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# The Mescaline Garden

## Choosing San Pedro or Peyote: A preliminary descriptive study of mescaline cacti consumers

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Corresponding author: Liam Engel. 8 Emily Avenue, Emu Plains, NSW, Australia, 2750. Ph: 0434937150.

Liam Engel<sup>1</sup>                      liam@themescalinegarden.com

Monica Barratt<sup>2,3</sup>                monica.barratt@rmit.edu.au

Jason Ferris<sup>4</sup>                    j.ferris@uq.edu.au

Cheneal Puljevic<sup>4</sup>              c.puljevic@uq.edu.au

Adam Winstock<sup>5</sup>                adam@globaldrugsurvey.com

The Mescaline Garden<sup>1</sup>

School of Global, Urban and Social Studies, RMIT University<sup>2</sup>

National Drug and Alcohol Research Centre, University of New South Wales<sup>3</sup>

Centre for Health Services Research, Faculty of Medicine, The University of Queensland<sup>4</sup>

Institute of Epidemiology and Health Care, University College London<sup>5</sup>

## ABSTRACT

### Background and Aims

Both Peyote and San Pedro cacti contain mescaline, a classical psychedelic eliciting mystical and visual effects, but only Peyote is a vulnerable species. We sought to address the questions 1; do people who use Peyote substitute with San Pedro, and vice versa, and; 2. how popular is the use of wild harvested mescaline cactus compared with the use of cultivated plants?

### Methods

Data were collected as part of the 2022 Global Drug Survey, a self-report survey distributed internationally in 11 languages. We asked mescaline cacti consumers about consumption practices, preferences and conservation and conducted chi square tests of associations comparing all motivations by preferred mescaline source.

### Results

Of participants who reported using mescaline in the last 12 months (N = 284; 73.2% male, 21.8% female, 5.0% other gender; mean age 36.3, SD 12.5), 20.0% reported consuming Peyote collected from native habitats. Of participants specifying Peyote as their preferred source of mescaline, 82.2% had consumed Peyote in the past 12 months.

Indigenous cultural traditions (57.8%), availability (40.0%) and environmental sustainability (33.3%) were the most commonly reported motivations for Peyote preference (n=45), whereas for San Pedro (n=86), availability (54.7%), potency (45.3%) and indigenous cultural traditions (44.2%) were most the commonly reported San Pedro preference motivations. Price and potency were significantly more likely to be chosen by those preferring San Pedro compared with Peyote.

Less than 7% of participants who consumed San Pedro in the past 12 months had consumed San Pedro from native habitats. Of the participants who specified San Pedro as their preferred source of mescaline, 96.5% had consumed San Pedro in past 12 months. San Pedro was the most commonly reported source of mescaline product consumed (56.1%) with *Trichocereus bridgesii* being the most reported preferred San Pedro species. Mescaline cacti consumed in the last 12 months rarely deviated from mescaline cacti of preference.

### Conclusions

Wild Peyote is not the most popular mescaline source, but consumption of related products remains unsustainable. Promoting San Pedro as a Peyote substitute may act as an intervention to reduce Peyote consumption.

**Keywords:** Mescaline, San Pedro, Peyote, sustainability, conservation, cacti

## INTRODUCTION

Both Peyote and San Pedro cacti contain the psychedelic drug, mescaline, but only Peyote (Ermakova, Terry & Trout, 2022) is considered a vulnerable species. Reasons for mescaline consumers choosing Peyote over San Pedro, or vice versa, are little understood, and could be leveraged to help protect Peyote.

Mescaline, alongside psilocybin and lysergic acid diethylamide (LSD), is often described as a ‘classical psychedelic’, being a 5ht<sub>2a</sub> receptor agonist with a history of use before the popularisation of ‘new’ psychoactive substance markets in the early 2010’s (Maurer & Brandt, 2018). New and classical psychedelics often share similar effects (Kettner, et al. 2019), including mystical experience, colourful and/or geometric effects on vision and increased sensitivity to stimuli.

Peyote is small, globular, slow growing cacti containing mescaline. Peyote is native to areas of desert in southern North America and are botanically known as a single species - *Lophophora williamsii*. Peyote is portrayed as foundational to the social construction of drugs (e.g. Shulgin & Shulgin, 1991; Weil & Rosen, 1983). The earliest bioactive evidence of psychedelic consumption, or indeed any psychoactive consumption by humans, is of mescaline, consumed in the form of Peyote, dated to ~3700 BC (El-Seedi et al. 2005). Further, mescaline was the first psychedelic ever to be extracted, as well as the first psychedelic ever to be synthesised (Gurschler, 2019). We might then say that mescaline, in the form of Peyote, is the classic psychedelic. Peyote has thrived historically, but recent increases in psychedelic use and interest in mescaline, alongside pressure from mining and agriculture, threatens this species with extinction.

Publications on Peyote in the field of social science have often focused on First Nations people who consume Peyote in traditional settings (e.g. Myerhoff, 1974; Prince et al. 2019), yet these cultures are diverse and there remain many First Nations cultures that use Peyote and are largely unrecognised in scientific literature. There is limited mention of such Peyote cultures beyond the Wixárika (AKA ‘Huichol’) people in Mexico (e.g. Schaefer, 2005), and members of the Native American Church in the United States (e.g. Maroukis, 2012), but there are other First Nations Peyote cultures within the Americas that fall outside of these groups (Feeney, 2016).

Research in the natural sciences specifically concerned with Peyote has historically focused on taxonomy (e.g. Lemaire, 1845) and quantity assays (e.g. Hulsey et al. 2011), while more recent research (Ermakova & Terry, 2020) has drawn attention to sustainability (Ermakova, 2019). While land clearing and the resulting loss of habitat is the primary threat faced by Peyote in the wild, the wild harvest of Peyote creates additional pressures (Trout & Friends, 2015). Current wild Peyote harvest, particularly given the popular harvest techniques used and current regulations (which heavily restrict consumption, collection, propagation and distribution of Peyote), is thought to be unsustainable – although there remains insufficient data to accurately project the future of Peyote populations (Ermakova & Terry, 2020). Strategies for Peyote conservation include replanting, sustainable harvest education, regulatory reform to encourage propagation and discourage in-situ harvest (Trout & Friends,

2015), land clearing salvage operations (Anderson, 1995) and propagation (Ermakova, Terry & Trout, 2022).

San Pedro are large, columnar, fast growing, mescaline containing cacti that are native to the Andes Mountains (Ogunbodede et al. 2010). Mescaline was not identified in San Pedro until 1960 (Poisson, 1960), although San Pedro has likely been consumed in traditional contexts since chavin culture ~3200 years ago (Feldman Gracia, 2006). Although San Pedro are a group of different species within the *Trichocereus* genus, but the exact number and names of *Trichocereus species* in the group is not clearly defined and requires further genetic analyses to be resolved (Noll, 2016). Without engaging in taxonomy disputes, it can be acknowledged that *Trichocereus bridgesii*, *T. pachanoi* and *T. peruvianus* are commonly recognised San Pedro species. Around the world, Peyote is more widely prohibited than San Pedro.

Numerous First Nations cultures that use San Pedro have existed, including Cupisnique, Chavin, Moche and Lambayeque cultures (Carod-Artal & Vázquez-Cabrera, 2006). Expansive in-situ San Pedro plant populations has meant that San Pedro studies have not been compelled to address conservation and sustainability as they have been for Peyote; as with Peyote, San Pedro natural science works have primarily concerned taxonomy (e.g. Britton & Rose, 1920) and quantity assays (e.g. Ogunbodede, et al. 2010).

Horticultural communities impact on sustainability by providing access to propagation material without pressuring native populations (Ermakova, Terry & Trout, 2022). San Pedro have boomed due to the proliferation of hybrids, much like communities around *Cannabis spp.* and *Psilocybe cubensis*. Growers in these communities have selectively bred traits of potency, vigour, tolerance and other desired characteristics. However, this has not been the case for Peyote, likely due to Peyote's autogamous (self) fertilisation, which reduces opportunities for hybrid breeding. Horticultural communities seem to have expanded more around false Peyotes. False Peyotes grow in similar conditions to Peyote and have a similar physical appearance to Peyote (Šnicer et al. 2009) and/or have been used as a Peyote substitute in traditional contexts (typically without or with minimal mescaline effects [Rätsch, 2005]) such as *Lophophora diffusa* and *Lophophora fricii*. Many False Peyotes are threatened in their native habitats, facing similar pressures to Peyote, excluding consumption.

While mescaline has been found (typically in low concentrations) in a number of plants in the *Cactacea* family, including within *Astrophytum*, *Aztekium*, *Gymnocalycium*, *Myrtillocactus*, *Pereskia*, *Stenocereus* and other genera (Trout & Friends 2015), *Trichocereus spp.* and *Lophophora williamsii* represent the primary, traditional and natural sources of mescaline. Mescaline is at a higher concentration in Peyote (variable ~ 3% whole plant dry weight [Trout & Friends, 2015]) and San Pedro (highly variable ~1.5% whole plant dry weight [Trout & Friends, 2015]) than in other cacti, with most other mescaline-containing plants having only trace elements of the psychedelic molecule (Trout & Friends, 2015). A common dose of mescaline is ~200-400mg; this roughly equates to 6.6-13.2g dried Peyote (66-132g fresh), or 13.2-26.4g dried San Pedro (132-264g fresh). It has been estimated that Peyote takes six years to recover following harvest for mescaline consumption (Terry, et al. 2014). While a mature Peyote is unlikely to produce much more than 20 grams of fresh growth in a year, a mature San Pedro can produce many kilograms of fresh growth in this same time frame.

Despite published reports of mescaline finds outside of the cactus family (Clement et al. 1997; Clement et al. 1998), many of these reports have not had reference standards, have been published as part of spectral compendiums, without identification of biosynthetic precursors, and are often published alongside the identification of substances unlikely to be observed in nature (Trout & Friends, 2015). As such, there does not appear to be strong evidence for the identification of mescaline in plants outside of the cacti family. Besides San Pedro and related products, there does not appear to be any accessible and sustainable source of mescaline.

Positive discourse and industry growth around psychedelics is on the increase (Sessa 2017). We are currently experiencing a psychedelic boom, driven by market speculation around promising new evidence concerning the efficacy of psychedelic-assisted psychotherapy for mental health conditions (Mithoefer, et al. 2019). While this boom has led to mescaline, San Pedro and Peyote being topics of increased public interest, there are limited, early clinical trials of mescaline-assisted psychotherapy (e.g. Journey Colab, 2022). We anticipate such trials to be uncommon, considering mescaline's long duration (12+ hours) and frequent reports of mescaline-related vomiting. Anecdotal reports (e.g. DMT Nexus, 2015) suggest nausea is more common with fresh or dried cactus material, but for refined mescaline cacti, and even pure, synthetic mescaline, nausea and vomiting are regularly reported. The intensity of nausea seems likely to increase with the quantity of mescaline product consumed.

This increased interest in psychedelics has caused concern for limited and threatened natural sources of psychedelics, including Peyote-based mescaline products, toad-based (*Incillius* [formerly *Bufo*] *alvarius*) 5-MeO-DMT (Lerer, et al. 2022) and DMT produced from some vulnerable Acacia species. While Peyote's threatened status stems mostly from land clearing (Boni, et al. 2015) with mescaline consumers a secondary threat, for the 5-MeO-DMT toad and rare Acacia, psychedelic consumers are a primary conservation hazard.

With the threatened status of Peyote as our key concern, we underwent a preliminary, descriptive investigation into consumer socio-demographic characteristics, patterns of use and preferences of use. We considered two specific research questions with implications for conservation-

1. Was mescaline cacti other than participants' preferred type reported as consumed in the past 12 months?
2. How common was reported consumption of wild harvested mescaline cactus compared to consumption of cultivated cactus?

## METHOD

### GLOBAL DRUG SURVEY

The data used in this study were obtained from the 2022 Global Drug Survey (GDS). The GDS is the largest self-report drug survey in the world and is promoted by a variety of international media outlets and targeted social media campaigns. The 2022 GDS was available in 11 languages (Danish, Dutch, English, Finnish, French, German, Hungarian, Italian, Portuguese, Romanian and Spanish).

The core GDS survey assessed socio-demographic characteristics, drug use history and drug-related consequences. The survey was open between 9 November 2021 and 14 March 2022 and took between 15 and 60 minutes to complete (depending on drug use history). In GDS 2022, additional modules covered drug policy, nightlife and the pandemic, new psychoactive substances, illicit tobacco, mescaline cacti, sex and psychedelics, mental health and development conditions, and darknet markets. There was no financial incentive for participation. To be eligible to complete the survey, participants had to confirm they were at least 16 years old and had used at least one drug (including alcohol) in the past 12 months, with no other participation eligibility requirements. Those respondents who indicated they had used mescaline in the last 12 months were invited to complete a specialist module on mescaline cacti. In the current study, we report on responses to the mescaline cacti module (n = 284).

### MESCALINE CACTI MODULE

The mescaline cacti module contained detailed questions for people who had used mescaline cacti around their consumption practices, preferences and conservation attitudes (Appendix 1). Concerning the last 12 months, we asked participants the type (synthetic, Peyote, San Pedro, other), frequency, form (liquid, resin, dried, fresh, crystal) and source of mescaline used, as well as the number of instances of any resulting emergency medical treatment. Concerning the last time people had used mescaline cacti, we asked participants about the type, form, processing technique, concurrent drug use, dose and undesirable physical effects they encountered. We also asked participants their preferred mescaline type, species/cultivar, form and the reason for their preference.

### ANALYSIS

We used descriptive statistics to analyse participant responses to questions concerning the type of mescaline people had used in the past year and the mescaline source and their preferences for different sources and products, and the reason for their preferences. We also conducted a chi square analysis to compare factors influence choice of San Pedro and Peyote, and compared consumption of cacti reported as consumed in the last 12 months to reported cacti preferences. In doing so we contrasted preference and use of wild and cultivated mescaline products and considered how much of the former was reported as sourced via ‘cultural groups’ – a category intended to capture First Nations and traditional use, such as members of the Native American Church, or Como Crudo or Wixarika peoples.

### ETHICS APPROVAL

The GDS received ethics approval from University College London (11671/001), which was registered at RMIT University (2020-23913-11758) and The University of Queensland (2017001452).

## RESULTS

### DEMOGRAPHICS

Participants (n = 284) completed the mescaline cacti module as part of the 2022 GDS. In the last 12 months, 56.7% had consumed San Pedro-based mescaline, 22.9% had consumed Peyote-based mescaline, 16.6% had consumed synthetic mescaline, 3.9% had consumed plant-based mescaline not from San Pedro or Peyote, and 14.1% reported they did not know what type of mescaline they had consumed (multiple responses were possible). 6.7% consumed both San Pedro and Peyote in the last 12 months.

Participant ages ranged from 16–78 years, with the mean being 36.3 years (SD=12.5). Most (73.2%) identified as male, 21.8% as female, 3.2% as non-binary, and 1.8% used a different term. Most participants identified as white (77%), some as mixed race (10.7%) with very few (0.7%) participants identifying as Indigenous. Most participants were employed full (53.2%) or part-time (22.2%). Other participants were looking for work (4.6%) or had other reasons for unemployment (16.6%). Participants reported having various levels of education, including technical or trade (11.3%), college (15.8%), undergraduate (33.5%) and postgraduate (22.5%). Participants' country of residence was Germany (20.1%), New Zealand (17.3%), United States (12.3%), Australia (12.0%), Brazil (7.7%), Colombia (6.3%), Mexico (5.6%) and other (19.0%).

#### CACTI SOURCING

Participants were asked if they purchased or how they otherwise obtained mescaline in the last 12 months. Over one third (35.9%) reported growing it themselves, one quarter (27.2%) received it as a gift or for free, while others reported collecting the cacti from outside (11.6%) or inside (10.7%) their native habitat. Only 22.8% of participants reported purchasing San Pedro, Peyote or mescaline products in the last 12 months. Of those who reported purchasing (n=47), most purchases were reported to be made through friends (36.2%), websites (31.9%), known dealers (14.9%) and cultural organisations (8.5%).

#### CACTI PREFERENCE

##### **Figure 1.**

Figure 1 depicts factors reported as an influence on participants' choice of mescaline product by whether they preferred San Pedro or Peyote cactus. For Peyote (n=45), indigenous cultural traditions (57.8%), availability (40.0%) and environmental sustainability (33.3%) were the most commonly reported motivations for their preference, whereas for San Pedro (n=86), availability (54.7%), potency (45.3%) and indigenous cultural traditions (44.2%) were most commonly reported. Chi square tests of associations were conducted comparing all motivations by preferred mescaline source. Price and potency were significantly more likely to be chosen by those preferring San Pedro compared with Peyote (price: 19.8% v 6.7%;  $\chi^2(1) = 3.919$ ,  $p = .048$ ; potency: 45.3% v 26.7%;  $\chi^2(1) = 4.337$ ,  $p = .037$ ), with all other comparisons not statistically significantly different ( $p > .05$ ).

Most participants (41.5%) reported preferring San Pedro as a mescaline source, 21.7% preferring Peyote, 3.4% another source, while 33.3% reported not knowing their preferred source. Of all participants that reported a preference for a particular species, variety or cultivar (n=46), there were no recurring variety or cultivar names, although there was a recurring species name. The San Pedro (*Trichocereus species*) species name 'bridgesii' appeared in 41.6% of these responses, 'pachanoi' in 15.2%, and 'peruvianus' in 10.8%.

Of the participants who specified San Pedro as their preferred source of mescaline (n=86), 96.5% had consumed San Pedro in past 12 months. Of participants specifying Peyote as their preferred source of mescaline (n=45), 82.2% reported having consumed Peyote in the past 12 months. Of participants that had consumed Peyote in the past 12 months (n=65), 20.0% reported consuming Peyote collected from native habitats. Less than 7% of participants who



reported consuming San Pedro in the past 12 months (n=161) claimed they had consumed San Pedro from native habitats.

## DISCUSSION

This study investigated the socio-demographic characteristics, and patterns and preferences of mescaline use among 284 respondents of the 2022 Global Drug Survey who reported mescaline use in the past 12 months. We found that more people reported preference for San Pedro than any other mescaline source material (41.5%), and San Pedro was the most likely source of a mescaline product consumed in the past 12 months. 'Availability' was the most commonly identified (52.6%) factor in preference for a certain mescaline source or product by participants. The availability of San Pedro is likely due the ease and speed of growth, ex situ and in situ distribution and legality of these cacti.

There is a clear species preference for *T. bridgesii*. Many participants (36.7%) identified potency as a factor influencing their mescaline source preference. This parallels a seemingly common folk preference for *T. bridgesii* in Bolivia and elsewhere (Trout & Friends, 2015). There is insufficient research on both San Pedro species genetics and San Pedro psychopharmacology to understand relative *T. bridgesii* potency. Common anecdotal reports of *T. bridgesii* potency have created confusion, as mescaline quantification studies in these species has typically yielded low results (~0.1%-0.2%, occasional strains 1-2.0%). *T. bridgesii* species preference is likely to impact hybridisation and seems to encourage the harvest of wild plants, and further biochemical analysis of these plants is needed (Trout & Friends, 2015). Our chi square test showed that people who use San Pedro were statistically more likely to report potency and price were factors influencing their choice than Peyote. These results likely relates to choosing of a potent San Pedro species, like *T. bridgesii*, and San Pedro's cheap market cost relative to Peyote.

More people reported that they did not know their preferred mescaline source (36.7%) than reported Peyote as their preferred source of mescaline (21.7%). Substituting mescaline products made from different source material, such as San Pedro, has been suggested as a potential conservation strategy for Peyote (Engel, 2021). It may be that there is greater awareness of conservation issues with Peyote compared with San Pedro.

From a conservation perspective, for consumers preferencing Peyote-based mescaline, ideally they would have consumed mescaline from alternative sources in the past twelve months, as this would imply Peyote's substitutability. However, for both San Pedro and Peyote, this was not the case. It appears people are sticking with their preference. When consumers have a preference, the substitution of mescaline cacti seems uncommon. Unfortunately, we do not have detailed data on how mescaline cacti consumers' choice of San Pedro or Peyote was influenced by availability, or other data around their mescaline cacti sourcing behaviours. The reasons behind not substituting a preferred cacti for a more sustainable option are unclear. Research hoping to impact on Peyote conservation might benefit from investigating these reasons further. The extent of awareness of sustainability issues amongst mescaline cacti consumers might be another beneficial area in order to guide education.

Given the environmental pressure on this species, the commonality with which wild Peyote was reported to have been consumed amongst Peyote consumers (20.0%) is cause for concern. Relative to consumption of cultivated plants (77.2%), consumption of wild harvested Peyote may appear infrequent, but some Peyote populations are incredibly limited

and have on more than one recent occasion been harvested to extinction (Ermakova, 2019). Further, none of this wild harvested Peyote was acknowledged as sourced through a cultural organisation. Membership of the Native American Church is the only regulated way of consuming wild harvested Peyote in the United States, although there are some Indigenous cultural groups with Peyote traditions that are not legally protected, such as the Como Crudo people. The lack of First Nations participation and targeting is an important caveat for this study, as both Peyote and San Pedro have extensive histories amongst First Nations people. Another limitation is the small proportion of participants that had access to wild and native cacti, with only ~18% of participants reporting residence in countries where Peyote grows natively and ~14% where San Pedro grows natively.

Conservation of mescaline cacti is clearly a concern both for researchers and the drug-use community. Nearly one third (30.9%) of participants identified environmental sustainability as a factor influencing their preferred mescaline product. While wild harvest of in situ plants does not pose the same threat to San Pedro as it does to Peyote, there are still concerns that the popularisation of such harvest has potential environmental consequences. *T. bridgesii* use has resulted in the species being targeted for eradication by Bolivian authorities (Trout & Friends, 2015) and the removal or theft of valued plants is common in San Pedro grower communities for both in situ and ex situ plants.

Most participants (77.2%) reported that they grew, rather than purchased, San Pedro or Peyote. This mescaline self-provisioning through consumer cultivation is promising from an environmental perspective, with household food production reducing food greenhouse gas emissions by ~3-5% (Vavra, et al. 2018). Of all participants who reported purchasing San Pedro, Peyote and related mescaline products most (36.1%) did so from friends or acquaintances. This prominence of consumption of local cacti also has positive implications for sustainability (Ermakova, Terry & Trout, 2022; Turner, 2011). A map of the comparative ecological footprints of mescaline and other psychedelic products would surely be a useful tool for consumer education and awareness.

It is interesting that many participants' (41.5%) reported preference for a certain mescaline source or product was influenced by Indigenous traditions, despite few of these participants identifying as Indigenous (0.7%). Western concerns with Ayahuasca traditions has been termed a narcissistic (Rodd, 2018) and colonial force, resulting in piracy and the social and economic indifference amidst tourism and commodification (Peluso, 2017). The value of promoting an approach to psychedelics that centres on personal cultural context is worthy of debate (Rodd, 2018; Stuart, 2002).

While this study sheds some light on the preferences of mescaline cacti consumers, our findings are subject to some limitations. The GDS is a self-select self-report survey, and only people who had consumed a drug within the past 12 months were surveyed. Due to these characteristics of our sample and the small sample size, analyses were restricted to descriptive statistics and a single chi square analysis.

## CONCLUSION

Harvesting of threatened in-situ Peyote still occurs amongst mescaline cacti consumers. The accessibility of San Pedro is a conservation resource, encouraging self-provision, discouraging in-situ harvest of both San Pedro and Peyote while satisfying the needs of many

consumers. While there was demand for Indigenous cultural traditions, Indigenous persons were barely present in our dataset.

Sustainability is an important concept to consumers of mescaline cacti, and this could be leveraged by including information about the conservation implications of preferencing San Pedro over Peyote and cultivation over wild harvest in harm reduction education. However, cultivation carries stigma and criminalisation that is often greater than consumption alone. Addressing conservation presents a challenge to initiatives that are not underpinned by a culturally sensitive approach to social justice. Drug reform and cultural difference represent additional barriers to engaging growers, manufacturers, dealers, First Nations people and other stakeholders in drug-related conservation efforts, that are distinct from the barriers faced by consumers.

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#### DECLARATION OF CONFLICTING INTERESTS

Adam Winstock is the founder and CEO of Global Drug Survey Ltd. The other authors declare that there is no conflict of interest.

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FIGURE 1. A COMPARISON OF SELF-REPORTED FACTORS INFLUENCING PREFERENCE FOR SAN PEDRO OR PEYOTE CACTUS AMONG A GLOBAL SAMPLE OF PEOPLE WHO RECENTLY CONSUMED PLANT-BASED Mescaline.

