

Ayahuasca: Propagating a Plant Teacher to Heal the World

(A Guideline for Future Greenhouse Production of
Psychotria viridis)

Jack Kuderko, Food Systems Major, College of Food and Natural Resource Science

December 19, 2015

Executive Summary

The purpose of this paper is to give a brief history of Ayahuasca and *P. viridis* Ruiz et. Pavon, present the currently known production methods, and provide insight into the future of *P. viridis* production. Since *P. viridis* has not been heavily researched, this may serve as an overview of future production. I hope this may be a helpful learning tool for anyone intrigued by the great mystery of Ayahuasca and anyone interested in legally producing *Psychotria viridis* in the future.

I. Introduction

The 21st century will encompass the greatest sociological and environmental challenges humanity has ever faced. What we are witnessing today with the rapid changes of the climate system; severe weather events are becoming more common, the oceans are slowly acidifying, we have reached 400 ppm of carbon dioxide in the atmosphere, we are heading a 4 degrees centigrade rise in global temperature, and we are seeing an unprecedented melting of the arctic ice sheet. Without a great shift in human consciousness we will push the earth's invaluable climate systems past their tipping points, the very life support system of this planet (Curry 2013). We need to radically redefine our relationship with the planet as well as each other. It is safe to assume that the 'business as usual' model will only end in ruin, leaving this planet uninhabitable.

Fortunately, we live in an age where we can connect with others instantaneously around the globe. Through the incredibly interconnected and complex networks of the internet we may

have a chance at shifting towards a progressive global conscious. I believe there has already been a significant shift in human conscious, but it is nowhere close to what we need to keep our species from destroying this planet. To survive the 21st century, we need to drastically change the way our modern society functions as a whole, but to do that, we must change the way people think.

A quick background on myself. I am a 20-year-old student at the University of Minnesota. I have been studying food production systems and learning how to grow food locally, organically, and sustainably. I have also had a large focus on botanical medicines and using psychedelics as healing tools in controlled therapeutic settings. I want to make the largest impact on society while I am still alive. I believe that what I will share today may encourage the greatest societal change in the 21st century because it is the quickest tool we currently have for changing people's hearts and minds.

A. Study Species.

Psychotria viridis is well known for its necessary role in the production of Ayahuasca, an incredibly potent psychedelic beverage that originates from the Amazon rain forest. This plant is brewed into a tea along with another woody vine, *Banisteriopsis caapi*, into a strong decoction containing the orally active visionary compound dimethyltryptamine (DMT). When DMT is orally ingested, the compound is broken down by an enzyme in the stomach, monoamine oxidase (MAO), inactivating the visionary agent. However, *Banisteriopsis caapi* contains a monoamine-oxidase inhibitor (MAOI), which allows DMT to be active after oral ingestion and to cross the blood brain barrier (Meech 2009). This ideal chemical mixture from the two plants

allows for a profound psychedelic experience, often described as a spiritual journey for the user that can last up to 5 hours- allowing the person to go deep within their own psyche.

There has been compelling research on Ayahuasca for possible therapeutic applications. Ayahuasca in the right therapeutic context has helped users overcome traumatic events in their past, alcoholism, substance abuse, and other psychological disorders (Winkelman 2013). It is important to note that Ayahuasca is not a recreational drug. The experiences can be very unpleasant; your emotions, thoughts, and memories from deep within your own subconscious mind will bubble to the surface- while you have little to or no control of it. Often the memories that we suppress most are thrust into the open allowing the person to come face to face with their emotions. In return, personal transformations can be attained. There is a saying in the Ayahuasca community, “One Ayahuasca session is the equivalent to 10 years of therapy” (Meech 2009).

Not only does Ayahuasca allow us to understand our own selves better but it has the unique trait of giving the user an immense feeling of unity with not only their fellow man but with the natural world. A common result from Ayahuasca users is that they come out with a renewed reverence for nature (Meech 2009) which is very meaningful considering how many natural resources have been depleted and how disconnected from the natural world our society has become.



Figure 1. Depiction of Ayahuasca visions by famous artist Pablo Amaringo (Amaringo 2008).

Psychotria viridis has already gained footholds around the globe, in a way ‘escaped’ from the Amazon, and is being propagated. Despite this globalized expansion in the U.S. and other countries, the active ingredient DMT still remains a Schedule I controlled substance- with harsh repercussions for anyone possessing even small quantities of the substance. Ironically, DMT is a naturally occurring endogenous compound found within the human brain (Fontanilla 2009). It is thought to be excreted from the pineal gland during traumatic states or at end-of-life events (Strassman 2001). This may explain why near death experiences contain moments of deeply

spiritual, euphoric, or cosmic sensation. Interestingly, this simple molecule is almost ubiquitous throughout the biosphere in various species of plants and other wild animals (Meech 2009).

Psychotria viridis will play a major role in assisted psychotherapy and may even revolutionize the healthcare industry some decades from now- it is just a matter of when. Some even speculate that Ayahuasca may be a pivotal tool to catalyze a shift in human consciousness that will redirect our path from environmental destruction towards global sustainability (McKenna 2005). Will the full potential of Ayahuasca be able to be explored? Only time will tell.

B. Taxonomic Classification and Geographic Distribution in the Wild.

Psychotria viridis is a perennial flowering plant (Figure 2) and a member of the coffee family, Rubiaceae. The genus *Psychotria* contains some 2,000 species, mainly, consisting of tropical understory vegetation. Some other notable species include *P. carthagenensis*, *P. alba*, *P. horizontalis*, *P. marginata*, *P. poeppigiana*, and *P. stenostachya*. Many of these species do contain trace amounts of the active chemical DMT but *viridis* is one of the most chemically abundant species and is most commonly used in Ayahuasca brews. *Psychotria viridis* has also gone by the synonyms of *Palicourea viridis* or *Uragoga viridis* (Trout 2001). Due to its geographical location and importance, *Psychotria viridis* picked up many indigenous common names from the Quechua and surrounding languages. Some notable common names include: amuru capanga (Ecuador), chacruna (Perú), kawa kui, oprito, sami ruca, and yagé.



Figure 2. A growing *Psychotria viridis* plant (Dohmen 2014).

Geographic Distribution (native and/ or invaded regions):

Psychotria viridis is believed to have originated in the tropical amazon rainforest. It remains native to locations in Central and South America. *Psychotria viridis* has been found in countries such as Cuba, Nicaragua, Panamá, Bolivia, Ecuador, Colombia, Costa, Rica, and Peru

(Figure 3; Trout 2001). *P. viridis* is not known to be invasive. However, the recent globalization of Ayahuasca has spread the distribution of *Psychotria viridis* across the world (Tupper 2006).

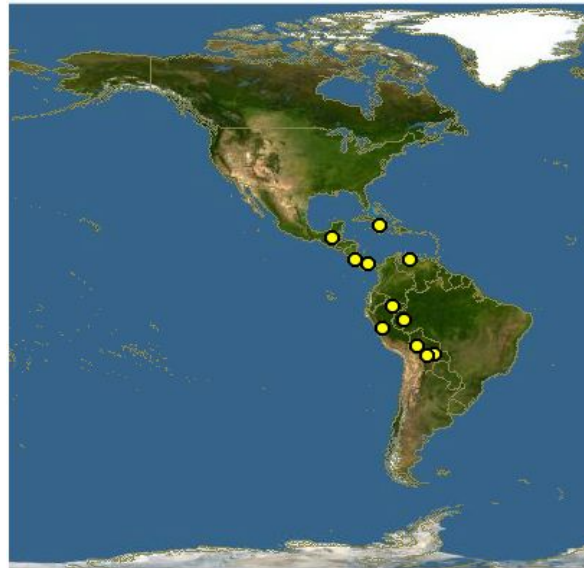


Figure 3. Distribution of *Psychotria viridis* (Trout 2001).

General climatic conditions for the crop species:

Psychotria viridis grows in tropical and subtropical locations. Naturally, the plant grows well in full shade, high humidity, and lots of water. Making the Amazon rainforest a perfect location- it is hot and humid throughout the year. *P. viridis* does well in fairly rich soils. It is suggested that *P. viridis* can survive in USDA plant hardiness Zones 11-14 (Chacruna 2015). At nighttime, it can get as low as 10 °C in the Amazon rain forest and may average up to 26-32 °C during the day.

Taxonomic Description:

P. viridis is characterized as a small perennial shrub or tree (Figure 4) . Usually, around 4.5 meters or less in height. It has oppositely arranged leaves that are elliptical in shape. The

leaves sit atop the stem on 1-10mm long petioles. The stipules are sharply pointed towards the apex. *P. viridis* also has distinct faveolae, small ribbed pockets underneath the leaf veins. When dried, the leaves become darkened and begin to curl. The inflorescence sits atop a peduncle, in a spicate like arrangement, open, and with many-flowers. The flower petals are greenish-white with red fruiting bodies, 4-5mm. long. (*Psychotria viridis* 2012).



Figure 4. Drawing of a *Psychotria viridis* flowering stem (*Psychotria viridis* Ruiz et. Pavon).

II. Crop History

A. Breeding and Domestication.

It is difficult to confirm a set time for the emergence of *Psychotria viridis*. Historically, this plant may have been in contact with the human species for a millennia or more (McKenna

1999). Indigenous cultures were the first to come in contact with the bizarre plant mixture that makes up Ayahuasca. Interestingly, it still remains unknown as to how these indigenous cultures discovered Ayahuasca. From the sum of the 150,000 plant species in the Amazon rainforest these indigenous cultures found the two plants that must be brewed together (Figure 5) for hours to produce the chemically psychoactive alkaloids. Ultimately, when Amazonian Shamans have been asked this question, they respond that, “the plants told us” (Meech 2009).

The first written western record of Ayahuasca came from English ethno botanist Richard Spruce in 1852 (Schultes 1979). Before his introduction, the use of this brew was only known by the indigenous cultures that used these plants for shamanic practices with medicinal, cultural, and spiritual applications that predate the arrival of Columbus (Tupper 2006). Further investigations from curious plant explorers attempted to understand the biological makeup of this plant; the chemistry, botany, and pharmacological interaction with the human species. We now have a better understanding of how the substance is metabolized, what it does to the body, and how it affects the brain. However, the more important subjective experience is much more difficult to define.

It was not until the second half on the twentieth century that there was more widespread attention on the plant as more explorers, such as Dr. Richard Evan Schultes in the 1960s, investigated the mystery of Ayahuasca (McKenna 2005). Ayahuasca has since then made a ripple effect in recent years; there have been established churches that regularly consume Ayahuasca sacraments, there has been a significant rise in Ayahuasca tourism to South American countries and, of course, many legal cases along the way (Grunwell 1998).



Figure 5. Ayahuasca bark and leaves being brewed into a medicinal potion (Jungle Medicine-1 2011).

In the past 30 years, *Psychotria viridis* has emerged from the Amazon with humans acting as the courier. It has become apart of a globalized network, growing in greenhouses on nearly every continent, and establishing footholds in climates thousands of miles away from its native environment (McKenna 2005).

It is uncertain whether the indigenous tribes actively grew *Psychotria viridis*, it is more likely that they would have collected the plants from the surrounding environment, much like how it is done today. Moreover, with a 1% seed germination rate, the likelihood to pursue seed propagation is doubtful (Plant Encyclopedia 2011). On the other hand, propagation by cutting is the easiest and most successful production method. Regardless of how easy the plant may be to

propagate, the illegality of the plant makes production very risky. For this reason, production has moved underground along with the ceremonies it promotes. Not many producers are willing to document their production methods for the public. Since *P. viridis* production remains largely undocumented, further research, funding, and scientific interest is needed to provide adequate information for production scheduling.

B. Distribution Chain.

There are no current large-scale horticultural distribution chains of *P. viridis*. However, if legal production was implemented it would closely resemble the process of other distribution chains. Below I have diagramed what a possible large scale production of *P. viridis* may look like in the horticultural distribution chain (Figure 6). Ultimately, the transport of *P. viridis* would need to be carefully controlled due to the evident risk of transporting a psychoactive substance. This is why I have made direct transports to health clinics, licensed shamans, and other institutions.

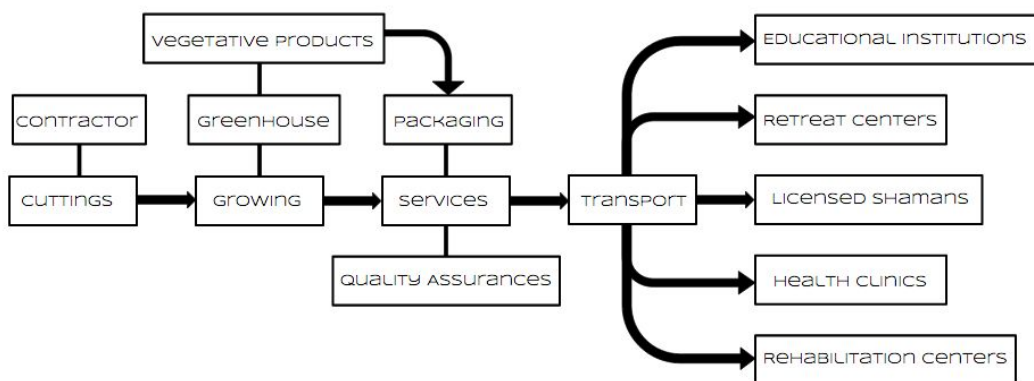


Figure 6. *Psychotria viridis* plant distribution chain (Adapted from The Supply Chain 2015).

III. Production Information

A. Current Production Practices.

It is important to replicate the conditions in which *P. viridis* grows naturally. Tropical environments with lots of humidity, shade, and heat are most suitable (Figure 7). However, many growers have still been able to grow *P. viridis* in greenhouses in cold northern climates. Intuitively, *P. viridis* should be grown in greenhouses to control temperature and humidity. If environmental conditions are suitable, *P. viridis* may be propagated outside with the use of high and low tunnels. However, maintaining the suitable humidity, temperature, and light conditions may be a challenge. Ideally, *P. viridis* should be grown with natural temperature conditions around 32-35 °C during the day, and 12-18 °C at night, allow natural fluctuations in RH from 50%-95%. Also maintain shade of around 70% of the greenhouse, allowing the understory light conditions for *P. viridis* to be met (Caapi Production 2003).



Figure 7. Musician, writer, and blogger Jonathon Twiz poses in front of cultivated *P. viridis* field (Twiz 2014).

Due to the limited research on the growth stages of *P. viridis* and even close relatives in the *Psychotria* genus, much of the information was found through websites where growers have briefly detailed their production methods and provided guidelines towards propagating *P. viridis* vegetatively. However, these are not published sources so the credibility is questionable. As mentioned before, there is limited research of *P. viridis* and due to the illegality many producers are hesitant about releasing information. These processes will need to be trialed and further investigated before their efficacy can be confirmed.

As mentioned earlier, propagation by seed is highly unlikely due to the 1% germination rate (Plant Encyclopedia 2011). A few online forums from growers that have had successful seed germination encourage soaking the seeds in mild bleach solution (30 ml. bleach in 236 ml. of water) for 15 minutes, this keeps the seeds from molding, then rinse and let seeds soak for 12 hours in water. Afterwards, the seeds should then be planted 8 mm deep into potting soil, placed into a Ziploc bag or a humidity tray, kept at 22-28 °C, out of direct sunlight, and germination can be expected in 6-16 weeks (Erowid Psychotria Vault 2015). However, for suitable production amongst a professional horticultural distribution chain, propagation via cuttings would be much more successful. Due to the limited data of growing *P. viridis*, more in depth research is needed to understand factors that may improve propagation methods.

P. viridis is most successfully propagated via leaf cuttings (Psychotria viridis 2012). Leaves are removed from the stem and are placed in water near a dim light source or in potting soil (Figure 8). Plants will grow from the exposed tissues on the veins of the leaf. Some producers may expose the midvein on the leaf for more root and shoot growth. Cuttings should be kept above 20 °C and out of direct sunlight. The cuttings will take about 6-12 weeks before the plants are conditioned enough to be transplanted into individual potting containers. Stem cuttings are also a viable option for *P. viridis* propagation. This process is fairly similar to that of the leaf cuttings. However in this case, shoot and root growth will come from the exposed tissue on the cut stem. The stem cuttings have been known to grow quicker in soil than the leaf cuttings; taking only 3-8 weeks until they are ready for transplant.



Figure 8. Successful propagation of *P. viridis* from leaf cuttings (Growing *Psychotria viridis* 2010).

The customer base for *Psychotria viridis* horticultural crops may be quite small. *P. viridis* has little to offer ornamentally and as a perennial shrub from the rainforest, maintaining healthy plant growth would be very energy intensive and costly process. This would certainly not be a crop that would be sold to people interested in growing it for ornamental purposes. However, the leaves of *P. viridis* are where the active compound DMT is stored. Essentially, the entire goal of producing *P. viridis* is to collect the leaves containing the active visionary agent for Ayahuasca. The leaves can then be dehydrated and stored for some years. With this in mind, an entire community now surfaces (i.e. churches, organizations, and communal gatherings) that are

actively performing Ayahuasca ceremonies in the U.S. and abroad (Figure 9). The customer base is centered on people who are willing to participate in these deeply spiritual and life enriching experiences. As well as, the Shamans who are brewing and performing the ceremonies.



Figure 9. People prepare to drink Ayahuasca in ceremony (Sacred Valley Tribe 2015).

B. Current Production Statistics.

There is very little known about the current production of *P. viridis*. It is not likely that this plant is to be "domesticated" and widely produced anytime soon. There are only a few species among the *Psychotria* genus that can be grown for Ayahuasca. Moreover, growing *Psychotria* species is a highly energy intensive process that comes with a lot of risk. The only major market currently is distribution of dried plant material for people who will either extract

DMT or make Ayahuasca. There is currently no large-scale production of *P. viridis* in the U.S. horticultural distribution chain. However, a majority of the commercial production of *P. viridis* does come from Peru, Hawaii, and other South or Latin American countries (Psychotria viridis 2012).

Much of the *P. viridis* market base is based on speculation and assumptions of where the current *P. viridis* and Ayahuasca industry stands and how it may evolve in the future. Online, one is able to find a plethora of *P. viridis* products for sale (i.e. seeds, cuttings, wet and dry leaves, powder, etc.). Depending on the quantity of purchase, sales can range from as little as \$5 to as high as \$1,000 USD (Psychotria Viridis: Home and Garden 2015). For example, a package of 10 *P. viridis* seeds goes for on average \$10 USD. While on the other hand, a kg of dry leaf material can cost up to \$230 USD. Not to mention, Ayahuasca retreats can cost anywhere from \$300-\$2,000 USD depending on the quality of the retreat. With the awareness of Ayahuasca accelerating, the entire Ayahuasca tourism industry today may be worth millions. It is hard to say, but with thousands of people traveling to South America each year for Ayahuasca retreats, paying for airfare and extended travel, it is easy to see how this spiritual industry is becoming a very lucrative business.

The biggest question is how, when, and if *P. viridis* enters the mainstream. Hopefully, with the compelling evidence backing Ayahuasca currently as a therapeutic and spiritual tool; this medicine can either enter mainstream through the religious or medical route. The greatest economic and societal impact that *P. viridis* can have would be in the future of psychedelic assisted psychotherapy. If Ayahuasca is to gain greater notice from the medical and scientific

community as an effective healing tool. This could become the second revival of psychedelic research since the therapeutic investigations of LSD in the 50s and 60s. Imagine, people who are suffering from drug dependency, depression, or other psychological illnesses could go to local clinics, centers, or retreats within the U.S. to safely participate in Ayahuasca ceremonies with a licensed medical practitioner or Shaman in a controlled environment. Allowing them to get to the ‘root’ of their own issues instead of only temporarily alleviating their symptoms with prescription medications. A transition of this magnitude could foster an entirely new evolution of our culture into a more accepting, creative, and community based society. As well as create a multi-billion dollar psychotherapeutic industry.

There have been a few interspecific hybrids made through natural genetic crossing. Notably, Psychotria ‘Nexus’, a recent commercial hybridization of *P. viridis* and *P. carthagenensis* (New Psychotria hybrid 2015). They claim that ‘Nexus’ has a faster growth rate than *carthagenensis* and contains only 70% of the DMT compared to *P. viridis*, however, further research and development is needed to quantify these results and the potential of new genetic crosses.

IV. Proposed Crop Transformation

A. Crop Production Change(s) for the Future.

The production of *P. viridis* in the future still remains very unclear. There are many factors at play regarding if *P. viridis* will enter into the mainstream or stay as a Schedule I controlled substance. However, I am hopeful that with the current shift in our culture’s mindset

and the great need to remodel our global civilization, Ayahuasca may get the recognition it deserves.

I envision that the future production of *Psychotria viridis* becomes commonplace all around the globe. Where healing centers are a viable option for those who are suffering to heal their emotional and spiritual wounds through controlled Ayahuasca ceremonies. There can be production in tropical locations that provide environmental conditions that suitable s for *P. viridis*, either in the field or in hoop houses. We already know that *P. viridis* can be propagated in greenhouses that replicate natural growing conditions, across various continents. This production would allow for direct shipment of product into healing centers where Shamans or medical practitioners could brew Ayahuasca and safely perform ceremonies.

There should be an emphasis on growing potted *P. viridis* sustainably, which, unfortunately, are systems that are not currently available to the public. If sustainable large scale potted production of *P. viridis* was more coveted by consumers, the production systems should, and would most likely include the following practices: drip irrigation, harvestable rainwater, using vermicompost and composted soils, renewable energies (i.e. wind or solar), utilizing passive solar greenhouses, thermal masses, and heating of the greenhouses with compost heating systems. Using sustainable practices such as these would help minimize the cost of maintaining the required tropical temperatures, especially if *P. viridis* production moves to northern climates. Other production systems like aquaponics or hydroponics may be possible. However, further research would be necessary to determine the economic viability of such projects.

I believe there should be greater research into the propagation of *P. viridis* so that commercial production in the future can be implemented easily and seamlessly. Even if commercial production does not extend into the U.S. the awareness and interest of Ayahuasca will only continue to grow, production will just move somewhere else. Considering how close our planet is to surpassing its delicate limits, there is certainly no time to lose. I strongly believe that Ayahuasca is a necessary tool that must be produced on a massive scale to ensure the sustainability of our species on this planet. Ayahuasca is one of the best tools we have today that can so quickly bestow a sense of unity, healing, and need to preserve the planet for those who are courageous enough to consume it. This is a race against time.

B. A New Production Schedule for *Psychotria viridis*.

As mentioned before, there is not adequate information about the crop scheduling for *P. viridis*. However, there is sufficient information to make assumptions on how best to produce *P. viridis* in controlled environments. Firstly, vegetative cuttings should be purchased from reliable contractors in South America. Then the cuttings should be propagated in controlled environments that meet the suitable growing conditions for *P. viridis*- high temperature, high RH, understory light requirements, soil pH, and day to night temperature variations. The growing operation should also reduce the risks of pathogens and insect herbivory. Growers should maintain the greenhouse with proper ventilation by using fans, reduce overhead irrigation, maintain adequate spacing, and use integrative pest management techniques. Furthermore,

growers should use sustainable practices such as the ones mentioned earlier to lower the cost of production.

After the environmental conditions are well attuned to *P. viridis* the plant can be given sufficient time to grow. The leaves of *P. viridis* are the most important harvestable unit containing the compound DMT. Since *P. viridis* is a perennial shrub the plant will experience continued growth and the leaves should remain harvestable for more than two years. When the leaves are ready for harvest they should be cleaned and packaged, preferably at the greenhouse facility, and then handed off to be transported. Old plants should be composted and the crop scheduling should maintain a balanced rotation to meet the demand for *P. viridis* plant matter. Depending on the travel distance the harvest may need to be dried first to reduce the development of mold or other waterborne pathogens.

Due to the lack of accessible research on *P. viridis*, information concerning the plant growth stages are currently not available. Further research is needed to substantiate the growth cycle of *P. viridis*. This will largely improve the logistical information regarding growing conditions, the duration of the growing season, cost to produce *P. viridis* on a large scale, and the transportability of the plant.

C. The New Crop Ideotype.

There are many challenges ahead for the legal production of *P. viridis* in the U.S. and abroad. Based on the preliminary research, there is major potential for the use of Ayahuasca to

have a beneficial impact on society. The current research is laying a foundation for the future application of psychedelics, especially Ayahuasca, in assisted psychotherapy. The research is proving that Ayahuasca is an effective healing tool to help people suffering with drug addiction and PTSD within only a few sessions (Meech 2009). Ayahuasca and other psychedelics in the right therapeutic context have the potential to revolutionize the healthcare industry. It is only a matter of when drug and healthcare policies change to support a safe, legal, and revolutionary way of helping people who are suffering.

Ultimately, there are many gaps in the political and health care system that are barriers to passing comprehensive legislation for using Ayahuasca as a therapeutic tool. However, the overwhelming research that supports the efficacy of this medicine will be a major driver for policy changes. The second driver will be members of our society standing together and demanding formation of a safe and legal administration of this medicine to people who are in need of it. Hopefully, public encouragement will open up further research on the use of Ayahuasca and the production of *P. viridis* can be further detailed to determine economic viability, sustainability, and logistics regarding distribution.

I envision an ethical healthcare and political system that is able to cater to people's spiritual and emotional needs. Not solely prescribe them prescription medication that temporarily alleviates their symptoms without getting to the root of the issue. Furthermore, policies need to support the production of *P. viridis* in safe and legal environments with one way transport to medical practitioners and licensed shamans. If governmental policies restrict the formation of a

safe and professional Ayahuasca industry, it shows that our society is just as oppressed as any society in the past. Our communities should be willing to support meaningful changes to drug and healthcare policies that can allow the use of Ayahuasca to heal people and our planet. I believe it will be my generation that will lead the industry to capitalize on this incredible opportunity at hand. Mainly, because my generation has inherited the largest challenges humanity has ever faced and we are the ones who must create solutions. Ayahuasca is one of the many solutions that we need to set off on the right path towards healing our society and planet.



Figure 10. Professor Dennis McKenna inspects *Psychotria viridis* in the greenhouse (Olson 2013).

V. Acknowledgements

Dennis McKenna PhD is a University of Minnesota Professor working at the Center for Spirituality and Healing who is deeply involved in Ayahuasca research (Figure 10). He is a co-founder of the Heffter Institute, a non-profit organization focused on quality research of classical hallucinogens in order to understand possible health applications. His work has inspired me to gain a greater understanding for Ayahuasca and the role it may play in the 21st century.

VI. Literature Cited:

Amaringo, P. (2008). The Hero with a Thousand Faces: Shaman Artist Pablo Amaringo. Retrieved November 11, 2015, from <http://thepathofthesun.typepad.com/blog/2014/06/a-heros-journey-through-the-visionary-eyes-of-the-shaman-pablo-amaringo.html>

Brown, S., & Mason, B. (2011). Psychotria nervosa. Retrieved November 8, 2015.

Caapi Production 101. (2003). Retrieved November 11, 2015, from <http://forums.ayahuasca.com/viewtopic.php?t=2694>

Chacruna- Psychotria viridis. (n.d.). Retrieved October 15, 2015, from <https://myfolia.com/plants/83991-chacruna-psychotria-viridis>

Curry, N. (2013). Some Credible Scientists Believe Humanity is Irreparably Close to Destruction. *Vice. com. Vice Media Inc, 31*.

Dohmen, L. (2014). Herbal Medicine starts with Herbs. Retrieved November 10, 2015, from <http://purplemoonherbstudies.com/herbs.htm>

Erowid Psychotria Vault : Info on Germinating Psychotria Viridis. (2015, February 21). Retrieved November 8, 2015.

Fontanilla, D., Johannessen, M., Hajipour, A., Cozzi, N., Jackson, M., & Ruoho, A. (2009). The Hallucinogen N,N-Dimethyltryptamine (DMT) Is an Endogenous Sigma-1 Receptor Regulator. *Science*, 323(5916), 934-937. doi:10.1126/science.1166127

Gilman, Edward, F. *Psychotria nervosa* Wild Coffee. EDIS Publication #FPS494. University of Florida, Gainesville, FL

Growing *Psychotria viridis* - Ethnobotany. (2010). Retrieved November 11, 2015, from <http://www.shaman-australis.com/forum/index.php?showtopic=23934>

Grunwell, J. (1998). *Ayahuasca Tourism in South America*. Retrieved November 10, 2015.

Jungle Medicine 1 – Ecuador. (2011, February 5). Retrieved October 15, 2015.

McKenna, D. (1999) *Ayahuasca: an ethnopharmacologic history*. In: R. Metzner, (ed) *Ayahuasca: Hallucinogens, Consciousness, and the Spirit of Nature*. Thunder's Mouth Press, New York.

Mckenna, D. (2005). *Ayahuasca and Human Destiny*. *Journal of Psychoactive Drugs*, 37(2), 231-234.

Meech, R. (Director). (2009). *Vine of the soul* [Motion picture]. Canada: Meech Grant Productions.

New *Psychotria* hybrid 2015 | Herbalistics. (2015, July 20). Retrieved November 11, 2015, from <http://herbalistics.com.au/new-psychotria-hybrid/>

Olson, D. (2013, June 4). For U of M prof, hallucinogenic plants offer more than meets the eye. Retrieved October 14, 2015, from

<http://www.mprnews.org/story/2013/06/04/minnesota-sounds-and-voices-plants>

Psychotria Viridis: Home & Garden | eBay. (2015). Retrieved November 11, 2015, from <http://www.ebay.com/bhp/psychotria-viridis>

Psychotria viridis. (2012). Retrieved November 10, 2015, from <http://www.kadagarden.com/EP.viridis.html>

Psychotria viridis Ruiz et Pavon. (n.d.). Retrieved November 11, 2015, from [http://catbull.com/alamut/Lexikon/Pflanzen/Psychotria viridis.htm](http://catbull.com/alamut/Lexikon/Pflanzen/Psychotria_viridis.htm)

Sacred Valley Tribe. (2015). Retrieved November 11, 2015, from <http://sacredvalleytribe.com/>

Schultes, R. (1979). Evolution of the identification of the myristicaceous hallucinogens of South America. *Journal of Ethnopharmacology*, 211-239.

Strassman, R. (2001). Death and Dying. In *DMT: The spirit molecule : A doctor's revolutionary research into the biology of near-death and mystical experiences* (pp. 220-230). Rochester, Vt., Vermont: Park Street Press.

The Supply Chain. (2015). Retrieved December 15, 2015, from <http://www.bfv.com.au/consumers/the-supply-chain>

Trout, Keeper of the. 2001. Ayahuasca: alkaloids, plants & analogs Section 3, Part 1. *Erowid*

Tupper, K. (2006). The globalization of ayahuasca: Harm reduction or benefit maximization? *International Journal of Drug Policy*, 19(4), 297-303.

Twiz, J. (2014, April 13). Personal Story: My Ayahuasca Experience In The Amazon - Reset.me. Retrieved November 11, 2015, from <http://reset.me/personal-story/jonathon-twiz-my-ayahuasca-experience-in-the-amazon/>

Winkelman, M. (2013). Therapeutic Applications of Ayahuasca and Other Sacred Medicines. *The Therapeutic Use of Ayahuasca*, 1-21.