediators between man and his gods. The prophecies of the oracle of Delphi, for example, are thought to have been induced through hallucinogens. Despite the different languages and origins, shamanism is associated with many different traditions and phenomena around the world, as well as the use of many "sacred plants," and this relationship is simply driven by repeated interactions with nature associated with certain cultural practices in many indigenous societies. Spirituality offers an original worldview, like traditional and complementary systems of medicine, with its belief that illness is not derived from chance occurrences, but through spiritual or social imbalance, while healing is achieved by restoring that balance. "*There is an emptiness of millennia between the verifiable use of entheogens in ancient civilizations and the present which permits one to speak of primitive and modern, pure and impure, vigorous and decadent shamanism*" [13].

The feat of developing agriculture required a previous accumulation of vast practical knowledge, and perhaps men intensified the terrestrial flora as when they transformed so many inedible species, minuscule in meaty and assimilable foods. Probably at the start of the urban revolution in the Neolithic around 4000 BC, mankind began to accumulate complex pharmacological

information along with a catalogue of effective botanical remedies against pain [14]. The rites of ecstasy were re-elaborated within the demands of heterogeneous and numerous groups, compelled to obedience by military and priestly classes in rapid expansion. Shortly after, (not before 2800 BC), the main Sumerian cosmogonic myth connected to this plant genealogy appears linked to Enki and Ninhursaga (Figs. 1/2) and the loss of Paradise (*dilmun*). Enki, the 'Lord of the earth', decides to *"know the heart of the plants to determine their destiny"*, and tries them one by one. Tasting the various fruits clearly constitutes an outrage to Ninhursaga, the Earth or mother goddess of fertility, and entails the curse of the goddess who decides *"not to look at him with the eye of life"*. Once appeased, Ninhursaga gives birth to healing goddesses, including Ninkasi, a goddess of concoctions, who in the end help to cure the sickened Enki. The myth clearly represented the kernel of the latest biblical tale of the tree in the garden of Eden since Adam and Eve (Figs. 3 /4) outraged Yahveh by eating the forbidden apple as Enki offends Ninhursaga by trying all the different fruits [15]. The physician A. Bennet thought that the fruit of the tree in the garden of Eden was a psychedelic plant, although in his opinion we should avoid a new fall, abstaining from any close relationship with this kind of substance [16].

Figs. 3/4. Masaccio, The Expulsion of Adam and Eve from the Earthly Paradise (1425-1428), fresco, Brancacci Chapel, church of Santa Maria del Carmine, Florence, Italy.

We also find the crucial idea of sin and the consequent punishment, analogous to practically all religious systems throughout history, not only in the Bible and the Sumerian world. The human's daring always unleashes the divine wrath, a perpetual version although protagonists change. While in the Sumerian poem, a god commits the sin by eating Ninhursaga's plants and receiving the corresponding punishment, in Genesis (III, 7-24) Adam and Eve, mortals, eat the forbidden fruit and are exiled from Paradise. As we can see, the dispute between gods predominates in the first case, and in the second, the man's offense to a single and supreme god; one leads to death while the other to exile; but in both versions, the punishment given to the sinners for the crime against the supreme god's decisions prevails.

3. Results

3.1. Determine the Geographic distribution of psychotropic plants and their alkaloids

Vegetation, enigmatic and mysterious, offers different types of sacred plants with powerful alkaloids. The most dangerous and deadly species can be hidden behind a beautiful and delicate but toxic flower, and instead, some of its parts can be, miraculously, the key component to survive. The toxicity developed by some of them is only one example of the general principle of adaptation to climate changes and different environments, and the need to protect themselves from the outside world. Evolution has thus allowed some animals, especially herbivores, to be able to differentiate the plants that are suitable for ingesting and purifying their organism from the harmful and deadly ones.

Fig. 5. *Papaver somniferum* (Köhler's Medizinal-Pflanzen, 1897).

Fig. 6. Betel preparation (Wikimedia commons)

However, it should be borne in mind that the toxins from these herbs are not equally aggressive to all species. There are some noxious substances that only affect a type of mammal and others, on the contrary, both animals and humans. Also, some plants are only poisonous during certain stages of their lives, so their threat is not permanent.

Psychoactive plants were categorized according to cultural affiliation and psychoactive uses and are widely distributed throughout different regions. In a wide southern strip called the Fertile Crescent, from the Nile valley to the Ganges valley, poppy, hemp, and datura proliferate, as well as in Indochina and China [17]. But the majority of opium poppy [18] (fig. 5) grows in a 4,500-mile stretch of mountains extending across central Asia from Turkey through Pakistan and Burma and in South-west China.

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Fig. 7. Betel Nut Thailand, at the first stage of drying (Supari. The Process)

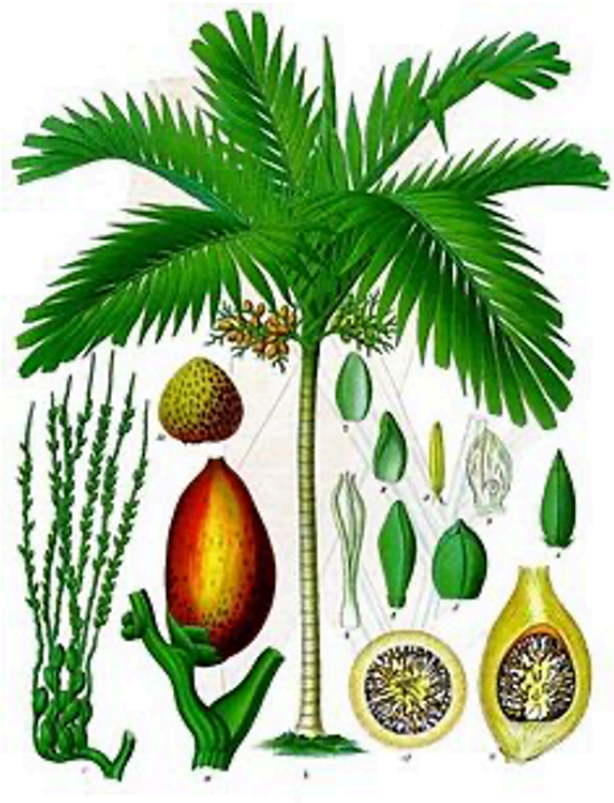

Fig. 8. *Areca catechu* (Köhler's Medizinal-Pflanzen, 1897).

In the Far East, tea must be added and, above all, betel quid (fig. 6), defined as any chewing substance that contains *areca nut*, a mixture of various ingredients. Betel plants (Piper betel) are flowering plants belonging to the *Piperaceae* family, a traditional herb in India, China, and other countries. Cultivated for their leaves, it is most commonly used as a flavouring in chewing areca nut (betel nut chewing (fig. 7)), the psychoactive element of a palm tree nut (seed of the Areca catechu (Fig 8)), described as a drug already by Theophrastus (ca. 371 BC – ca. 287 BC) and called *guvaka* in Sanskrit and *kava kava* in the Pacific Islands. It is native to Malaysia and has spread to India, Indonesia, and Sri Lanka. Betel nut can be used on its own or as betel quid, which consists in its most basic form of betel leaf, betel nut, slaked lime (calcium hydroxide), various spices, and often mixed with tobacco. This stimulant drug is chewed, forming a ball similar to the 'cocada' of South America's Indians, for its excitant and narcotic effects. It speeds up the messages travelling between the brain and the body and gives people a sensation equivalent to six cups of coffee. Caffeine gets the blood moving and the engine of the mind to spring to life, producing an arousal. It is used interchangeably as a symbol of love, marriage, and a cure for indigestion and impotence and has also numerous pharmacological properties: antimicrobial, antioxidant, antimutagenic, anti-inflammatory, although it also acts as a stimulant, carminative, antiseptic, astringent, and healing. However, betel nut chewing is addictive and has been linked with adverse health effects (mainly oral and esophageal cancers) [19].

Fig. 9. *Piper methysticum (Wikipedia)*

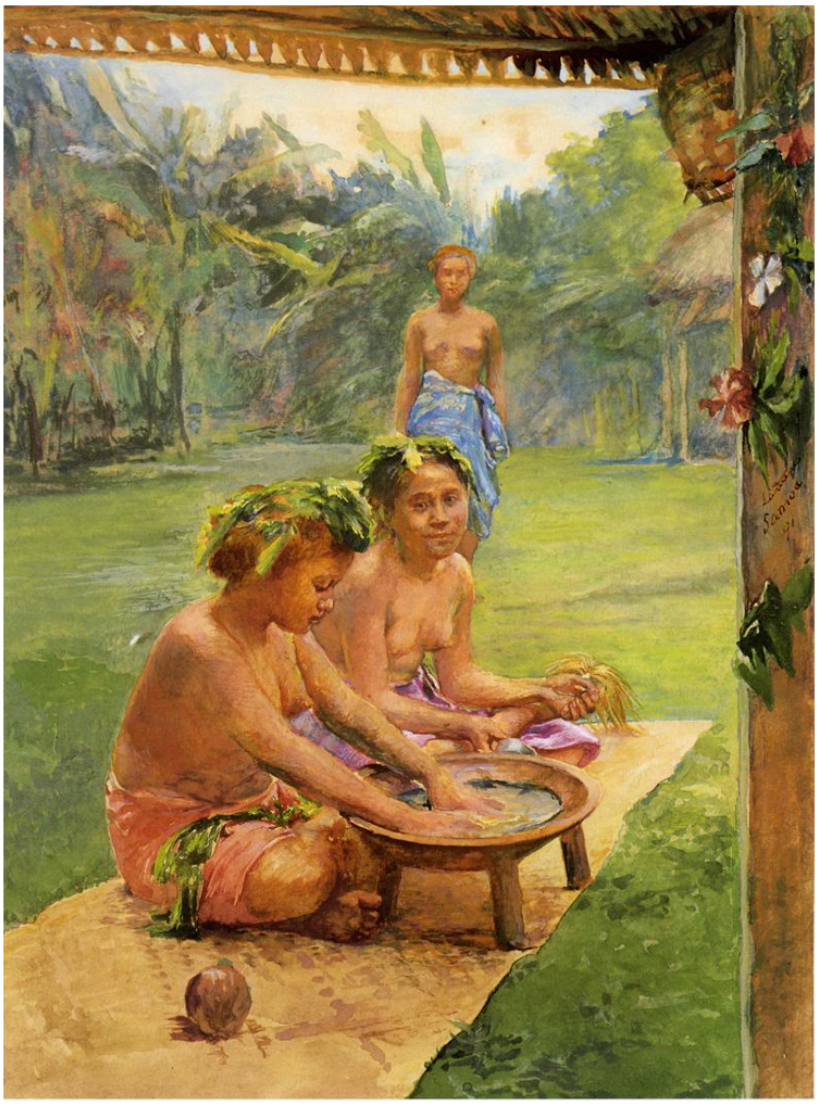

Fig. 10. A painting with women preparing kawa or the Kawa-kawa

The betel is also expended in part of the Pacific islands, although in Oceania, the most widely employed drug is **kawa-kawa** (*Piper methysticum*(fig. 9) [20], a plant closely related to the pepper tree, *Piper nigrum* or intoxicating Pepper. More commonly referred to simply as 'kava' (bitter), nobody knows for sure the origins of the kava plant, but today, most believe it originated in either New Guinea or Vanuatu by seafarers. Due to its sedative effects, **kava** is still *an* important psychoactive drug consumed throughout *the* Pacific Ocean cultures of *Polynesia*, including Hawaii, Vanuatu, Melanesia, and some parts of Micronesia[21], but it is absent in New Zealand where it cannot grow. It is a concoction rich in kavapyrones [22] extracted from the root of the plant, which are ground into a fine pulp to which water is added (fig. 10). They have effects similar to alcohol, such as relaxation, talkativeness, and euphoria, and are incorporated into shamanic rituals in some areas, but in others, it is ingested for strictly profane reasons. The kava pyrones are believed to have anxiolytic, analgesic, muscle-relaxing, and anticonvulsant effects, mediated by effects on the limbic system, the part of the brain linked to emotions. For centuries, kava has been applied in the traditional medicine of the South Pacific Islands for central nervous system and peripheral effects. It has been proposed more recently in concentrated forms in herbal medications and used in patients as treatment for insomnia, stress, premenstrual syndrome, and women's health problems. Also, it is applied to relieve pain and to treat infections and respiratory problems [23]. Touted for

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its medicinal qualities, kava is said to alleviate anxiety while promoting a heightened sense of well-being and mental clarity.

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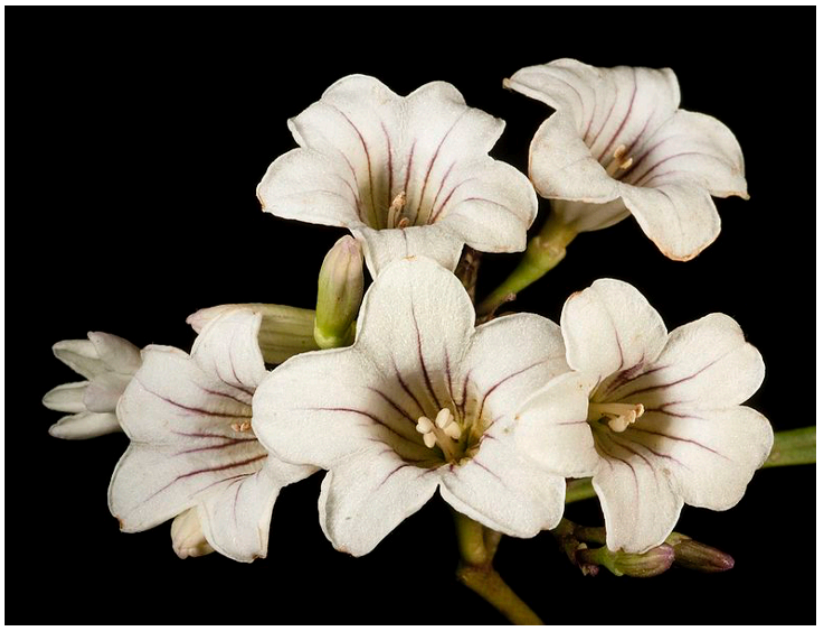

Fig. 11. Pituri *(Duboisia hopwoodii)*, native of the arid Australia interior region

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Fig. 12. *Tabernanthe iboga (Wikimedia commons)*

Only Australia, according to Schultes [24], seems devoid of peculiar drugs, although other scholars mention a plant, *Duboisia hopwoodii* (fig. 11), a species from the nightshade family (Solanaceae) native to Central Australia, locally called 'Pituri' [25], with remarkable powers. Root material contained hyoscyamine, a high proportion of scopolamine, a very hallucinogenic alkaloid [26], nicotine, the major alkaloid in plants from Western Australia and Queensland, and was later found also to contain the more potent d-nornicotine, more toxic toward mammals and used to poison animals, and whose leaves have traditionally been used for their stimulant, analgesic, and hallucinogenic effects by members of Aboriginal tribes in sacramental contexts.

Regarding Africa, although anthropological and ethnobotanical studies focusing on the subject are still very insufficient, the African continent is endowed with an enormous wealth of plant resources and a remarkable variety of psychoactive flora. Hemp and datura seem autochthonous, as well as iboga, the root bark of

Tabernanthe iboga (fig. 12), a West African shrub that grows in Congo and Angola, West Africa [27]. Harvesting of *Tabernanthe iboga* rootbark is a lucrative activity for forest dwellers in the Congo Basin. Its traditional use as an epiphanic sacrament in local religious practice in the bwiti ritual cult of healing [28], a spiritual discipline of the forest-dwelling Punu people and Mitsogo peoples of Gabon (where it is recognized as one of three official religions), turns it into a religion similar in many ways to the American Peyote Church, which resists Christianity and Islam with some effectiveness. Recognized as an official religion in Gabon and Zaire, they still use Iboga to promote radical spiritual growth, to stabilize community and family structure, to meet religious requirements, and to resolve pathological problems. The indole alkaloid ibogaine is the most abundant hallucinogenic constituent present in the root bark with stimulating effects, suitable for rituals. Its main active ingredient, in small amounts, is traditionally used to suppress hunger, thirst, and exhaustion in extreme working conditions and as an aphrodisiac. In bigger amounts, however, it can cause intensive visions.

The **kola nut** (fig. 13) or **Sudan nut**, the fruit of a wild tree (*Cola acuminata* or *Cola nitida*), native to the tropical rainforests of Africa, grows wild in a strip that goes from Guinea to the sources of the Nile. Kola belongs to the same family as cacao and, in fact, it contains many stimulants and has been cultivated in West Africa (its natural habitat) for hundreds of years. The kola nut is bitter to taste but has a pleasant aroma. Its seeds have 2% caffeine — the same as coffee — and small amounts of the stimulant theobromine, substances that are also found naturally in tea, coffee, and chocolate or cocoa beans. They also have sugar and kolanin, a heart stimulant. In short, it is a central nervous system stimulant (comparable to coffee or tea but with a milder effect), a diuretic, it combats asthenia, weakness, or fatigue, and has a cardiotonic, digestive, and lipolytic effect, mobilizing fat. In Africa, people have chewed it for a long time as a stimulant, since it combats reluctance to work. Kola, like the qat or khat, is massively consumed with fervor, (fig 15) *"it is not uncommon to see the poor pick up a piece of nut gnawed and exhausted by the rich, and put it back in the mouth to get some effect"* [29]. The first cola soft drink, Coca-Cola, was invented in 1800 by mixing the extracts of kola and coca with sugar, carbonated water, and other ingredients. However, Coca-Cola no longer uses kola nut extracts in their drinks.

Fig. 13. ***Kola nut*** *(Alchetron)*

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Fig. 14. *Catha edulis (Wikipedia)*

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Fig. 15. A Somali man prepares qat in Mogadishu (Wikimedia commons)

On the other hand, ***Catha edulis*** **(khat**) (fig.14), also spelled cat, tschat, qat, chat, or miraa, from the Celastraceae family, is a flowering plant native to the Horn of Africa and the Arabian Peninsula, tropical areas of eastern Africa. This stimulant vegetable is cultivated in the Republic of Yemen and traditionally used in Ethiopia, Somalia, and other neighboring Arab countries in the Horn of Africa. It is the plant with the most powerful psychostimulant properties known to date, widely consumed in Abyssinia and Yemen. The bitter-tasting leaves and young buds are chewed for the stimulants cathinone and cathine, both psychostimulant molecules, derived from phenethylamine and structurally and functionally related to natural amphetamines [30] which produce excitement, loss of appetite, and a mild euphoria. Drug takers suffer heart, ejaculation, and libido disorders, similar to those of heavy cocaine addicts [31]. In particular, cathinone, the most active, serves as a substrate to obtain in the United States clandestine laboratories a powerful drug, methcathinone, simple and low-cost chemical synthesis, that resembles methamphetamine, with a booming secret market. This synthetic by-product comes from ephedrine and other similar derivatives [32]. The main toxic effects of khat include increased blood pressure, tachycardia, insomnia, anorexia, constipation, urine retention, general malaise,

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irritability, migraine, and impaired sexual potency in men, affecting the gastrointestinal and nervous systems [33]. It is also useful to point out that in the areas contiguous to those of the khat and kola, it appears around the 10th century on the Ethiopian plateau — coffee, in the cultivated varieties that decrease hunger and reduce fatigue.

Fig. 16. Belladonna (*Atropa belladonna*) (GrowingVale)

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Fig. 17. Black henbane (*Hyoscyamus niger)* (Amazon.com)

Central and South-Western Europe can be considered the paradise of hallucinogenic belladonna or deadly nightshades, habitat also of black henbane and mandrake, and where various datura emerge spontaneously. This diverse group of plants feeds us, poisons us, sends us on mind-bending trips, dulls pain, and looks pretty in gardens.

Belladonna (*Atropa belladonna*) (fig. 16) or **deadly nightshade**, is a toxic perennial herbaceous plant with beautiful flowers, native to Europe, North Africa, and West Asia. From ancient Egypt to the Middle Ages, it was encouraged as a powerful narcotic [34]. Used as pharmaceutical anticholinergics, the foliage and berries are extremely toxic, containing tropane alkaloids such as atropine, scopolamine, and hyoscyamine that cause delirium and hallucinations, affecting the nervous system [35].

Figs. 18/19. Flowers and roots of the mandrake (Wikipedia)

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Fig. 20. Cereal ergot (Herbarium)

Hyoscyamus niger, commonly known as **black henbane** (fig. 17) or stinking nightshade, is a poisonous plant in the nightshade family *Solanaceae*, native to temperate Europe and Siberia. These psychoactive properties include visual hallucinations and a sensation of flight, originally used in continental Europe, Asia, and the Arab world [36]. Henbane was historically employed in combination with other plants, such as mandrake, deadly nightshade, and datura, as an anaesthetic potion, as well as for its psychoactive properties in 'magic brews' [37]. The use of henbane by the ancient Greeks was documented by Pliny, who said it was "of the nature of wine and therefore offensive to the understanding", and recommended by Dioscorides as a sedative and analgesic. The plant, recorded as Herba Apollinaris, was used to yield oracles by Apollo's priestesses [38].

The **mandrake** (genus *Mandragora*) actually belongs to a genus of six hallucinogenic plant species in the nightshade (Solanaceae) family [39], native to the Mediterranean region and the Himalayas. However, mandrake is strangely absent in the Eurasian archaeological finds, while the oldest record is located in Egypt. Being a powerful narcotic, emetic, sedative, and hallucinogen, its poisons can easily lead to death. It is particularly known for its powerful roots, a long and frequently bifid taproot whose shape sometimes resembles a man's body or a human figure (figs. 18/19).

North Asia and Europe, although poor in psychoactive drugs, have several types of visionary mushrooms [40], that grow wild in some areas (such as the *fly agaric* in Catalonia or *psilocybins* in Wales) and have long been entwined with the supernatural in popular traditions, art, and literature. In the Greek territory — especially in the plain of Eleusis, a very short distance from Athens — the ergot of cereals, or ergot (fig. 20), a plant disease that infects developing grains of cereals and grasses, appears in notable abundance, in the most prominent variety of this group, *Claviceps purpurea* or 'rye ergot', sometimes not very toxic but with great visionary power.

Fig. 21. *Yerba mate (Ilex paraguariensis)* (American Botanical Council)

Figs. 22/23. Guarana ((*Paullinia cupana*), fruit (Wikipedia)

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Americas, or the American continent, from the Mississippi Valley to the south, have an extraordinarily rich psychoactive flora, some more or less mild stimulants (**coca, coffee, mate** (Ilex paraguariensis) (fig. 21), **cocoa** or cacaolatl, **guarana** (Paullinia cupana) (figs. 22/23), fruits rich in vitamins, with stimulants of the central nervous system such as caffeine, theophylline, and theobromine) [41], as well as plants rich in visionary principles. Others are more difficult to classify, first of all **tobacco** (*Nicotiana tabacum*), which contains the highly addictive stimulant alkaloid nicotine as well as harmala alkaloids. It causes the release of dopamine in the brain, which gives people a good feeling or stimulant effects, followed by a state of depression, which is why it then acts as a ganglioplegic or ganglionic blocker and stimulant of the sympathetic system and parasympathetic. Among *Solanaceae* with hallucinogenic properties, the *daturas* stand out. Hemp, poppy, and vines were brought by the Spanish and Portuguese when colonization began.

Jimson weed (*Datura stramonium*) (fig. 24), also called thorn apple, is a poisonous plant with hallucinogenic properties that grows naturally in warm areas around the world, although its likely origin was in Central America. It was spread widely to the Old World early, where it has also become naturalized; it contains dangerous levels of tropane alkaloids atropine, hyoscyamine, and scopolamine, substances which, in high doses, cause aggressive behavior, coma, and even death. It has frequently been employed in traditional medicine to treat a variety of ailments. It has also been used as a hallucinogen (of the anticholinergic/antimuscarinic, delirant type), taken entheogenically to cause intense, sacred, or occult visions [42]. Their association with voodoo and witchcraft comes because shamans used to smoke its leaves along with tobacco to enter a trance.

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Fig. 24. Jimson weed (*Datura stramonium*) (Wikipedia)

Fig. 25. *Sophora secundiflora* or Mountain Laurel (Wikipedia)

Fig. 26. Fruits of mezcal bean (Pinterest)

It has been proposed that many nomadic hunter-gatherer societies always utilized various drugs to ensure the practice of shamanism, a lifestyle commonly reported today. One of them is the Mescal bean or Texas mountain laurel (the sacred *Sophora secundiflora*) (fig. 25), an evergreen, usually multi-trunked shrub or small tree very popular for its poisonous, brilliant, lacquer red seeds, valued by indigenous people for ornament and ceremonial use. They contain the highly poisonous alkaloid cytisine (or sophorine), a substance related to nicotine and widely cited as a narcotic and hallucinogen, and several toxic quinolizidine alkaloids. *Sophora secundiflora* has upright

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branches, pinnately compound, dark green leaves, and drooping clusters of fragrant, lavender-blue flowers, with woody seed pods. These seeds have been used by groups of the original populations of the United States and northern Mexico for their 'toxic'/delusional properties in tribal rites. Its flowers (blue-violet) have a peculiar perfumed smell and stand out radiantly with the reddish tone of its 'beans' (fig. 26).

Fig. 27. Peyote (*Lophophora williamsii) (Ciber cactus)*

Fig. 28. Mexican hallucinogenic mushrooms (Amazon.com)

Undoubtedly, the peyote (fig. 27), a cactus, and the magic mushrooms [43](fig. 28), known by the Mexicas as *teonanacatl*, 'the meat of the gods', are two of the most important sacred hallucinogenic drugs. In Mexican civilization, the analysis of a wide range of medicinal plants has been a primary concern with a long history, especially in assessing and identifying the plant's quality for medicinal purposes; such was the case with several species of cacti, with alkaloid compounds and hallucinogenic powers, although the vast majority of current botanical studies have focused on peyote due to its healing powers and visual hallucinations, in addition to tobacco, toloache, and some mushrooms.

Since pre-Hispanic times, peyote cacti have been considered by the indigenous people as a divine plant, giving them a series of benefits: curing diseases, having good harvests, predicting the future, and being brave in battles, as well as giving them telepathic powers.

In our work, we will only analyze two species of plants with psychoactive powers, the mandrake, a nightshade widely known in Europe for its powerful magical properties (both positive and negative) since immemorial times, and the peyote, a wild-growing cactus typical of America that plays a central role as a sacred plant for its beneficial qualities in the traditions of indigenous groups since pre-Hispanic times.

4. Discussion 1

4.1. Mandragora officinarum [44] *or Atropa mandragora*

Called the potato or deadly nightshade family, *Solanaceae* has about 90 genera and nearly 3000 species. This Latin name perhaps comes from a certain resemblance of some of its flowers to the sun and its rays. It contains some of the world's most important food plants, such as tomato, potato, eggplants, and chili peppers, while others grow as ornamentals such as petunia and tobacco (*Nicotiana tabacum*)[45]. They all contain powerful alkaloids and a common component, solanine, a glycoalkaloid poison which gives the family its name and functions as an insecticide while the plant is growing. Nicotine, abundant in the tobacco plant, is also present, although in lesser concentration, in potatoes, tomatoes, or aubergines.

Mandrake is just one of the 2,500 species of the deadly nightshade (= toxic *Solanaceae*) family, very dangerous: they cannot be touched or eaten in Europe [46]. Tomatoes, as potatoes, a root, when they arrived in Europe from Latin America in the early 16th century, were regarded with suspicion as food because botanists recognized them as a nightshade or a strange type of mandrake. Once the Europeans decided to try them, the population of northern

Europe doubled in a hundred years because potato tubers provide plenty of starch and vitamins, and tomatoes, thanks to lycopene, help reduce blood pressure, prevent strokes, lower cholesterol, and reduce the risk of prostate cancer.

However, the best-known species of the plant genus Mandragora, from the Greek word *μανδραγόρας* (*mandragóras*) 'harmful to livestock', 'dangerous for the cattle', genus of six species of hallucinogenic plants in the nightshade family *Solanaceae* [47] is *Mandragora officinarum* or *Atropa mandragora*, often known as mandrake as its root and for its poisonous properties. It is a very toxic perennial plant of at most 30 cm that has a short stem bearing a tuft of ovate wrinkled leaves from 5-40 cm. Long (fig. 29), often arranged in a basal rosette. The hermaphroditic flowers (with male and female organs) are pollinated by insects but are self-fertile, they are solitary with a bell-shaped corolla of five petals; they range from purple to yellow-green in colour. The inflorescences are produced on peduncles and from them arise the oval-shaped fruit, a fleshy orange-coloured berry (fig. 30) similar to small tomatoes that turns black when ripe and dry and exhales a fetid odour. The plants are characterized by a long thick taproot with carrot-shaped and a meter in length that is often forked and resembles a human figure (fig. 31).

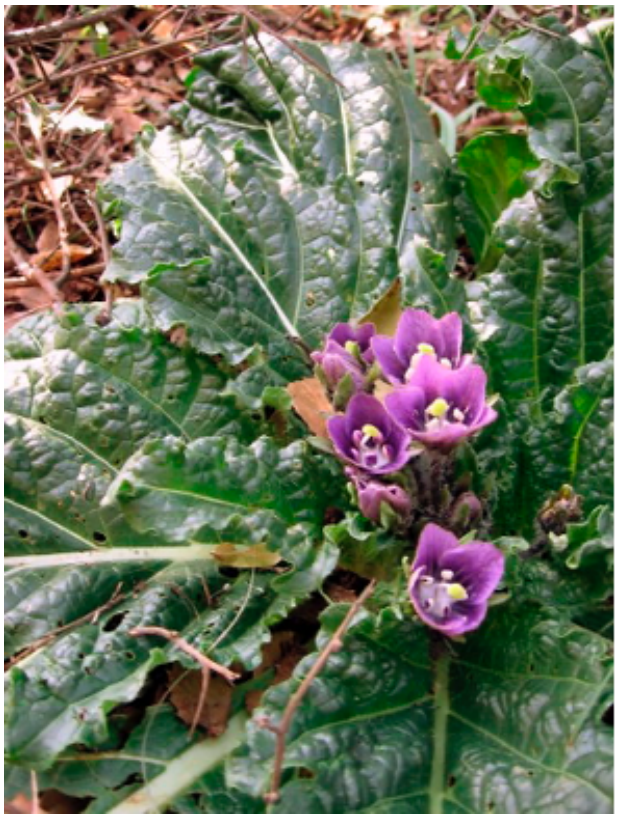

Fig. 29. Mandrake Plant (Wikipedia)

Fig. 30. Mandrake fruits: fleshy orange berry (Serrania natural)

From the shape of its root, many names were given to the plant. Pythagoras, according to Dioscorides (IV, 75) called the mandragora '*antropomorphos*' ('anthropomorphic') (fig. 32) that is, *hominis imago*, and Columella speaks of it as '*similis-homo* or half human' and popular traditions, little man planted. Its English name derives from Latin *mandragora officinarum* through French main-de-gloire [48]. Other designations are Satan's apple, Manroot, Devil's testicle, Circe's plant (*Mandragora* spp) because in the Odyssey (X, 5), the Greek enchantress Circe used Mandragora in a brew to turn Odysseus' men into swine.

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Fig. 31. Mandrake Roots (Naukas)

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Fig. 32. Manuscript *De Materia Medica* by Dioscorides (sheet (Folio) 90)

The plant grows in the arid areas of the Mediterranean, in southern and central Europe, and the Middle East [49]. It is classified as a poisonous plant that produces contact poisoning; avoid handling leaves, fruits, and especially roots that are hallucinogenic and narcotic. The plant was used for soothing, analgesic, aphrodisiac, and fertility purposes, but also for its hallucinogenic properties as a medication for thousands of years in correct doses. At appropriate levels, it was used in ancient times for surgery, in general anesthesia which was designed to induce a deep state of unconsciousness; also as common sedative-analgesic medications and as a painkiller. In the past, juice from the finely grated root was applied externally to relieve rheumatic pains and to treat melancholy, convulsions, and mania [50]. But if the dose taken internally is high enough, however, it is said to excite delirium and madness. Common symptoms include dizziness, shortness of breath, and bradycardia (below normal heart rate), and also the heart rate accelerates; *"It could also impair vision and cognition and can kill"* says Michael Heinrich [51].

Deliriant hallucinogenic tropane alkaloids, such as atropine, scopolamine, apoatropine, hyoscyamine, and mandragorin, are found in all parts of the plants [52], with the highest concentrations in roots and seeds, identifying in the fresh or dried root the same active ingredients and highly toxic alkaloids in addition to cuscohygrine, a pyrrolidine alkaloid found in coca. Scopolamine [53], also known as hyoscine or *Devil's Breath*, is a highly toxic drug, an atropine-like substance found in belladonna (Atropa belladonna), that should only be used in minuscule doses (transdermal dosage should not exceed 330 µg each day) because it blocks pain, the nerve impulse, and prevents nausea and vomiting (for example, in the prophylaxis of motion sickness or vehicle sickness); therefore, their consumption produces effectively euphoria and sedative-hypnotic, hallucinogenic, anesthetic, and narcotic effects and even is lethal to humans. It acts by stimulating the parasympathetic nervous system, decreases respiration and heart rate, depresses the respiratory and nervous system (central and peripheral), contracts the smooth muscles (involuntary muscles of the internal organs, heart, intestine, and other tissues), increases digestive juices and aqueous fluids in the glands (saliva, tears, bronchial mucus), and dilates the bladder with sphincter spasm and urinary retention.

4.2. Medicinal uses

An overdose of more than 10 mg in children or more than 100 mg in adults causes convulsions, severe depression, cardiac arrhythmias, severe tachycardia, fibrillation, respiratory failure, vascular collapse, delirium, and sometimes psychosis, paralysis, stupor, and death. The victim can be left unconscious or without will, totally

vulnerable, submissive, and very easy to manipulate due to its strong sedative action, or suffer amnesia or temporary memory loss with mental blackouts without remembering the episode details, becoming associated with sleepwalking. It is thus used for criminal purposes such as attempted robbery or rape, but the effects sometimes end up as very serious poisoning of another nature, tachycardia, arrhythmia, psychosis, requiring hospitalization. The excretion occurs in a few hours, between 4 and 5 hours, and the dose drops by half, although even days later a part is excreted in the urine. In some cases, physostigmine salicylate, from the Calabar bean, is used to treat anticholinergic poisoning caused by overdoses of atropine, scopolamine, and other drugs of this type and blocks the action of acetylcholine.

The plant, due to its narcotic and sedative power (even against coughing), induces a state similar to that of the REM sleep phase [54]. Being analgesic, it reduces pain in cases of intestinal colic or toothache and, according to ancient medical tradition, it also offers benefits in sexual satisfaction and wellbeing. In fact, used as an aphrodisiac, it increased sexual desire and power, and cured female sterility. Mandrakes were believed by ancient Hebrews to be a stimulant to help with conception in barren women, as reported in Genesis (30, 14, 24). Rachel, supposedly sterile, ate mandrake and was able to conceive Joseph. Legend held that mandrake's roots, bizarrely looking like a human body, could be brought to life in male and female form as a human embryo, proceeding always with caution and strictly following a set of step-by-step instructions passed down from generation to generation. It can look rather like babies, and this seems to indicate reproductive power, so those having trouble conceiving would sleep with them under their pillows.

The pharaonic courts' doctors highlighted its narcotic, anesthetic, but above all, aphrodisiac properties [55]. It was cultivated in Egypt during the New Kingdom and was called *rrmt,* although for Dioscorides (IV, 76) the name given by the Egyptians was *aperioum*. In the Pharaonic era, their fruits are confused with those of the Persea in different tomb representations, and apparently, the imagery of banquet scenes includes intoxication and mandrakes, offered as an aphrodisiac to increase sexual desire and life [56].

Hippocrates' disciples were already familiar with the mandrake's medicinal properties and took advantage of its emetic, sedative, and hypnotic qualities, in force until the 18th century. Theophrastus (IX, 8-9), for his part, notes its aphrodisiac activity and its narcotic powers, and also that it could induce madness [57].

Although the basic molecular, cellular, and integrative mechanisms of its action were not explained until the end of the 20th century, the healing properties of the entire plant were historically known [58]. Greco-Roman medicine already described many of its pharmacological effects, including Dioscorides (1st century AD) and Galen (circa 129-199), and from the 16th century, these were adopted by herbalist books in local languages. According to Dioscorides, it could elicit a range of reactions, from wooziness to death, and it was well established as an anaesthetic for surgery in low doses as 'soporific sponges' or 'inhaled anesthetic' [59] while in Pliny's days, the patient chewed a piece of the root before undergoing the operation [60]. The fresh root operated very powerfully as an emetic and purgative, and macerated and mixed with alcohol in oral administration, it may confer analgesic effects or induce sleep for insomniacs, while in sufficient quantity, mandrake was prescribed internally to induce oblivion, to treat melancholy, and convulsions [61], although in large doses it could be fatal, excite delirium, and madness. Juice from the finely grated root was applied externally to relieve rheumatic pains; the fresh root operated very powerfully as an emetic and purgative. Boiled in milk, its leaves were used as a poultice to treat skin wounds or indolent ulcers. In modern times, they have been used therapeutically in very small doses to treat insomnia, rheumatic pain, and gout. The root is still in use against lung, gastric, and breast cancer and in combination chemotherapy for germ cell tumours, although herbal mandrake is still used occasionally in homeopathic and folk medicine and has applications in modern witchcraft and occult practices, but almost all pharmacopoeias in the world proscribe plant drugs of real medicinal value. However, it is a very poisonous plant - an overdose can cause tachycardia, delirium, and even death.

In North America, the name mandrake is often used for the mayapple (*Podophyllum peltatum*) [62] American mandrake or wild mandrake [63], an entirely different plant belonging to the barberry family (*Berberidaceae*) that should not be confused with the poisonous European mandrake, a member of the *Solanaceae* family. Mayapple roots were used by Native Americans and early settlers as a powerful laxative against worms and other intestinal parasites, as a purgative, emetic, 'liver cleanser', for jaundice, constipation, hepatitis, fevers, syphilis, and to induce vomiting; it was applied as a topical for its antiseptic and pain-relieving effects. The green fruit is harmful and poisonous like the rest of the plant, but it is edible when ripe, although it can have a cathartic effect.

4.3. Association with mystical and divine

Although *Mandragora officinarum* is one of the most famous medicinal plants in western cultures since Antiquity and throughout written history and is still in use today in popular medicine, it has always been associated with the mystical and divine, while superstition

phenomena and beliefs have always played an important role. Curious and mysterious ceremonies surround the ritual for gathering the mandrake [64]. A common theme in these traditions was that the mandrake not only was human-like in shape but could also cry, shriek, and kill (fig. 33).

In medieval times, it was thought that as the mandrake was pulled from the ground, it uttered a shriek that killed or drove mad those who did not cover their eyes and ears with pitch (or wax).

Herbalists who pulled up this root that groans and screams, a risky activity, would be condemned to hell because an evil Satanic spirit would force them to commit unspeakable sins. In fact, at this time, it was believed that human hands should not come into contact with the plant because mandrake poisoning could cause extremely serious adverse health effects, including death, a well-founded assumption since a wide range of acute dermal toxicities have been reported [65]. Already, Dioscorides had suggested using a dog to uproot the mandrake so that the dog would fall victim to the plant's screams rather than the cultivator, allowing for the root to be safely harvested. During the Christian period, a fasted dog, driven by extreme hunger, was tied by strong cords to the stem of the plant, and pieces of meat were thrown just out of its reach (fig. 34). In its agitation to get something to eat, the dog would haul the dreaded plant out of the ground, and the evil spirit would pass into the unfortunate animal when the root was harvested, and the dog died.

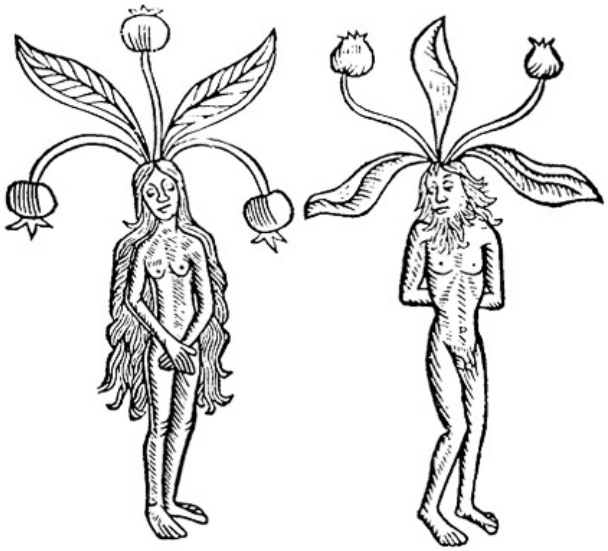

Fig. 33. Drawing of mandrakes representing a little woman and a little man. (Hortus Sanitatis, Wellcome Institute)

Fig. 34. Portrait of a man pulling a mandrake root with a dog (*Tacuinum sanitatis,* manuscrito de1390) (Wikimedia)

Once freed from the earth, it could be used for some benevolent purposes, such as healing, inducing love, fertility, or providing soothing sleep. Mandrake roots were often carried as good-luck charms, hoping the plant would grant them not only wealth and control of their own destiny but also those of others as well. For resembling a human body, these roots were thought to be powerful allies that bring their masters good fortune, prosperity, and protection from evil and illness, but also misfortune for others [66]. The Catholic Church vehemently discouraged this practice, akin to magic and witches. Joan of Arc, during her trial in 1431, was charged that the voices she claimed she had heard belonged to Satan, delusions produced by an overdose of mandrake [67] an herb with a narcotic-like substance that has magical powers, and she was known to carry mandrake in her bodice [68] Thanks to this, she was better able to bear the pain of being burned alive at the stake. Her judges insisted that "her premonitions were witchcraft and that her (successful) battles were diabolical crimes," and Joan was found guilty of heresy.

During the High Medieval Period, when the German Crusade started, a Germanic legend arose: the humanoid-shaped Mandrake root, or *Mandragora officinarum*, was widely believed to be produced by the semen of hanged men under the gallows. Alchemists claimed that hanged men ejaculated after their necks were broken and that the

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earth absorbed their final "strengths". In some versions, it is blood instead of semen [69]. Laurent Catelan (1567-1642), a famous Catalan apothecary in Montpellier, wrote a study of the mandrake, discussing its generation from sperm. He explained this legend and assured that, *"the mandrake comes from the sperm of a man, who in the germination of this plant does the job and the effect of the grain"*, sperm preferably "*released from criminals hanged from the gallows or crushed on the wheel.... the semen fell drop by drop on the earth that was rich in human fat, 'like that in a graveyard', which aided the fertilisation process* [70].

In addition, during the Late Middle Ages, the fertility powers of mandrake gained new credence under the so-called doctrine of signatures of Paracelsus (1493-1591). Dating from the time of Dioscorides and Galen, it states that herbs resembling various body parts could be used by herbalists to treat ailments of those body parts, either limbs or organs [71].

4.4. Literature and magical powers

Its magical powers as a love filter, aphrodisiac, and to promote fertility were known since Antiquity, as already reported by the Greek comic poet Alexis of Thurii, Lucania (Italy) in Magna Graecia (375-275), one of the foremost writers of Middle and New Comedy who lived in Athens and wrote a comedy called *Mandragodixomene*. Its magical powers as a love filter, aphrodisiac, and to promote fertility were known since Antiquity, as already reported by the Greek comic poet Alexis of Thurii, Lucania (Italy) in Magna Graecia (375-275),, one of the foremost writers of Middle and New Comedy who lived in Athens and wrote a comedy called Mandragodixomene. These beliefs about the plant's aphrodisiac and fertility-enhancing qualities persisted almost two millennia later, when the Florentine theorist and writer Niccolò Machiavelli (1469-1527) mocked his contemporaries in the most extraordinary of Renaissance comedies called precisely *The Mandrake* [72] written in 1518. The protagonist, Callimaco, convinces Lucrezia's husband, who desires a son and heir, to drug her with mandrake, claiming it will increase her fertility, a ploy to have sex with, and impregnate, this local woman, becoming her lover and trying to get the plant.

Shakespeare's work is rife with botanical references of both mythical, foreign, and regional origin. The mandrake, a fascinating crypto-pharmacological botanical plant and a rather frequent trope in Shakespeare's plays, appears alternatively as a curse, a charm, and a sedative, underlining the conflicting and contradictory myths about this subject in the 1600s. Shakespeare mentioned the plant in *Anthony and Cleopatra* (Act 1, Scene 5), *Romeo and Juliet* (Act 4, Scene 3), *Henry VI Part Two* (Act 1 Scene 2; Act 3, Scene 2), *Macbeth* (Act 1, Scene 3), and *Othello* (Act 3, Scene 3)[73]. Being a key component in sleeping draughts due to its soporific effects, both Othello and Cleopatra call for it in times of emotional distress. In *Macbeth* the coven of witches reveals to him three prophecies about his future, and he doubts if they were real or just a hallucination. In 1606, at the height of the witch-hunt or the witch purge in Europe, Shakespeare provides a reasonable interpretation of the state of bewitchment, that is, of delirious dreams, while pointing to a possible cause of this insanity [74]: there are poisonous plants that, by contact or ingestion, cloud our mind, attempting unreal sensations even though, unfortunately, such botanical knowledge was lacking in Europe at that time.

The 'insane root', as Shakespeare quotes in *Macbeth* I, 3: "*Were such things here as we do speak about? Or have we eaten on the insane root that takes the reason prisoner*?"[75], may well have been mandrake (*Mandragora officinarum*), the most famous magic Mediterranean herb, sold at high prices in markets north of the Alps.

In Romeo and Juliet (IV, scene 3), she proclaims her fear of being encased in the Capulet family tomb and hearing the shrieks of mandrakes: "*Alack, alack, is it not like that I, so early waking, what with loathsome smells, and shrieks like mandrakes torn out of the earth, that living mortals, hearing them, run mad*"[76]. At the final act, our tragic heroine takes a potion to fake her own death and place her into a catatonic state. Many believe that the sleeping potion was an elixir made from mandrake, while Romeo uses a powerful, fast-acting poison to take his own life, the medieval monkshood, a common name for wolfsbane (*aconitum napellus*), a forbidden botanical product in the crypto-pharmacology which causes rapid respiratory failure. The fast-acting Aconitum alkaloids, known as cardiotoxins or neurotoxins, cause severe neurological, cardiovascular, and gastrointestinal complications and, if untreated, a quick death. The rapidity with which death follows a lethal dose of aconite is echoed in Romeo's reference to gunpowder in "hasty powder fired," and Henry IV echoes in comparing aconite to "rash gunpowder" (4.3.48). In Henry VI (Part Two), Suffolk similarly curses his enemies: "*Would curses kill, as doth the mandrake's groan*" (3.2.312). Both Juliet and Suffolk refer to the myth surrounding the mandrake that, upon being unearthed, its scream would induce either death or madness.

Figs. 35/36. *Bryonia alba root* (slide.share)

On account of its properties, both mythical and real, mandrake was in great demand in medieval times, which led to its beginning to run out. As a result, many imitations sprung up, and many artists of the 16th century tried to fake the anthropomorphic root. *Bryonia alba* or *Bryonia dioica*, (figs. 35/36), the English mandrake also named false mandrake [77] was an inexpensive surrogate for the true plant (*Mandragora officinarum* L.) and was sold as such in northern and central-eastern Europe. This poisonous climbing plant in the gourd family produces greenish flowers in summer and red, shiny berries in winter. Due to an apparent resemblance of both roots, the mandrake folklore and medicinal attributes were passed on to white bryony, as alternative stories spread by such swindlers who sold fake mandrake roots to people. Nowadays, *Bryonia alba* is considered at best as an ornamental plant, and at worst as a noxious weed.

However, as mandrake leaves and roots are poisonous and can easily lead to death, it is the herb that time has forgotten, not currently used today. Early in the 20th century, it was considered a 'cursed' plant that brings bad luck. Modern science has stripped mandrake of its enchanting mythology and has found no safe medical use for it.

5. Discussion 2

5.1. The sacred plant of peyote (in Nahuatl peyotl) and mescaline

In many religious traditions, plants are rich in spiritual symbolism and are seen as revitalizing, healing, and sometimes even acting as intermediaries with the divine world. The Huichol Indians (Wixarika) of Mexico believe the Peyote cactus with hallucinogenic properties is not a plant but a god, a gift from the Earth Goddess to her people, deriving the name itself from a Nahuatl word in the Aztecs' native language that means "divine messenger" [78]. Many cacti are known to be psychoactive, containing phenethylamine alkaloids such as mescaline, but are not always used with a ritualistic intent [79]. The two main ritualistic (folkloric) genera with psychoactive high concentrations are definitely the San Pedro cactus (*Echinopsis pachanoi*, previously listed as *Trichocereus pachanoi*) (fig. 37), the most psychoactive and ethnographically important species [80], and the woolly Mexican cactus, whose scientific name is *Lophophora williamsii* (Lemaire, Salm-Dyck, J.M. Coulter). The peyote is used in intricate ceremonies that could take up a lot of hours and that have reached a grave and sacred importance. San Pedro, also known as Aguacolla, Huachuma, Gigantón, is a large columnar cactus that has long been used by shamans of indigenous tribes of the Andes in South America for both healing and spiritual transcendence sessions. It serves both as medicine and as a way for people to cleanse and connect their souls, and it is the main ingredient in 'cimora', a hallucinogenic brew that concentrates mescaline, used for healing and religious purposes in Peru and Bolivia. Several other psychoactive species have not always been used with a ritualistic intent.

Fig. 37. *Echinopsis pachanoi,* syn. *Trichocereus pachanoi or San Pedro Cactus*

Figs. 38/39. Peyote: Flowers' detail (Wikipedia)

Peyote would be the New World hallucinogens prototype, one of the earliest discovered and probably the most spectacular vision-inducing plants encountered by the Spanish conquerors. Its psychoactive properties, its healing powers, and its thousand-year-old sacramental use have persisted to the present time, and an impressive

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body of research has been focused on peyote. There is no general agreement about who were the first Indians to discover its psychoactive properties. Some authors suggest the Chichimeca people, others the Tarahumara Indians, living where peyote abounded, and the use spread from them to the Cora, the Huichol, and other native tribes.

The word 'peyote' is a Hispanicized rendition of the Nahuatl word peyotl that signifies, according to Sahagún, 'silk cocoon' or 'caterpillar silk', which means something white and silky and evidently refers to a distinctive tuft of white, woolly flocculence that crowns the apex of the plant [81] from a root peyōni, 'to glisten'. The word 'peyote' of Aztec origin could mean 'disturbance' or 'stimulation' [82] and for other sources was translated as "divine messenger'. In native West Mexico, it is called hikuri or hikuli by the Huichol people. However, it is also known by many names, including: cactus pudding, challote or shallot, devil's root, earth cactus, cactus pudding, mescal flower, mescal button, peote, piote, tuna de tierra, whiskey cactus.

Peyote, from the *Cactaceae* family in the genus *Lophophora*, is a small globular spineless cactus, blue-green to gray-green in colour, although it can take on white or reddish tones due to dust and sun, almost spherical and flattened at the apex (5 to 12 cm in diameter by about 2-7 cm tall), with the body of the bulbous cactus divided into 5 to 13 button-shaped segments that stick out just a few centimeters from the ground. The areolas [83] do not have spines, except if it is young [84], and they are covered by whitish hairs similar to feathers or cotton, called glochids, white or slightly yellowish pubescent woolly extensions. It has pale pink to white flowers (figs. 38/39) that arise from the apex between March and May and has a second flowering period in late summer (usually in August–September), while the small edible pink fruit ripens the following year in summer. The seeds, small and brown, are dispersed by water, wind, and animals, and disc-shaped buttons are at the top or crown of the cactus. These buttons should be cut above the subterranean roots, immediately below their base, so that the deep root remains buried and another bud can grow in its place or can generate new shoots from the areoles above the cut without it rotting. When improper harvesting techniques are used, however, the entire plant dies.

Fig. 40. Blue agave (Wikipedia)

The plant contains at least 28 alkaloids, concentrated mainly in the epigeal part, with the principal one being mescaline, extracted from the dried vegetable buttons, erroneously known as 'mescal buttons,' from which possibly derives the active ingredient, structurally related to amphetamines. The term mescal, derived from the Nahuatl *mexcalli* meaning 'oven-cooked agave,' is a misnomer introduced in colonial times by mistake because the Spaniards believed the inebriation produced by peyote was similar to that resulting from drinking pulque, made from the fermented sap of the common agave (fig. 40), a variety of maguey that does not contain mescaline. Agave is a type of evergreen succulent that has spiny tips, commonly with a monocotyledonous type, that ranges in size from a few centimetres to more than 2.5 metres in length, commonly confused with a cactus, but cacti do not have leaves, native to some regions of southern Mexico [85].

Peyote grows in an area that stretches from the limestone soils of the Chihuahuan Desert of northern Mexico to Southern Texas because it sprouts with high temperatures and low humidity. Native to the Rio Grande Valley in southwestern Texas, United States, and northeastern Mexico, it is found primarily in the Sierra Madre Occidental and in the states of Nayarit, Coahuila, Nuevo León, Chihuahua, Tamaulipas, Durango, under thorn scrubs, and on some occasions in Querétaro and Zacatecas [86]. Belonging to the extremely slow-growing plant family, in the wild, peyote takes between 3 and 15 years to reach the flowering stage, or 10-30 years to mature. Cultivated specimens grow considerably faster, sometimes taking less than 3 years, normally 6-10 years, to go from seedling to mature flowering adult. It is an important conservation tool for this endangered

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species [87] and is over-harvested by poaching [88]. This makes mature peyotes highly prized.

5.2. Antiquity of its use

This sacred plant, collected in the deserts of San, between the mountains, in the sacred territory of Wirikuta of the indigenous Huichol and Tarahumara communities in the north of Mexico, is considered an oracle plant, renewing root, sacred heart, ancestral bread, and an absolute manifestation of their deep animism. Their sacred substances bring knowledge, power, healing, and mystical insight and must be used with utmost respect and caution. With the spread of Christianity, and especially since the Inquisition and Conquest of the New World, the religious use of psychoactive plants has been severely and sometimes violently suppressed.

The sixteenth-century conquerors were both horrified and intrigued by Mesoamerican religion, the popular usage of certain plants, hateful and diabolical, and the practice of human sacrifices. Thus, the riches of indigenous ethnobotanical knowledge complexity were also destroyed. In 1571, the Holy Office of the Mexican Inquisition was established, and the Institution's distaste for the native peoples' religious use of peyote culminated in the 1620 peyote ban, officially declared a satanic cult, and religious persecution confined it to areas near the Pacific coast and up to southwest Texas. However, despite the Catholic restrictions, continuing until the 18th century, some Church leaders regrouped aboriginal people in hybridized religious practices and healing ceremonies. In Coahuila, for example, the Franciscan Mission del Dulce Nombre de Jesús de Peyotes was founded in 1698 [89] and the miracle-working powers of peyote were simply transferred to a calendar saint named Santa Niña de Peyote. By 1880, peyote use began to spread north of South-Central America with "a new kind of peyote ceremony" inaugurated by the Kiowa and Comanche people. These religious practices, incorporated legally in the United States in 1920 as the Native American Church, have since spread as far as Saskatchewan, Canada. Even today, an interesting mixture of Roman Catholicism and peyotism has developed with many Mexican Native Americans. Currently, mescaline continues to be legally used with apparent safety by the Native American Church during religious ceremonies, which are traditionally held at night and last for approximately 12 hours. In some instances, a Roman Catholic priest may actually have performed as a curandero, a medicine man or shaman, serving peyote during night-long ceremonies.

Despite Mexican ethnobotany not having received the attention it deserves, this branch of indigenous science, knowledge of the plants was provided by the chronicles of the Spanish conquest in America and the physicians' writings interested in scientific matters. Several chroniclers, mainly Fray Bernardino de Sahagún (fig. 41), described their effects in the sixteenth century. This Franciscan friar, missionary priest, and pioneering ethnographer who participated in the Catholic evangelization of colonial New Spain (now Mexico) wrote *La historia general de las cosas de la Nueva España*. He learned Nahuatl, the Aztecan language, spent more than 50 years studying Aztec beliefs, collecting ethnographic information, and living much of his life among the indigenous Mexicans [90]. He wrote notable accounts of indigenous life and culture. Sahagún's work was originally conducted only in Nahuatl, but he translated sections of it into Spanish, although his precious, first-hand observations were not published until the nineteenth century. In this document, the plants are drawn, named, and presented according to the Aztec system of organization. The text describes where the plants grow and how the Aztecs *prepared* herbal medicines, this 'herbal' probably used to teach indigenous medicine at the college [91]. In the section about medicinal plants, a tuberous root is described called peyotl — in Nahuatl meaning 'caterpillar cocoon', and it is said that those who ate or drank it did not need wine. He estimates the use since at least 300 BC due to evidence found in a sniffing pipe from the Monte Alban culture.

Fig. 41. Fray Bernardino de Sahagún (wikipedia)

Fig. 42.

Following Fray Bernardino de Sahagún's texts, the plant was already ingested at least 2,000 years before the Spanish arrival, but archaeological evidence of peyote use dates back to over 5,000 years. For the American anthropologist Weston La Barre, based on some archaeological pieces from Colima dating 2,000 years ago, including peyote, the magicoreligious use of hallucinogenic plants by American Indians represents a survival from very ancient times, just like the Bronze Age [92]. He also believes that Chavin pottery from Peru suggests that infusions of the hallucinogenic San Pedro cactus (*Echinopsis pachanoi*) were taken rectally by Native Americans more than 2,500 years ago [93]. However, Norwegian explorer and naturalist Carl Lumholtz, a pioneer among the Indians of Chihuahua, proposes that the Peyote cult is even older, dating its use back to more than 7,000 years, because ritualistic carvings from that age suggest ceremonial use. *Mexico is the world's richest country in hallucinogenic drugs and in the various indigenous communities that have made use of them.*

But the first complete description of peyote appeared in a Mexican herb treatise, *De historia plantarum Novae Hispaniae,* written by Francisco Hernández (fig. 42), court physician to King Philip II of Spain. He spent five years collecting and classifying in Nahuatl, Spanish, and Latin an estimated 3,000 species on this first scientific expedition. *"It causes those eating it to be able to foresee and*

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predict things", Felipe II's personal doctor noted when describing it. However, Hernández's narrative describes two plants, *Peyotl zacatensi* and *Peyotl xochimilcensi,* the second of which is not even a cactus, being in fact *Cacalia diversifolia*, and received the name peyotl because of the similarity of both roots.

Spanish physician Juan Cardenas published in 1591, before Sahagún's work, *Wonderful Problems and Secrets of the Indies* (*Problemas y secretos maravillosos de las Indias*), where he probably attached one of the first medical descriptions of the experience produced by peyote: "*Those who eat or drink it see visions either frightful or laughable. This intoxication lasts two or three days and then ceases. It is a common food of the Chichimeca, for it sustains them and gives them courage to fight and not feel fear nor hunger nor thirst. And they say that it protects them from all danger*" [94].

An extract from this essay provides a brief overview of the different effects of peyotl on the body and the mind, although Spanish chroniclers also mentioned in their writings a great number of plants with intoxicating, stimulating, or narcotic effects, unknown in the Old World, highlighting their medicinal properties and reviling the 'idolatry' it produced. The cultic use and divine worship given to many of these drugs met with the disapproval of the Christian missionaries, but the native population secretly continued using the drugs considered by them as holy even after having been converted to Christianity. It was the first cactus to be harvested; it *has* a rich, fascinating, ancient, and complex history, and peyote buttons were honoured with an offering of corn, tobacco, and incense. It became present in the modern intellectual Western geography; its active principle, mescaline, has been the cornerstone of penetrating artistic expressions and philosophical discussions, especially in the second half of the 20th century.

5.3. Cactaceae Diversity

Fig. 43. Plant view in its habitat (Wikipedia)

Fig. 44. The first illustration of peyote appeared in *Curtis's Botanical Magazine* in 1847 (plate 4296).

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Until 1950, peyote plants (fig. 43) had not been carefully and extensively botanically recorded, much less studied chemically and pharmacologically, but none of the taxonomic studies, however, were based on careful fieldwork, causing frustrating botanical chaos. Just in the 1950s, a research biochemist interested in plant hallucinogenic properties personally financed a graduate school program to determine the botanical relationships and to unscramble the nomenclature [95]. Thanks to this, the botanical aspects are now much clearer, but not the ecological studies. It has been verified that the association of a large percentage of individuals with some mother plant, such as nopales, agaves, and the gobernadora or creosote bush, greasewood (*Larrea tridentata*), exists. Nursing plants (phenomenon of nodricism) provide favorable microclimate conditions for young cacti in early developmental stages to survive harsh desert climates and sun during germination, favoring certain microclimatic conditions [96].

Apparently, in 1845, the French botanist Charles Lamaire became the first person to publish a botanical name for peyote and called it '*Echinocactus Williamsii*', which appeared without a picture or description in a horticultural catalog. Another European botanist, Prince Salm-Dyck, provided the necessary description without any illustration. By 1847, though, the first picture of peyote (fig. 44) appeared in Curtis' Botanical Magazine named '*Lophophora Williamsii*' [97].

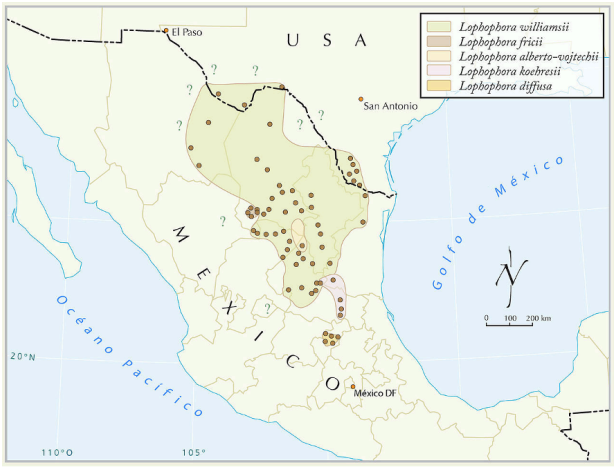

Fig. 45. Map with the distribution of peyote in Mexico in 2008 (Wikimedia Commons)

It was assigned in 1894 to the new genus for peyote alone, *Lophophora,* (name from the Greek *lophos,* crest, *and phoreus,* bearer*),* by American botanist *John* Merle *Coulter after* a systematic study [98], helping clarify its nomenclatural situation because of its inclusion in at least five different genera of cacti by the late nineteenth century. Being the peyote group unique within the cactus family, it deserves separation as the distinct genus *Lophophora* with four recognized species, but only *Lophophora Williamsii* has hallucinogenic properties.

The most recent study by Bravo (1967) utilized considerable field data, while Edward F. Anderson [99] studied selected sites and described growth characteristics, soils, associated plants, and climate. Widely distributed in the Chihuahuan Desert of Texas and Mexico (fig. 45), the genus has at least two forms that need more study: the northern populations of *L. Williamsii* (fig. 46), self-fertile and with no genetic diversity among individuals, today subject to special protection (Pr), according to the Ecological Standard of Mexico, and a more southerly species, *L. diffusa* or false peyote (fig. 47), considered an endemic and threatened species restricted to an area in the outskirts of the state of Querétaro that differs morphologically and chemically from the first. The former, both wide-ranging and highly variable morphologically, has a neotype since 1969, a specimen from San Luis Potosí (*Echinopsis williamsii*).

Fig. 46. Illustration (wikipedia)

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Fig. 47. Peyote from Querétaro *Lophophora diffusa* (Croizat)

Cacti usually have a long life cycle and low growth rates, which are prone conditions for vulnerability. Disturbed specimens in the Potosí desert have low levels of recruitment due, above all, to an increase in agricultural activity and overcollection. For the past 30 years, the San Luis Potosi wild peyote has been steadily decreasing as harvesters pick it illegally, leaving isolated fragments. Likewise, in the Real de Catorce, north-central state of San Luis Potosi and the sacred peyote country, *L.williamsii* distribution has been drastically reduced, the same as in Cuatrociénegas, the state of Coahuila. In a last study, a population in equilibrium was found; however, no individuals smaller than two centimeters (fig. 48) were observed, which could mean that this population may be at risk.

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Fig. 48. One year old *L. Williamsi* (Wikimedia commons)

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Fig. 49. *L. Williamsi* at maturity and flowering age

For their part, the germination test reveals a high percentage (64%) in comparison with low percentages (14%); however, in both scientific works, seeds can remain viable for 1 or 2 years, whereas others are viable for over a decade. The effect of seed size and colour on germination was studied in *Cecropia obusifolia* Bertol and applied to *L. Williamsi* at maturity (fig. 49). Seeds of soaking treatments almost doubled their percentage of germination at 15 DAS, arriving at almost 75%, with inhibition being greater under white light than under continuous darkness.

Fig. 50. *Echinopsis macrogona* (*Trichocereus macrogonus*) or Peruvian cactus (Wikipedia)

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Fig. 51. *Echinopsis peruviana*, syn. *Trichocereus peruvianus* or Peruvian torch

Fig. 52. *Echinopsis terscheckii, T. terscbeckii or big cardon, Argentina (Wikimedia commons)*

Fig. 53. *Trichocereus werdermannianus* or *Echinopsis werdermanniana,* Bolivia.

There are *numerous varieties* of *mescaline-containing cactus* found throughout the world, such as several *Trichocereus*

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and *Echinopsis* species, with peyote perhaps being the *most* famous:. *Echinopsis macrogona* (*Trichocereus macrogonus*) (fig. 50), is a sacred cactus similar to the Peruvian Torch (*Echinopsis peruviana*, syn. *Trichocereus peruvianus*) (fig. 51), a fast-growing columnar cactus native to the western slope of the Andes; *Echinopsis terscheckii*, *T. Terscbeckii* (fig. 52), is commonly known as big cardon or Argentine saguaro, while *Trichocereus werdermannianus*, also known as *Echinopsis werdermanniana* (fig. 53), is a columnar *Trichocereus* species from Bolivia.

Fig. 54. *Astrophytum asterias (wikipedia)*

Fig. 55. *Strombocactus disciformis*

Fig. 56. *Turbinicarpus pseudomacrochele (wikidata)*

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Fig. 57. *Obregonia denegrii* (wikipedia)

Fig. 59. *Pelecyphora aselliformis*

Even if many cactus species are grouped as peyote, not all have a recorded history of any aboriginal use. However, some succulents seem to have purely medicinal or ceremonial use, while others receive only this name as a result of some superficial resemblance to *L. williamsii*, like *Astrophytum asterias* (fig. 54), *Strombocactus disciformis* (fig. 55), and *Turbinicarpus pseudomacrochele* (fig. 56), although in some cases the resemblance is not so apparent, as in the many *Ariocarpus* and *Mammillaria* species [100] and also in *Obregonia denegrii* (fig. 57), *Aztekium ritteri* (fig. 58), *Pelecyphora aselliformis* (fig. 59), etc. But the true peyote is unmistakable due to its bluish-green colour and because it lacks thorns.

Fig. 58. *Aztekium ritteri (Wikipedia)*

5.4. Peyote components of the drug

The peyote cactus, one of the most powerful psychoactive and stimulant drugs known today, has alkaloids derived from phenylalanine and tyrosine, closely related to one another structurally. It contains more than 50 psychoactive alkaloids that have been isolated and characterized for their effects, with mescaline or mescalin (3, 4, 5-trimethoxy-phenethylamine) concentrated in cactus buds [101], with hallucinogenic and psychotomimetic effects in man, similar to those produced by psilocybin and psilocin (the active substances in "magic mushrooms") or LSD-25 (mushroom lysergic acid diethylamide). However, it differs by not being synthetically made in a lab to produce hallucinogenic effects, nor does its consumption cause addiction or long-term damage to the body. This “cocktail of compounds” may enhance mescaline effects, but some are solely present in a few parts of the plant. The hordenine of the phenethylamine class is an antibiotic found only in the roots with a sympathomimetic effect attributed to its structural similarity to neurotransmitters, including dopamine and adrenaline, while the lophophorine can be detected both in the cactus roots and buds [102]. Tyrosine and phenylalanine serve as the metabolic precursors to the biosynthesis of mescaline. Mescaline is *directly* responsible for the effects on the central nervous system, and in 2015, Ibarra-Laclette et al. detected the following psychotropic compounds that complete the initial tentatives: anhalonine, anhalonidine, anhalidine, *hordenine* (*N, N-dimethyl*-4-hydroxyphenylethylamine), pellotine or peyotine, o-methylalonidine, lophophorine, n-methylmescaline, n-acetylmescaline, and tyramine.

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Western doctors identified and studied peyote for the first time in the late 1890s. The original chemical study was made by Louis Lewin in 1888, a German pharmacologist who received the material from John R. Briggs, an American physician who wrote about its effects in 1887, unleashing thus the peyote boom. He isolated an alkaloid he called anhalonine, which today is considered to be a mixture of various alkaloids, and the earliest botanical name given to the plant was *Anhalonium lewinii*, which was in fact the southern species of peyote, *Lophophora diffusa* [103]. Years later, between 1895 and 1896, Arthur Heffter published two more studies on peyote, in which he described having isolated four different alkaloids: mescaline, peyotine, anhalonidine, and lophophorine. Heffter also performed self-tests to find the psychoactive action of these alkaloids and discovered that isolated mescaline was the main psychoactive agent. It was the first time that an entheogenic alkaloid had been isolated from a natural botanical species. The following year, in 1898, he published his work in the academic journal Naunyn-Schmiedeberg's Archives of Pharmacology [104].

In 1919, based on Heffter's description of the molecular structure of mescaline, Ernst Späth, an Austrian chemist, synthesized the molecule initially, in this case possible but relatively expensive, at the Chemical Laboratory of the University of Vienna in Austria, being the only lab test for hallucinogenic alkaloid chemical synthesis [105]. The mescaline molecule is a natural member of the phenethylamine class of intoxicants, as is the neurotransmitter dopamine, structurally related, but not to serotonin, an indole different at the level of chemical structure.

Dr. John Halpern, assistant professor of psychiatry at Harvard Medical School and probably the most notable doctor researching peyote today, has reinforced this idea. For him, it *"contains mescaline, a classic hallucinogen of the psychedelic phenylethylamine group"* [106], that probably works as others: affecting the serotonin receptor in the brain called 5-HT2A, partially agonist. The drug stimulates the production of the serotonin neurotransmitter, which boosts positive moods and relaxation. Researchers suggest that mescaline excites certain neurons in the brain, leading to the well-known psychedelic effects. This specific receptor has three switches: off, on, and running-with-psychedelics, necessary for the psychedelic experience. Specifically, some of their most prominent effects occur in the prefrontal cortex—an area involved in mood, cognition, and perception—as well as other regions important in regulating arousal and physiological responses to stress and panic. Mescaline inhibits the oxidation of sodium lactate, pyruvate, and glutamate in the brain, but does not affect sodium succinate oxidation. On this basis, it has been used as an antidote in human mescaline poisoning [107]. But outside of its initiation context used for thousands of years by indigenous nations, peyote has negative mental and unsafe effects, closer to psychiatric madness than to spiritual revelation.

In 1955, English politician Christopher Mayhew took part in an experiment for BBC's television program Panorama, in which he ingested 400 mg of mescaline under the supervision of a psychiatrist, Humphry Osmond, an event known as '*The 1955 Mescaline Experiment*'[108]. The film was deemed too controversial to air, but Mayhew later called it *"the most interesting thing I ever did"*.

The mescaline content of the peyote cactus is usually 0.4% in the fresh plant and 3-6% in the dried cactus. It is thought of as one of the milder hallucinogens; despite its lower potency, it does result in hallucinogenic effects. The buttons' potency decreases very little even when they are stored for long periods [109]. People can ingest mescaline in several ways: chewing the dried peyote buttons (the "crown" or top of the peyote cactus), grinding them into a white powder and putting it into capsules, or boiling the cactus in water to make psychotropic tea. Dosages ranging from four buttons (low dose) to 10 (large dose or 'visionary') may be ingested. In most cases, users take between 200-500 milligrams of mescaline at a time to get a potent experience that lasts between six and twelve hours. The psychoactive effects appear approximately 40 minutes after ingestion, reaching their highest point within two hours, and it is recommended to be carried out at nightfall. Experiences are often unpredictable and may vary with the amount ingested and the user's personality, mood, expectations, and surroundings. It is not advisable to make homemade preparations because its unpleasant effects greatly restrict its consumption. On the other hand, as expected, its use should be done under strict medical supervision, since it is illegal in some countries.

Physical symptoms associated with the consumption include nausea, vomiting, cramps, generalized abdominal discomfort, and other features such as uncontrolled crying not related to feelings of sadness. The initial vomiting is very common after a few hours and is an important phenomenon in indigenous ceremonies that refers to the purging of vomit to purify the soul. The sympathomimetic manifestations of this alkaloid induce effects such as increased energy and mood elevation, increased heart rate, high blood pressure, hyperthermia (increased body temperature), uncoordinated movements (ataxia), tremor, mydriasis, diaphoresis, and tachycardia, dilated pupils. Approximately 4-6 hours post-ingestion, symptoms can range from mild to serious with euphoria, depersonalization, disorientation, anxiety, ataxia, nystagmus, and vivid visual hallucinations. Changes in taste, smell, and hearing can also be present, while high doses cause bradycardia, hypotension, and respiratory depression.

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Mescaline effects take a certain time to kick in, but then it is to trigger non-ordinary states of consciousness (known as psychedelic experiences, powerful and intense, or introspective "trips"). During the period of intoxication, world perceptions change so dramatically that it can feel as if you have taken a trip to a strange, new land. It begins with a visual experience, seeing geometrical and kaleidoscopic images with fractal patterns and very bright and vivid colours, or perceiving also moving and animated images, two-dimensional as well as three-dimensional. Next, it feels like flying to a dark, empty, and peaceful sky place, far away from everything previously known. Some trips are enjoyable and mentally stimulating; empathy and a pleasant feeling flood the body and involve a heightened understanding of another's emotions. Bad trips, however, are an unpleasant experience among the top five most challenging experiences that have ever been faced, involving terrifying thoughts and nightmarish feelings of anxiety and despair that include fears of losing control, insanity, or death. It usually can fluctuate from the maximum sensation of pleasure and joy, which tends to increase, to paranoia. The delusions can be very convincing, and one may also struggle with problem-solving and decision-making, which can place the person, or people around them, at risk. For this, it is recommended to consume it in a group, together with people who can help relax and reassure users. As the hours go by, the intensity of the experience is reduced, and little by little, the control of consciousness is felt again. The next day, there is usually a feeling of relaxation and physical fatigue.

The long-term residual psychological and cognitive effects of peyote remain poorly understood. Even in low doses, depersonalization, loss of temporal perception, or disappearance of the ego with a 'complete loss of subjective self-identity' and the accumulation of thoughts and emotions can occur, as well as visual, tactile, and auditory hallucinations, synesthesia, and finally, hallucinations of the entire sensory organs. Higher doses are more likely to cause ecstasy, extreme euphoria, excitement, and happiness, oceanic bliss, and self-fulfillment, in the case of a 'good trip' [110] but in 'bad trips,' dysphoria, anxiety, fear, mania, delirium, psychosis, and acute schizophrenia can occur without putting directly the person's life at risk [111]. The Huichols call these episodes 'revolcada' or 'regaño' when the person discovers dark aspects of himself that, however, can be terrifying due to the chemical discharge that takes place in the body.

Although one study found no evidence of psychological or cognitive deficits among Native Americans who use peyote regularly in a religious setting, those findings may not generalize to those who repeatedly abuse the drug for recreational purposes [112]. Peyote users may also experience hallucinogen persisting perception disorder (HPPD)—also often referred to as *flashbacks,* which can occur days, weeks, months, or even years after taking the hallucinogen. The active ingredient mescaline has also been associated, in at least one report, with fetal abnormalities [113].

According to a group of clinicians that have proved the drug, the psychedelic experience of mescaline is spiritually significant [114]: they reported it as a profoundly healing and transformative experience, giving rise to a great connection with oneself, with nature, and with life in general. It has long been considered a powerful agent for healing many mental health ailments, forgotten psychic wounds, addiction, depression, end-of-life anxiety, and post-traumatic stress disorders. Due to its psychoactive properties, mescaline was the first hallucinogenic substance to be used in psychiatric studies, mainly for the study of schizophrenia. Highly valued and rated as a psychiatric assistant, peyote has also been used in psychotherapies of two types: psychedelic and psycholytic. The first is typical in the US, and high doses of peyote are administered in a single session. The second is more typical in Europe, and small doses are used in various sessions.

Carl Lumholtz [115], a Norwegian scientist who furnished the first description of a Native American tribes' beliefs and medicine, the Tarahumara Indians of Sierra Madre, famous for their use of peyote [116], reported that they also used it in the treatment of snakebites, burns, and wounds. It was considered an effective agent against the venom of the viper, for scorpion stings, arrow wounds, the treatment of toothaches, fever, and for 'strength in walking.' Macerated for 1 week in alcohol, it makes up a powerful remedy for rheumatic pain thanks to its analgesic action, as well as for arthritis, bone pain, contusions, bruises, or other physical pain, and even to relieve anxiety and neurasthenia. The fresh or dry intake form also helps against constipation. Wendell C. Bennett, Robert M. Zingg [117] and later Robert Bye [118], in their comprehensive study of the Tarahumara culture, also point out that it cures rheumatism, treats snake and scorpion bites, and mitigates bruises. For his part, Edward Palmer (1829-1911) [119] who made extensive botanical, zoological, and archaeological collections throughout his life in the southwestern United States and Mexico, reported that peyote was, in Mexico, a remedy for fever, to increase lactation, to soothe back pain, to induce restful sleep, and, in conjunction with other plants, to alleviate more serious illnesses.

5.5. Ritual practices

Hallucinogenic drugs, among them peyote, were linked to the theocratic, political-religious complex of pre-

Columbian Mesoamerican societies [120]. They were considered since pre-Hispanic times by indigenous people as a divine plant because they alter perception and mood, affect numerous cognitive processes, and produce visions of alternative universes or the spiritual world. Used by shamans and healers for thousands of years, they allow them to enter a trance and to see the blocked and disturbed body-energy (information), being able to free the body and mind from the energetic causes of diseases and manipulate the blockages. Through ritual practices with entheogenic plants, the ancient indigenous civilizations sought to "*induce experiences of initiation into certain mysteries and to cure diseases of the body and soul*"[121]. The Tarahumara venerated several species of cacti with hallucinogenic properties, called peyote in Spanish and hikuli (jÌkuri) in their language because it had "*the power to give health and long life and to purify body and soul*" [122]. Peyote, an herb with healing abilities and visionary powers, became the most powerful medicine to ward off evil or supernatural influences. Para Bye it allows the shaman to help the relief of his patient.

Today, Mesoamerican local shamans and healers still use them in their ritual ceremonies for being instruments that allow the maintenance of the shamanic complex, the induction of altered states of consciousness, and healing ceremonies. Peyote rituals, neo-indigenous peyote tepee ceremonies, and pilgrimages in different parts of the Mexican territory are largely concentrated in the country at present day, recently spreading its use through North America. Various American tribes, united together under the name Native American Peyote Church, were legally recognized in the US since 1918, mixing Christianity with the beliefs of Native Americans, especially the Navajo [123]. The diffusion from Mexico to the United States is based on its therapeutic usage as the main factor [124]. In the Mexican area, native communities adopt it to protect themselves from diseases, that is, to create a barrier against any evil influence or harmful effects on them. On the contrary, among the North American Indians, it is employed to treat the sick person, to purge him of the cause of illness.

Known for its psychoactive properties when ingested, *peyote has* at least 5,500 years of entheogenic and medicinal use by indigenous North Americans. Because this plant was widespread in the Mexican ecosystem, many tribes have probably discovered its properties quite independently of one another. The Tarahumara in Chihuahua, the Huichol Indians of Jalisco, direct descendants of the Aztecs and speakers of a Uto-Aztecan language, the Coras of Nayarit, and the Tepehuanes of Durango utilize it ancestrally for ritual purposes. The Mexican state has stimulated a policy of drug respect in particular areas of indigenous groups, since psychoactive substances are employed in ritual or religious contexts culturally sanctioned in many of these worldviews, under which they are allowed to cultivate, collect, transport, manufacture, and use peyote freely and legally [125] while these actions are illegal under federal and state law in the case of non-natives, in order to moderate their consumption. This permit is associated with indigenous usage only of the Huichol, Cora, and Tarahumara groups. In fact, the State Law for the Development of Indigenous Communities and Peoples recognizes peyote as a 'sacred' plant, a sacrament in spiritual indigenous ritual, so this activity is not prohibited [126]. But it is not included in article 32 of the Convention on Psychotropic Substances. These regulations show contradictions, ambiguities, and interpretation errors in connection with international conventions and normative frameworks signed by Mexico concerning psychoactive substances. On one side, due to the international agreements signed, the government is committed to respecting the traditions and customs of indigenous communities; on the other, since the arrival of Europeans in North America, peyote use has been a continual source of controversy and Native persecution. In the United States, where federal law exists, the plant was banned during the 1970s thanks to the General Law for the Prevention and Control of Substance Abuse of that year, in which it was determined that it did not serve any medicinal purpose. Although this law has not managed to prevent tourists from acquiring it. The 1994 amendment to the American Indian Religious Freedom Act of 1978 allowed Native Americans to smoke peyote freely and legally in religious services and for sacramental use. The Act requires policies of all governmental agencies to eliminate interference with the free exercise of the Native American Church.

Under Mexican law, it is illegal for anybody who is not part of the Wixárika (en español Huicholes) tribes to harvest and use peyote; only the Huicholes or Warikira (one of the few ethnic authorized groups in Mexico) can extract and use it in the ancestral religious rituals. They live in the Nayarit region, Jalisco (Cora), and Zacatecas, but every year Wixárika communities make a several-hundred-mile pilgrimage to a sacred site, for them the center of the world, called Wirikuta, in Real de Catorce, in the deserts of San Luis Potosi, near the northeastern city of Matehuala. Groups travel — these days by car, trucks, and buses — hundreds of kilometers to get there, led by a shaman-guide, a mara'akame [127].

Rituals of purification are necessary before consuming the hikuri, through fasting, the ritual confession of sexual sins, and ritual baths. The pilgrims, divided into groups based on their ancestral family lands, undergo a public confession around midnight; each person lists all their past and present sexual relationships. The names are then publicly read around the bonfire with the intention to let go of the past. Each group can only access a particular area

within Wirikuta, and they must also receive an initial blessing in their homeland before setting out on the journey.

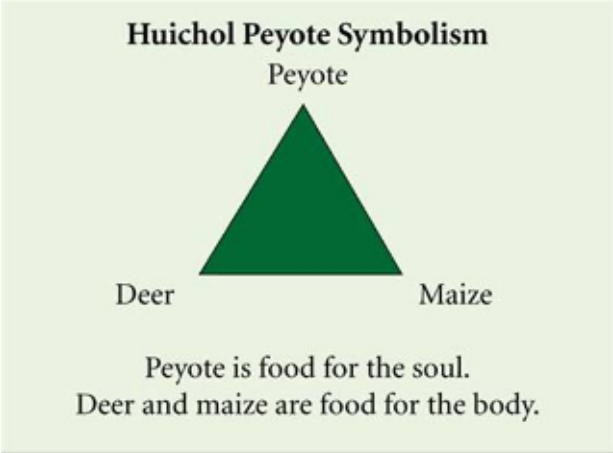

Fig. 60. Elements of Huichol Peyote Symbolism (Doctorlib.info)

Fig. 61. Representation of the god Kauyumari (Deer) Blue cosmology) (Wikipedia)

Fig. 62. A Nayarit tomb figure (The Children's Museum of Indianapolis)

They gathered the hallucinogenic cactus up to 150 crowns, after which the plants were dried and blessed. The pilgrimage prepares the plants, tells stories about the origin of humanity, and even presides over the initiation rites of other shamans and marriages. They extract medicine for the body and the spirit not only for themselves but also for family members who could not make the journey. The pilgrims bring back with them the supply of peyote necessary for the annual rituals performed back home. The medicine is a teacher, a master; it is the Blue Deer, the one who determines from the four directions where the sacred song is summoned. The three most important elements of Huichol cosmology are the peyote, the deer, and the maize (fig. 60). In their creation myth, the deer showed the Huichols' ancestors the way to a sacred desert, Wirikúta, where it transformed into a peyote cactus that provided them with nourishment. The peyote is often used by the Huichol to communicate with 'the blue deer' god; it represents the god Kauyumari (fig. 61), which is part of "The five cosmic hunters". The peyote and the deer are featured in virtually all Huichol handicraft (fig. 62), proclaiming the significance of the two symbols.

5.6. Spread to Western countries

The increase in national and international 'mythical' tourism to Real de Catorce and the consumption of peyote in Huichol areas have put the plant at a level of drug. The

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narco-tourism and the non-ritual consumption have put peyote at risk of quickly becoming endangered in San Luis Potosí, since the plant takes approximately 15 years to reach maturity. Many anthropologists, botanists, and healers [128] have asked to treat the plant carefully to prevent its exploitation. Since the 1960s, the use of plant derivatives found in psychedelic molecules has also spread to Western countries [129]. According to the chronicles of those years, artists and intellectuals were fascinated by psychedelic molecules that allowed them to "think outside the box" and, therefore, increase their creativity [130].

Not only indigenous peoples have praised the spiritual powers of peyote. The psychedelic properties of the cactus garnered it an almost religious following and have received increasing attention from artists, musicians, and writers since the 1950s. During this period, the University of Saskatchewan in Canada, particularly the small southeastern community of Weyburn (fig. 63), was home to some of the most important psychedelic research in the world. The provincial government hired Saskatchewan-born psychiatrist Abram Hoffer to develop a research program in psychiatry. In 1951, Hoffer was joined by British psychiatrist Humphry Osmond, an innovator in his field, who had previously examined hallucinogenic drugs in relation to schizophrenia and who coined the word psychedelic in 1957. In the mental health field, therapies based on guided LSD and mescaline trips offered an alternative to long-stay care in asylums. They gave clinicians a deeper understanding of psychotic disorders and an effective tool for mental health and addictions research. Treating patients with a single dose of a psychedelic was seen as an attractive, cost-effective approach. It fit with the goals of a new, publicly funded health-care system aimed at restoring health and autonomy to patients who had long been confined to asylums [131]. The CIA was said to be interested in testing a variety of drugs as possible truth serums during the Cold War, and rumours swirled that the CIA was involved in funding the psychedelic research in Weyburn as well [132].

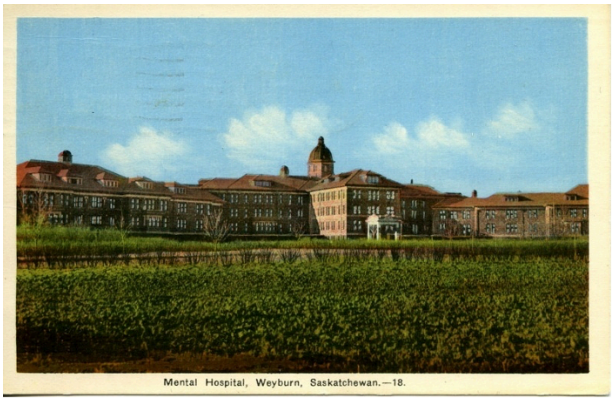

Fig. 63. Postcard of the Weyburn Mental Hospital (courtesy University of Saskatchewan, University Archives & Special Collections, Pamphlet Collection, LXX-1643)

Ken Kesey claimed that he had written the opening passage for *One Flew Over the Cockoo's Nest* (translated into Spanish as *Atrapado sin salida* or *"Alguien voló sobre el nido del cuco"*, published in 1962) when he was high on peyote. Set in an Oregon psychiatric hospital, the narrative serves as a study of institutional processes and the human mind, including a critique of psychiatry [133] and a tribute to individualistic principles [134]. Regarding its effects – according to Schultes and Hofmann's book – it reveals a "*kaleidoscopic game of colorful visions of indescribable beauty (...). Flashes and flashes of colors are perceived, the intensity and purity of which defy description*" [135].

5.7. Diffusion and pilgrimage: Real de Catorce

Fig. 64. Real de Catorce town

Real de Catorce (fig. 64), an old mining town in the Sierra de Catorce mountain, one of the highest plateaus in Mexico, was one of the villages that guaranteed the most

doi.org/10.32388/IFKWO7.2

silver to the Spanish Crown. Located 2,770 meters (9,000 feet) above sea level, it has always been the place where the Huichols perform their rituals. Now it has become the centre of the psychedelic cactus trade and a pilgrimage destination for would-be psychonauts. Its population fell drastically from 40,000 in the late 19th century (when mining was at its peak) to fewer than 1,000 after the silver mines ran out in 1893. Few go to contemplate the desert landscape and *Old West–style buildings*, both restored and abandoned, while many people go to the town to get the local cactus. The Real de Catorce unique trade has been reported in various media, from the US public radio NPR to National Geographic. This diffusion favoured all kinds of cacti preparation trade, such as jelly, drink, or ointment, and has helped keep local coffee shops, hotels, and bars open.

The people and the plant's worldwide fame began after a series of 11 books, beginning with 1968's *The Teachings of Don Juan: A Yaqui Form of Knowledge*, written by the Peruvian anthropologist Carlos Castaneda, father of the New Age movement, and submitted as his Master's thesis in the school of Anthropology at the University of California, Los Angeles (UCLA). He wrote that these books were ethnographic accounts describing an eight-year apprenticeship with a traditional "Man of Knowledge" identified as don Juan Matus, an 86-year-old self-proclaimed Yaqui Indian Sorcerer from Sonora, Northern Mexico, between 1960 and 1968. The veracity of these books was doubted from their original publication, and they are now widely considered to be fictional [136]. Juan introduced him to the 'non-ordinary reality' of the ancient Mexico´ sorcerers. They taught him the animism philosophy, the ancestral shamanic tradition, and the knowledge and manipulation of the elemental forces of beings, either living or inanimate. Octavio Paz wrote: "*If Castaneda's books are a work of literary fiction, their theme presents the revenge of the anthropological 'object' (a sorcerer) on the anthropologist until turning him into a sorcerer. Antianthropology*", "*it begins as a work of ethnography (hallucinogenic plants —peyote, mushrooms, and datura— in the ritual practices of Yaqui sorcery) and "the function of hallucinogenic drugs in the visionary experience" and that at the few pages it becomes a story of a conversion*" [137].

Castaneda claims that he showed him how to use peyote to explore 'a separate reality' and discover truths about modern society and unhappiness. He also tells how he talked to coyotes, turned into a crow, and learned to fly. Many traditionalist researchers have dismissed his work thanks to these fantastic stories. However, the book describing a mysterious sorcerer was an immediate New York Times bestseller and has aroused the interest of a large group of people who want to try hallucinogens in the desert. His third publication, *Journey to Ixtlan*, was a hardback bestseller, which revised the narrative of the first book to downplay the importance of the 'power plants' in favour of a quasi-phenomenological project of 'stopping the world'. It earned him a special dispensation PhD under the title *Sorcery: A Description of the World.*

Scholars have debated the academic status of his work and whether he invented the whole odyssey [138], even while reviewers praised the writing and storytelling and although their publisher classified it as non-fiction. In the five years since Castaneda had first introduced don Juan to the public, nobody had succeeded in tracking him down. Though apparently a Yaqui speaking a Uto-Aztecan language, don Juan did not participate in Yaqui ceremonies or exist in a Yaqui community. According to Jay Fikes's research in Mexico, Castaneda spent some time with Ramón Medina Silva [139], a Huichol mara'akame (shaman) and artist murdered during a brawl in 1971, who may have inspired the don Juan character [140] "*Is it possible*", novelist Joyce Carol Oates wondered in a November 1972 letter to the New York Times Book Review, "*that these books are non-fiction*?" *Time* sowed further doubts. Whatever the truth of his fieldwork in Mexico, Castaneda had been less than straightforward about the facts of his own biography. The author hadn't been born in Brazil in 1935 as he claimed, but in Peru ten years earlier, and his father wasn't a professor of literature, but a jeweller. "*We all liked Carlos*," his Lima schoolmate Jose Bracamonte told Time. "*He was witty, imaginative, cheerful — a big liar and a real friend*". Castaneda denied it. "*The idea that I concocted a person like don Juan is inconceivable*", he told writer Sam Keen in November 1972. "*The truth is much stranger. I didn't create anything. I am only a reporter*"[141].

Edmund Leach praised *The Teachings of Don Juan* as *"a work of art*", but *"he doubted its factual authenticity*" [142]. Anthropologist E. H. Spicer noted that the events described were not consistent with other ethnographic accounts of Yaqui cultural practices, concluding it was unlikely that don Juan had ever participated in Yaqui group life. There is not "*connection between the subject matter of the book and the Yaquis' cultural traditions*" [143]. R. Gordon Wasson, the ethnobotanist who made psychoactive mushrooms famous, expressed doubts regarding some of the claims' accuracy [144].

In the 30th-anniversary edition, published by the University of California Press in 1998, Castaneda writes of a general discouragement from the project by his professors, but he offers a new thesis on a mind-state he calls 'total freedom' and claims that he used the teachings of his Yaqui shaman as '*springboards into new horizons of cognition*' [145].

New Age theory, a philosophical and spiritual movement that emerged in recent decades, appeals to people imbued with the values of modern culture: freedom, authenticity, self-reliance, and the like considered to be sacred",

beckoning all religions, especially those classified as "spiritual, but not religious". It looked forward to a 'New Age' of love and light and offered a foretaste of the coming era through personal transformation and healing. It spread through the occult and metaphysical religious communities in the 1970s and '80s. For its part, this individualistic spiritualist current combines diverse traditions, Eastern (especially) and Western, and evokes issues such as spiritual healing, the memory of previous lives, subtle energy centres (or chakras), etc.

Its multiple sources can be summarized into four: 1. The rebirth of esotericism, based on the acquisition of mystical knowledge, in the late 19th century in Europe and America with different nuances; 2. The 'discovery' of Hinduism, Buddhism, and Taoism by the West, embraced by theosophists, with at least two culminating moments; 3. A renewed interest in European pagan traditions (especially Greek and Celtic), and in the philosophical currents of Hermeticism and Pythagoreanism; 4. The more recent interest in shamanism and the animist beliefs of 'primitive peoples'. New Age mysticism is fusion with the universe, an ultimate annihilation of the individual in the unity of the whole" [146]. Traditional occult practices (e.g., tarot reading, astrology, yoga, meditation techniques, and mediumship) were integrated into the movement as tools to assist personal transformation.

As for its recreational use, I think there's little more to be said. However, the abuse of these substances for hedonistic addiction is a recent fact in Euro-American postmodern societies. Drug use is voluntary behavior motivated by pleasure-seeking, and the pursuit of a hedonistic lifestyle is a response to minimize pain and avoid difficulties. However, addicts suffer in significant part because of strong social and moral disapproval of their type of life and by social stigma. Since the 1960s, the recreational use of peyote has prevailed in Western countries. In the following years, governments imposed strict bans on the use of psychedelics, taking into account that they are narcotics. The possibility of consumption or dependence on these new substances should be considered among young people who are treated for delirium or altered levels of consciousness in hospital emergencies [147]. On the other hand, psychedelic mythical tourism and its recreational use have intensified its extraction to manufacture mescaline and have put it in danger of extinction.

6. Conclusions

Sacred plants have played an important role in medicine, religion, ritual life, and recreation since ancient times. Due to their special qualities, they lead to altered states of consciousness, in contact with the deep psyche, and induce ecstatic trance and mystical illumination. But since then, only the shaman, the witch, or the priest, being one and the same person, can exercise their power by ingesting the so-called psychoactive plants and visit the underworld, accompanying mankind since prehistoric times. Botany was the means to heal and, at the same time, the one used to transcend and obtain visions of the beyond.

This extensive review, based on the archaeological and modern literature identifying the presence and focusing on the effects of two hallucinogenic plants or powerful narcotics, mandrake and peyote, allows demonstration through iconography and ritual that both have been used by humans for tens of thousands of years as medicines and in religious contexts and healing rituals for their various psychoactive effects [148].

The magico-religious use of hallucinogenic plants indicates that both in the Old and in the New World, the awareness of these properties makes clear the impressive botanical, chemical, and pharmacological knowledge of the traditional peoples, including a plant lore and also how to achieve altered states of consciousness.

These mind-altering plants may be of exceptional interest as potential medicines in modern psychiatry and as an effective tool for mental health and addictions research and have been used since 1950.

Without exactly unraveling the enigma of these properties, many legends and misconceptions about drugs and alkaloids, which are highly toxic and several fatal, have often been created and circulated among ancient people, still in Ancient Egypt where toxic plants were also cultivated.

Both the mandrake, always related to magic and witchcraft or a mystic and divine ancestral cult, having a psychosomatic effect, linked to the West, although the Native Americans also knew it, as well as the peyote, employed as a religious sacrament among American Indian tribes in Mexico and the United States, and by the 1960s very sought after and consumed by Western intellectuals as a psychedelic drug, have a long historical background as medicinal and religious plants.

Statements and Declarations

Acknowledgments

This article is dedicated to the memory of Dr. Guillermo Zanniello, who has supported and guided me in my medical works.

Competing Interests

The author has declared that no competing interests exist.

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8. ^It is a practically inexhaustible chemical family, where psilocybin, harmine, lysergic acid amide, dimethyltryptamine, etc. stand out.
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10. ^Lewin L. Phantastica. Paris, Payot; 1970.
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12. ^Doctor in Classical Studies from Boston University and in Comparative Religions. He is co-author of The World of Classical Mythology: Gods and Goddesses, Heroines and Heroes, and author of The Road to Eleusis: Unveiling the Secret of the Mysteries and The Apollo's Apples: Pagan and Christian Mysteries of the Eucharist.
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