

*Salvia divinorum:*

The Botany, Ethnobotany, Biochemistry and Future of a Mexican Mint

Robin Marushia

12 June 2002

BPSC 170: Ethnobotany

Dr. Arturo Gomez-Pompa, TA Nisao Ogata

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#### *Abstract*

*Salvia divinorum* (Labiatae) is an entheogen used by the Mazatec Indians of the Sierra Mazateca in Oaxaca, Mexico. *S. divinorum* was introduced to the scientific community in the 1950's, and has since become the subject of ethnobotanical, botanical, and biochemical research. Plant biologists are interested in *S. divinorum* due to its anthropogenic distribution and limited sexual reproduction, while biochemists have found that *S. divinorum* contains one of the most potent natural hallucinogens known: salvinorin A. Ethnobotanically, the Mazatec shamans used the plant for healing, divination, and shamanic training, and the spiritual qualities of *S. divinorum* may now contribute to its growing popularity among the general public, as experimental users seeking to “expand consciousness” order *S. divinorum* over the internet. The many applications and mysteries of *Salvia divinorum* have led to numerous research opportunities, and the plant may become more important both pharmacologically and socially worldwide.

#### **Botany of *Salvia divinorum***

*Salvia divinorum* is a perennial herb in the Labiatae, which grows in the highlands of the Sierra Mazateca, Oaxaca, Mexico. One of almost 1,000 species of *Salvia* in the world, *S. divinorum* is recently discovered by western science, but has become rapidly well known for its hallucinogenic properties, but has also been researched for its unusual botanical characteristics.. Traditionally, the herb has been used in healing and divination among the Mazatec of Oaxaca.

The first introduction to *S. divinorum* came in 1938 when Jean B. Johnson, son-in-law of anthropologist Roberto Weitlaner, wrote about *Hierba Maria* in his publications about the Mazatec shamans (1939). In 1945, Blas P. Reko also found the magical plant among the Cuicatecs and Mazatecs which produced visions, referred to as “leaves of prophecy,” but could not identify the plant from the loose leaves collected. Weitlaner also conducted interviews

concerning the magical plant, *Yerba de Maria*, but no identification was made until 1957, when Arturo Gomez-Pompa collected the plant while collecting mushrooms for the drug firm CIBA. He obtained enough of the plant, called *xka Pastora*, to identify it as a *Salvia* sp; however, no flowering material was available, and Gomez-Pompa could not identify the plant further (Valdes 2001a). Finally, in 1962, Gordon Wasson and Albert Hoffman undertook the goal to find and definitively research the purported “magical” plant. Hoffman, who had already discovered LSD and isolated psilocybin and lysergic acid amides from mushrooms and morning glory seeds used by the Mazatec, joined with the leadership of self-styled ethnomycologist Gordon Wasson to traverse the Sierra Mazateca looking for *S. divinorum*, particularly in the wild. Wasson and Hoffman could not find independent populations of *S. divinorum*, but obtained the first flowering specimens of the plant from an old *curandera*, Natividad Rosa, in the village of San Jose Tenango. Wasson and Hoffman were not allowed to visit the location where the plants grew, leading Wasson to conclude that *S. divinorum* was probably a cultigen (Wasson 1962). The specimens were identified as a new species of *Salvia* by Carl Epling and Carlos D. Jativa at the Botanical Institute of Harvard University in Cambridge, Massachusetts (Epling and Jativa 1962).

*S. divinorum* is described as a perennial herb, mostly 1-1.5 m tall, with taller stems often decumbent, enabling plant to reproduce vegetatively by rooting at nodes and sometimes internodes, and to resprout vigorously from dry, senescent stem material. It has several characteristics related to other *Salvia* sp., including a quadrangular stem, serrated leaves situated oppositely on the stem, and sigmoidal flowers growing on tall racemes (Epling and Jativa 1962). However, it is highly distinctive and unusual among the *Salvia* species is certainly anomalous in sect. *Dusenostachys* Epl., to which it was originally assigned (Epling & Jativa 1962, Reisfield 1993).. According to Epling and Jativa, *S. divinorum* may be allied to *S. cyanea* Lamb ex. Benth, which is also found in central Mexico, but differs in the leaf shape and the flattened upper style branch (Epling and Jativa 1962). In the original description of *S. divinorum*, Epling (1962) described the plant as having a blue calyx tube and corolla, an error which persisted in some literature, including the first edition of Emboden’s book *Narcotic Plants* and R.E. Shultes’ *Hallucinogenic Plants*, among others. Emboden was the first to correct this error, however, in his

second edition of *Narcotic Plants* when he described *S. divinorum*'s corollas as "pure white" (Ott 1996). The official description of *S. divinorum* was amended again by Reisfield in 1993, who described the reproductive parts of the plant in detail, including the nutlets, which are about 2 mm long and dark brown when viable.

Distribution is limited to the highlands of Sierra Mazateca, where it grows at elevations of 300-1800 m in primary and secondary cloud forest or tropical evergreen forest. *S. divinorum* prefers to grow in the black soils along streambanks, where it spreads vegetatively in heavily shaded, moist ravines. *S. divinorum* has also been found planted in coffee plantations, which are frequently blanketed in heavy fog, providing necessary humidity to grow. *S. divinorum* is usually anthropogenically distributed, grown in cultivated or semi-cultivated populations that are well hidden by the Mazatec, (Wasson 1962, Valdes 1983, 1987, Reisfield 1993). Because of the Mazatec's secrecy, ethnobotanists were unable to identify the plant for many years because they were not allowed to visit the growing sites, and flowering material was required for a definitive identification (Wasson 1962, Hoffman 1990).

Since 1962, the botanical characteristics of *S. divinorum* have been studied in greater detail, particularly regarding its flowering and seed set. (Valdes 1982, 1983, 1987, Reisfield 1993). By mapping the known Mexican populations of *s. divinorum*, Reisfield witnessed a few populations in flower, and discovered that while vegetative growth is promoted by cool, wet, shady environments, flowering is promoted by sunlight and may occur anytime from October to May in Mexican populations, though flowering occurs sporadically and infrequently. In Mazatecan populations, seed set has not been observed and all plants appear to be clonal (Reisfield 1993, Valdes 1987). The nectar and dimensions of the *S. divinorum* flower suggest ornithophily, but the only pollination event observed in the wild involved a single hummingbird. It is believed, then, that pollination is opportunistic, rather than the result of a specialized plant-pollinator coevolution (Reisfield 1993). As a result, it is possible that many populations of *S. divinorum* are clonal, but this has not yet been investigated. Valdes asserted in 1987 that all *S. divinorum* in the United States at that time was cloned from the original specimens given to Epling, which was propagated at the University of California, Berkely.

Valdes and Reisfield investigated the reproductive qualities of *S. divinorum* using both collections from the forests of the Sierra Mazateca and clones from the original plants introduced by Hoffman and Wasson. In Valdes' greenhouse experiments, newly collected plants from the field were crossed with the original clones. Of the 14 flowers cross-pollinated, 4 set seed (28%). Valdes was unable to test the viability of these seeds, however (Valdes 1987). Reisfield performed both self-pollination studies and cross-pollination studies. Of the 432 potential seeds that could be formed from the 108 self-pollinations, only 11 nutlets developed (2.5%). Of the 190 cross-pollinated flowers, 24 nutlets developed (3%). Reisfield planted several mature seeds in the greenhouse, and "vigorous seedlings developed which were undistinguishable (though not grown to flowering) from their parents." Reisfield further investigated the reproductivity of *S. divinorum* by experimentally observing that only 53% - 56% of pollen is viable, and adhesion to the stigma is poor. 33% of pollinated styles showed pollen germination and pollen tube growth, and pollen tubes appeared healthy, suggesting that the primary barrier to fertility is not inhibition of the pollen tube. Reisfield suggested that the probably cause of infertility in *S. divinorum*, then, is post-zygotic embryonic abortion due to either inbreeding, hybridity, or a delayed self-incompatibility reaction. The abnormalities of *S. divinorum* seem most closely aligned to characteristics of hybridity; however, no two *Salvia* species have been found that show an obvious affinity to *S. divinorum* (Reisfield 1993). *S. cyanea* may be one potential progenitor (Epling and Jativa 1962), but this has not been tested, and no other *Salvia* species appear to be likely candidates. Reisfield concludes that *S. divinorum* may be a hybrid or an inbred cultigen, but asserts that the origin of *S. divinorum* is still a mystery (1993).

### ***Ethnobotany of S. divinorum:***

Though little has been known about *S. divinorum* until recently, it was originally researched primarily because of its fascinating role in the ethnopharmacology and rituals of the Mazatec Indians. *S. divinorum* is one of a suite of local hallucinogens employed for curing, divination, and shamanic training by the Mazatec, and a few other nearby indigenous groups. Ethnobotanists learned of its existence while researching the better-known Mazatecan

hallucinogens: mushrooms and morning glory seeds, but soon took an interest in the “magic leaves” of *S. divinorum*.

*S. divinorum* is a sacred plant in the Sierra Mazateca, where it is identified with the Virgin Mary, mother of Christ. The common names of *S. divinorum* reflect this relationship; in Mazatec, the plant is known as *ska Maria*, or *ska Pastora*, or in Spanish, *Hojas de la Pastora*, *Hojas de María Pastora*, *La Hembra*, and *Hierba de Maria*. Finally, the plant has been translated in English as “Leaves of the Shepherdess”, “Leaves of Mary Shepherdess”, “Sage of the Seers”, and “Diviners’ Sage”(Ott 1996). The origin of this plant is unknown. Though the Mazatec have been present in the Sierra Mazateca since pre-Hispanic times, it is unclear whether *S. divinorum* is a wild plant native to the Sierra Mazateca, a cultigen developed by the Mazatec, or a cultigen of another indigenous groups, perhaps of Mexica or Aztec origin, which was brought to the Sierra Mazateca and cultivated. In the present day, *S. divinorum* has not been discovered growing outside of the Sierra Mazateca, and indigenous groups of the Sierra Mazateca are the only people known to use *S. divinorum* in traditional ceremonies. However, Emboden suggested that the plant may be depicted in ancient Aztec murals (Ott 1996), and could in fact be the mysterious hallucinogen *pipiltzintzintli* known as “little prince” (Wasson 1963). Support for this hypothesis exists in the linguistic naming of *S. divinorum*; the plant lacks a true indigenous, Mazatecan name, but is included in a family of similarly pharmaco-religious hallucinogens; *Salvia divinorum* is known as *la hembra*, “the female” *el macho*, or “the male” is *Coleus pumila*, followed by *el nene*, “the child,” and *el ahijado*, “the godson,” which are both forms of *Coleus blumei* (Wasson 1962). Both *Coleus* species are Asiatic introductions, which Ott contends strengthens the argument that *S. divinorum* is nonnative (1996). Another hypothesis is that *ska Maria* is indeed native to the Sierra Mazateca region, but that the pastoral, shepherdess image of the Virgin depicted in many common names (such as *ska Pastora*) represents a remnant of the pre-Hispanic animal god worship, since Mary is not traditionally considered a shepherdess in Christianity (Wasson 1962). It is also unclear from many *S. divinorum* populations whether the plant is a cultigen or wild: while the plant is not grown in home gardens, *curanderos* seem to grow or encourage it in secret grottos or ravines near their villages, and “wild” populations found

by Reisfield could very possibly be vegetative clones surviving from a historic planting by indigenous peoples (1993).

The Mazatec are very protective of their knowledge regarding the use of ritual hallucinogens, and as a result, ethnobotanists have been challenged in their attempts to form a comprehensive understanding of pharmaco-religious hallucinogens in these traditional societies. Ethnobotanists have found in their research experience that it may be more fruitful to carefully develop a trusting relationship with one or two *curanderos* rather than interviewing many. While this method may skew the information somewhat, it has been most effective in producing the bulk of knowledge about Mazatec ethnobotany. The few willing informants, *curanderos* or *curanderas* who have risk committing sacrilege and desecration in allowing outsiders to witness the sacred ceremonies (Valdes 1983). Wasson described how the *curandera* María Sebastiana Carrera detailed the use of the leaves and repeated some of the ceremonial chants, but would not admit the researchers to an actual ceremony. After supplying them with this information, she broke out in tears, begging the heavens for forgiveness for revealing her knowledge (Wasson 1962). Hofmann further describes how the team members were taken in secret, at night, to the house of Consuela Garcia, where she performed a divination ceremony for them, concerned all the while that they would be discovered (Hofmann 1990). Ethnobotanists have learned much about the ethnobotanical uses of *S. divinorum* in curing, divination, and shamanic training among the Mazatec Indians, but mysteries still exist.

Many *Salvia* species are used throughout the world to cure; even the genus name comes from the Latin *salvare*, meaning “to save” (Valdes 1983). Though it may not be the primary role of *S. divinorum*, the plant is used medicinally by the Mazateca. Small dose infusions made from four to five pairs of leaves may be taken as a tonic or panacea (Valdes 1987). Taken in this form, *S. divinorum* is thought to regulate eliminatory functions, relieve headaches, and alleviate rheumatism. It may also be given to the sick and dying to revive them. The Mazatec also believe that *ska Maria* will cure *panzon de barrego* (sic), or a swollen belly, which is supposedly caused by a curse from a *brujo*, or evil sorcerer. The victim's stomach swells up due to a "stone," but the *ska Maria* causes elimination of this "stone," curing the victim of the disease (Valdes 1983).

Maria Sabina, the *curandera* who informed Wasson on the uses of hallucinogenic mushrooms, mentions in her autobiography that crushed *hojas de la Pastora* could be used in place of mushrooms to cure a sick person, if mushrooms were not available (Valdes 1983). To use as a curative, *S. divinorum* is usually crushed by hand or in a *metate* and steeped in water, and depending on the illness, either the victim, the shaman, or both may take the infusion (Weitlaner 1959 in Valdes 2001a).

Healing and divination are closely linked in the Mazatec usage of *S. divinorum*. Shamanic hallucinogens of the Mazatec are almost always prescribed in pairs, which represents the human element of man and woman, symbolizing the dual principle of creation and procreation (Munn 1973). Weitlaner conducted interviews in which a native Mazatecan described healers using the leaves of the *Yerba de Maria* to divine illness when the cause was unknown. 50 leaves would be prescribed for a normal person, but 100 leaves would be prescribed for an alcoholic (reasons were not stated); the leaves would then be squeezed in water, and the sick person drank the potion in a dark, quiet place, such as a house. Then, after 15 minutes, the sick person would describe the illness from which he or she suffered. Then, at daybreak, the sick person would be bathed in the water they drank, thus releasing the person from the effects of the *Yerba de Maria* and curing them of the illness. Also, the native mentioned that robbery or loss could be divined by giving the person whose items were missing *Yerba de Maria*, and the *curandero* would then listen to them speak in trance to discover the cause (Weitlaner 1952, in Valdes 2001a). *S. divinorum* is also used by *curanderos* to foretell the future and answer questions about distant enemies, family or friends (Hofmann 1979, Valdes 1983). Hofmann describes a ceremony conducted by a *curandera* Consuela Garcia, attended by himself, Gordon Wasson, and Hofmann's wife Anita. While Hofmann did not participate due to illness, all other adults, including the *curandera*, took infusions of *S. divinorum* made by crushing 3 to 6 pairs of leaves in a *metate* (stone grinder) and squeezing them through a fine sieve. The infusions were incensed with copal "with great ceremony," before the *curandera* asked them if they believed in the holiness of Christ and the ceremony in which they would participate. Upon answering in the affirmative, they took their infusions. After chanting and singing, Consuela



Garcia asked them what information they wanted to know, and Wasson asked after the health of his daughter and new granddaughter in New York. The *curandera* responded that mother and child were well and healthy. Incidentally, the information was true, though neither Wasson or Hofmann suggest this as support for the *curandera*'s divination (Hofmann 1979). Wasson witnessed a similar ceremony conducted by Augustina Borja in Ayuatla (Wasson 1962). In traditional ceremonies involving native Mazatecs, details in the ceremonies may differ. For instance, the Mazatecs are accustomed to chewing the leaves of *S. divinorum* directly, but researchers found this impossible due to the extremely bitter flavor of the leaves (Wasson 1962, Valdes 1983). Also, there is enormous variability in the number of leaves proposed for dosage in divination. Dosages could be as low as 6 leaves (Hofmann 1979) to as high as 120 pairs of leaves (Valdes et al 1983), though most reports seem to indicate that dosages are common in the 10-50 pair range (Wasson 1962, Valdes et al 1983).

Finally, *S. divinorum* is used in the training of new shamans among the Mazatec Indians. *Curanderos* and *curanderas* are made through informal apprenticeships, but believe that their true teaching comes through a series of visions showing or originating from heaven. Training can last 2 years, or longer, and involves the progressive use of psychotropic plants and mushrooms taken at intervals ranging from one week to one month; also, shamans may adopt a special diet before they take the hallucinogens. *S. divinorum* is the hallucinogen which begins a shaman's training, to "show him/her the way to heaven." Next, the student is exposed to morning glory seeds (*Rivea corymbosa* (L.), *Hallier, f.*) Hallucinogenic mushrooms containing the hallucinogen psilocybin are the final hallucinogen used to teach healers. This progression of psychotropic plants is based upon the strength of the effects: *S. divinorum* is the weakest of the three hallucinogens, generally producing a mild experience which can be terminated by noise or light. Morning glory seeds have more intense effects similar to LSD, though they also cause drowsiness and torpor. Finally, the psychotropic mushrooms employed by the Mazatec are used only as a final step, because the mushrooms have a "dark or sinister side;" apparently visions can be frightening, and the effects cannot be controlled or resisted. The Mazatecs contend that misuse of the mushrooms can lead to madness. The Mazatec believe that the visions they

experience from taking the sacred drugs allow them to contact Mary, The Trinity, and the Saints, who show them the different medicinal plants and teach them about their usage and treatments (Valdes et al 1983).

### ***Biochemistry of Salvia divinorum***

In the past two decades, most research concerning *S. divinorum* has focused on the psychoactive chemical compounds and its pharmacologic potential. *S. divinorum* has proven to be unique not only in its botanical significance and ethnopharmacological tradition, but also in its biochemical characteristics. Like many other members of the genus *Salvia*, *S. divinorum* contains unusual terpenoid compounds (Ott 2001).

In 1962, Gordon Wasson and Albert Hofmann collected *S. divinorum* juice from a leaves given to them in San Jose Tenango from the same flowering plants used as identification by Epling and Jativa.. The juice was preserved in alcohol to be studied, but chemical investigation at the time was unsuccessful. Hofmann concluded that the psychoactive principle must be unstable (Hofmann 1979). Diaz et al. also studied the mint, but were also had limited success in studying the chemical properties of the plant (Valdes 1994) .

*S. divinorum*'s hallucinogenic components were isolated in 1982 by the research group of Alfredo Ortega, who had also isolated the new compounds salviarin and splendidin from *S. splendens* (Ott 2001). Ortega et al. isolated a novel trans-neoclerodane diterpene from *S. divinorum* and determined its structure using X-ray crystallography, but did not study biological activity, or extend the research to investigate the pharmacological applications of the compound. The new compound was named salvinorin (Ortega 1982).

L.J. Valdes has produced a large body of work regarding *S. divinorum*, both in ethnobotany and chemistry, and was also the first to test salvinorin as a psychoactive principle. In 1984, Valdes et al. isolated the same compound as Ortega et. al. Unaware that the compound had already been characterized and named, the group referred to active compound as divinorum A, and its inactive desacetyl derivative was called divinorum B. The two terms (salvinorin and divinorin) are now applied interchangeably, although salvinorin A and salvinorin B are,

officially, the correct names for these molecules (Valdes 1987, 1984). Valdes et. al. tested the biological effects of salvinorin A in mice, and noted that salvinorin had similar effects to mescaline, dramatically reducing animal activity in a manner similar to sedation, but without true sedation since the mice were able to move rapidly for short periods of time. The absolute stereochemistry of the salvinorins was also determined (Koreeda et al. 1990). While Valdes, Diaz, and Paul had personally tested *Salvia divinorum* leaves during Mazatec ceremonies while conducting ethnobotanical research, Valdes et. al. did not conduct psychonautic human bioassays to determine whether salvinorin A was, in actuality, the visionary principle active in *S. divinorum* (Ott 1996).

“Basement shamans” (apparently Daniel Siebert and friends) in California were the next group to isolate and test salvinorin as a psychoactive principle (Ott 1996). Siebert soon tested various methods of leaf and salvinorin intake by volunteers to determine site of absorption, effects, and dosage. Siebert found that extended exposure (10 minutes) to the oral mucosa produced psychoactive effects in all volunteers, while quick swallowing and rinsing of leaves produced no effects at all, leading Siebert to conclude that the gastrointestinal system breaks down the psychoactive compound and that leaves must be chewed or held in the mouth to produce hallucinations. Siebert isolated salvinorin A by the same method used by Valdes et al. (1984). 20 volunteers were given capsules of salvinorin A, which produced no effects, reinforcing the hypothesis that salvinorin is inactivated by gastrointestinal absorption. Because salvinorin A is not water soluble, injection was not tested. Inhalation of the vaporized salvinorin A was tested, however, and proved to be the most efficient and dramatic method of salvinorin A intake to produce hallucinations. Threshold effects were usually noted at 200-500 µg, and hallucinations occurred within 30 seconds, rather than the 10-15 minutes required by oral ingestion (Siebert 1994). With activity apparent at the 200 µg level, salvinorin A is now the most potent entheogen known thus far, and one of the most potent natural compounds discovered (Valdes 2001, Ott 1996). Samples of salvinorin A were also submitted to Novascreen for receptor site screening, and was shown not to affect any brain receptor sites affected by most

other hallucinogens, suggesting that a unique pathway and receptor site may be present for salvinorin A (Siebert 1994). Salvinorin A is the first diterpene to be identified as a hallucinogen in humans (Valdes et al 2001). Siebert has also determined and compared levels of salvinorin A found in leaves from several plants grown throughout the United States and Mexico, concluding that leaves may contain a range of .89-3.70 mg/g salvinorin A in dry weight (Siebert 1999). Valdes et al. have further studied the bioactive compounds of *Salvia divinorum*, and discovered that a third compound exists, salvinorin C, which comprises only about 10% of the bioactive compounds in *S. divinorum*, but may be even more potent per unit of measure than salvinorin A (Valdes et al 2001).

Salvinorin A, salvinorin B, and salvinorin C bear close resemblance to other neoclerodane diterpenes from Latin American *Salvia* species, such as salviarin and splendidin. The salvinorins have been the only neoclerodane diterpenes tested for hallucinogenic properties thus far, however, and other similar *Salvia* compounds should be tested for psychotropic activities (Valdes et al 2001). Great research potential exists in the biochemistry and application of the salvinorin compounds, and related molecules, as hallucinogens, antibiotics, and to discover new neurological pathways and receptor sites.

### **The Future of *Salvia divinorum***

Since its introduction to the scientific community, *Salvia unknown* has proven to be a fascinating and enigmatic plant. While science has begun to unravel some of the many secrets surrounding *Salvia unknown*, both ethnobotanically and biochemically, *Salvia divinorum* is still very new to the general public. As a newcomer among western drugs, the role of *Salvia* as a recreational or pharmacological drug is, as of yet, undefined.

Until recently, *S. divinorum*, or “diviner’s sage” was not popular as a recreational drug in western society. *Salvia divinorum* has occasionally been used for some time outside of the Mazatec Indians as a recreational drug among Mexican teenagers, who purchase the dried leaves and smoke them as a replacement for marijuana (Valdes 1987). However, a number of factors discouraged the plant from greater popularity: a large number of fresh leaves are required to

obtain an intense experience (about 75-100 leaves). Once consumed, fresh *S. divinorum* leaves have an extremely bitter taste, which may induce vomiting. Even the effects of *S. divinorum* have been considered unpredictable or disappointing (Valdes 1994, Siebert 1994b).

Several developments have boosted the popularity of *Salvia divinorum* within the last decade. Young adults and adolescents have returned to entheogens as “natural highs,” or to “expand consciousness.” Moreover, the internet has made *S. divinorum* widely and rapidly available worldwide. Experimental drug users can now find an overwhelming amount of information and sales on webpages (Schabner 2002, pers. obsv.) *S. divinorum* is still completely legal everywhere in the world except Australia, where it was listed as illegal in November 2001 (Erowid 2002). While narcotics control groups in major nations worldwide are beginning to monitor *Salvia divinorum* closely, there are few movements to list the plant as illegal (Erowid 2002, Schabner 2002).

While the role of *Salvia divinorum* seems to have some parallels to other vision-inducing drugs such as LSD, it also has many differences which may prevent it from becoming a recreational drug similar to cocaine, marijuana, or LSD. Firstly, “diviner’s mint” is not a social drug; it cannot be used to effect in distracting surroundings (Siebert 2002, Erowid 2002). Since it is not a party drug, *Salvia divinorum* is immediately more isolated to individual experimentalists. For *S. divinorum* to produce rewarding visions, users often find it best to smoke the dried leaves in a quiet, darkened room or to wear a blindfold, in order to experience the hallucinations at their fullest. Accounts of experiences from taking diviner’s sage range from blissful to mystic to terrifying (Schabner 2002). Hallucinations can be interrupted by light, noise, and activity. Furthermore, there is no evidence that the drug is addictive, and the nature of the experience does not encourage users to repeat usage on a regular basis (Siebert 1994).

The effects of *Salvia divinorum* on the user vary greatly with setting and expectation. Valdes, Diaz, and others experienced *S. divinorum* usage in a religious, visionary ceremony with a Mazatec shaman, and thus had visions of the Virgin Mary and white-robed spirits (Valdes 1983). Milder trips often include visions of bright colors or changing shapes, while more intense experiences may produce hallucinations of being in another time and space, of flying or floating,

or speaking to strange beings (Siebert 2002, 1994). Drug users well accustomed to other hallucinogens often try the plant, appreciate the experience, but have no wish to repeat it . While the effects of *S. divinorum* seem to range from the mundane to the overpowering, no side effects or health problems have been known to occur from *Salvia divinorum* usage thus far (Schabner 2002, Siebert 1994). The danger in *Salvia* usage comes from the more intense experiences at higher dosages (500-1000 mcg salvinorin A), when the user may completely lose awareness and control over their body. People on *S. divinorum* may get up, lunge around the room, and attempt to walk through or over objects. It is necessary for *Salvia divinorum* users to have a sober and attentive sitter present to watch over their actions, particularly if the user intends to experience strong visions at high dosages (Siebert 1994, Campbell 1997, Valdes 1994).

*S. divinorum* appears to present few health risks either to individuals or the general public (Schabner 2002). The mechanism for psychoactivity with salvinorin A is completely unknown as of yet, since it binds to no known receptor sites (Siebert 2002). Therefore, the long-term health risks and effects of *Salvia divinorum* usage have not been studied. A group submitting a request to the DEA to maintain legal status of *Salvia divinorum* made a survey of emergency room records from across the country and found no records of treatment due to *Saliva divinorum* usage. No fatal overdoses are known to have occurred from *Salvia divinorum* or salvinorin A, although high doses may cause some unconsciousness and memory loss. If smoked (the most common method of consumption), experiences with *S. divinorum* are generally relatively short, lasting a few hours at most (Siebert 2002). However, doctors warn that users should be particularly careful not to mix salvinorin A with other drugs, and should not use *S. divinorum* if they, or their family, have a history of mental disorders, since hallucinations may trigger mental instability (Schabner 2002, Siebert 2002).

The pharmacological and research implications of *Salvia divinorum* are many and varied. Great potential exists for research with *Salvia divinorum*. Salvinorin A does not bind to any common receptor sites in the brain, and studies to discover the new pathway may further knowledge about consciousness and the human brain (Schabner 2002, Valdes 1994). *Salvia divinorum* may also produce studies in psychology. In one case report, a patient was found to

have found relief from symptoms of chronic depression after years of conventional treatment. The patient discovered *Salvia divinorum* independently (on the internet), but found that weekly, low dosage treatment helped her find a “psychospiritual” awakening which alleviated her depression (Hanes 2001). Rovinsky also found that acetone-soluble compounds from *Salvia divinorum* inhibited the growth of rod-shaped bacteria and decreased the duration of smooth muscle contraction in mice (1998). These findings suggest that *Salvia divinorum* may have several pharmacological applications that should be further researched.

In conclusion, the role of *Salvia divinorum* in the United States and other countries worldwide will depend greatly on societal perception of the plant as a drug in the near future. Already the media has begun to title *Salvia divinorum* as the “Hip New Drug,” “The New LSD,” which may sensationalize *Salvia divinorum* and increase the likelihood that it will be scheduled as an illegal narcotic. However, responsible use of *Salvia divinorum* may counter the media, particularly if the plant continues to affect only a small portion of experimental drug users. If so, *Salvia divinorum* may remain as a legal hallucinogen, set apart from other narcotics and pharmacological drugs by its ethnobotanical role, its unique attributes, and may someday provide new and beneficial uses in health and spiritual awareness.

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