

# *Psychotria Viridis* - A Botanical Source of Dimethyltryptamine (DMT)

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**ABSTRACT:** Dimethyltryptamine was identified by GC/MS in a sample of dried leafy material that was subsequently identified as *Psychotria viridis* (Rubiaceae), a tropical shrub native to Central and South America that has ethnobotanical use as a hallucinogen by many indigenous peoples of tropical South America. The botanical characteristics of *Psychotria viridis* are illustrated and described.

**KEYWORDS:** *Psychotria viridis*, Dimethyltryptamine, DMT, *Banisteriopsis caapi*, *Ayahuasca*

## **Introduction**

The Naval Criminal Investigative Service Regional Forensic Laboratory (NCISRFL) in San Diego, California recently received several items that investigators had obtained from a U.S. Marine stationed in Yuma, Arizona. Item A (see Figure 1) consisted of a self-sealing plastic bag containing dried whole leaves mostly still attached



**Figure 1 - A Portion of the Sample as Received**

to stem pieces. Analysis by macro and microscopic examination indicated that the material clearly was not marijuana, nor were there any visible signs that anything had been added to the leaves.

### Experimental

Approximately 1 gram of dried leaf material was placed in a glass beaker and covered with about 3 mLs of methanol. The beaker was then heated on a hot plate in a fume hood. When the methanol volume had been reduced to about 0.5 mL, the beaker was removed from the hot plate and 1 $\mu$ L of the remaining extract was injected into a Hewlett-Packard 5890 Gas Chromatograph (Palo Alto, CA) equipped with a 5971 Mass Selective Detector and fitted with an HP-1 capillary column (crosslinked methyl silicone, 20 m x 0.25 mm i.d. x 2.65  $\mu$ m film thickness). The column oven temperature was programmed from an initial temperature of 70° C (held for 2 min) to 200° C at 10° C/min, then held at 200° C for the final 2 minutes.

### Results

The total ion chromatogram revealed just one strong peak above the background, as shown in Figure 2. The mass spectrum of this peak is shown in Figure 3. A library search gave N,N – dimethyltryptamine (DMT) as the

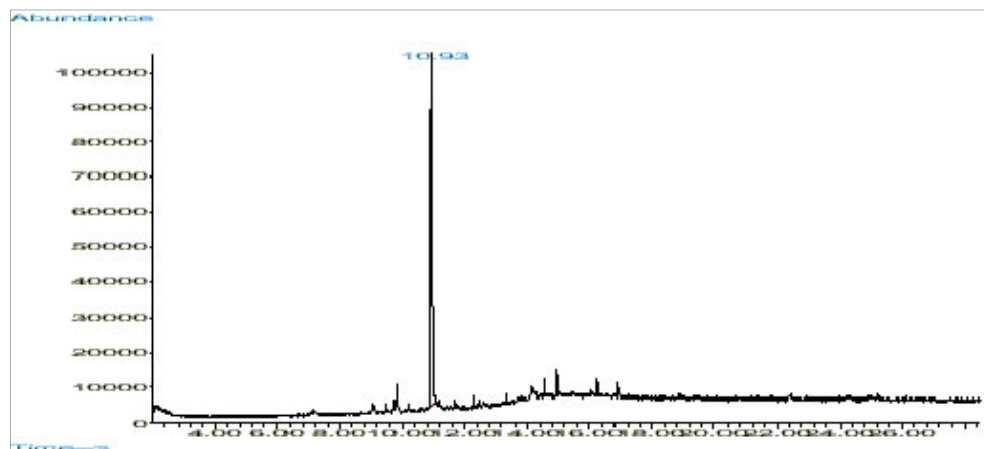


Figure 2 - Total Ion Chromatogram of a Methanol Extract

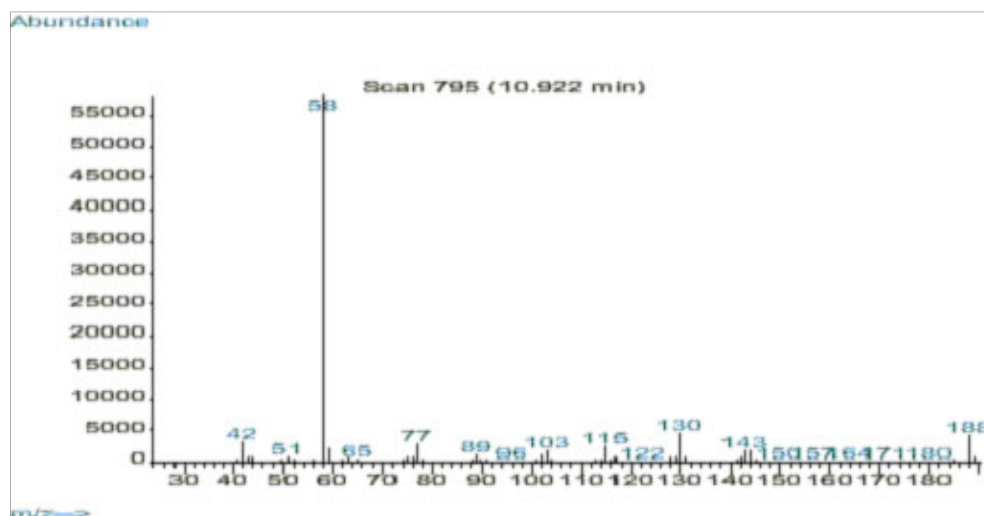


Figure 3 - Mass Spectrum of Dimethyltryptamine (Major Peak)

closest hit. The identification of DMT was confirmed when subsequent injection of a DMT standard produced a matching spectrum at the same retention time. DMT, an hallucinogen, is a Schedule I Controlled Substance. The dried leaves and stems were in good condition for botanical evaluation, and were matched to reference specimens of *Psychotria viridis* from Peru. DMT is known to be present in *Psychotria viridis* (1,2).

### ***Ethnobotanical Use of Psychotria viridis***

A narcotic drink often called *ayahuasca* or *caapi* is made from an infusion of the bark of the so-called “Spirit Vine”, *Banisteriopsis caapi* [(Spruce ex Griseb.) C.V. Morton, Malpighiaceae] and related species of tropical rainforest lianas, by many indigenous peoples of the Amazon River basin and northwestern South America (2,3). *Ayahuasca* contains several hallucinogenic alkaloids, including harmine and harmaline, and is widely used in traditional medical rites and mystical and religious ceremonies as a purgative, a magic hallucinogen, and for prophecy, diagnosis, and telepathy. Other plants are frequently added to the infusion to alter and/or enhance the effects of the *Banisteriopsis* hallucinogens. A commonly used admixture is another plant containing DMT, which reportedly increases the intensity and duration of the *ayahuasca* intoxication. DMT is found in several plant species that grow in the same region as *Banisteriopsis*, including *Psychotria viridis*. Schultes and Hoffmann have detailed the botany, ethnobotany, and chemistry of *ayahuasca* and its common admixtures (3), and Casale and Koles have detailed the forensic analysis of a typical sample (4).

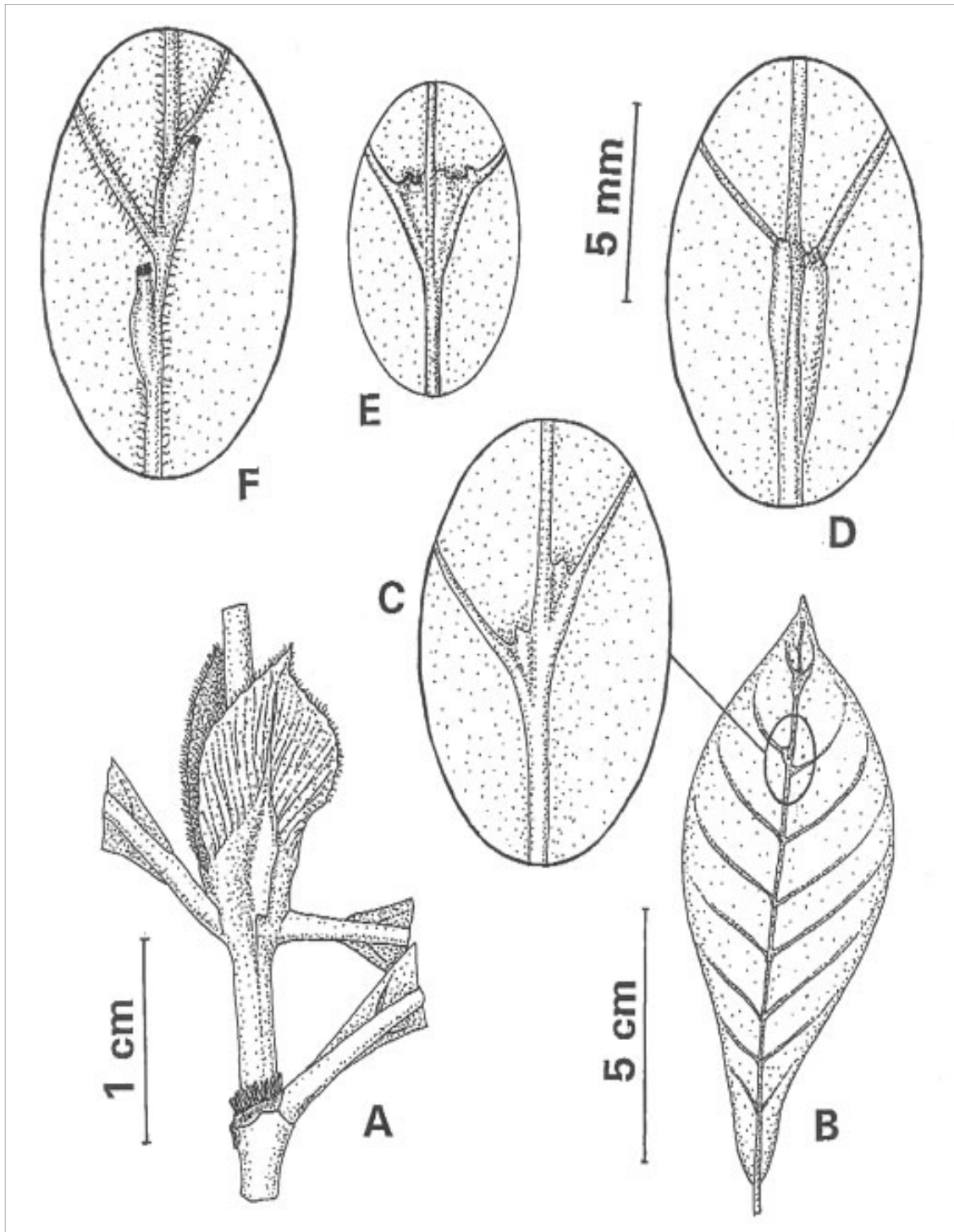
### ***Botanical Identification***

*Psychotria* is a large genus of shrubs and small trees found in tropical regions around the world (including about 1400 species, with perhaps 700 in the New World), and its taxonomy is somewhat complicated. Not surprisingly, several other New World tropical species are morphologically similar to *Psychotria viridis*, and at least some of these may also be used as admixtures in *ayahuasca* (3).

*Psychotria viridis* [Ruiz & Pav., Rubiaceae] can be recognized by a combination of features found on the vegetative portions of the plant, listed below and shown in Figure 1, although reproductive structures provide conclusive identification [see Figure 4 (next page) for illustrations of the reproductive characters]. *Psychotria viridis* grows naturally in wet lowland tropical forests in Cuba and northern Central America through western and central South America; it appears to be most common in Amazonian Peru and Bolivia. Because the genus *Psychotria* includes a large number of morphologically similar species, and there are other genera of the same plant family that are similar, the presence of all the characteristics listed below is needed to conclusively identify *Psychotria viridis*. Botanical identification of shredded or powdered material, or even leaves without stems, would be challenging.

· **Stems.** In the middle and lower parts of the stem, situated between the insertion points of the two opposite leaves there is a horizontal scar 0.3-1 mm wide that extends between the leaves (or leaf scars) and sometimes also connects over the tops of these scars, and along the top side of this scar there is a dense, usually furry line of fine trichomes (i.e., plant hairs) usually 0.5-1 mm long that are reddish brown when dried (Figure 4A). This combination of features is diagnostic for many species in the genus *Psychotria*, though not for any individual species [i.e., these features distinguish *Psychotria* L. Subg. *Psychotria*; other subgenera of *Psychotria* lack the well developed reddish brown trichomes inserted above the stipule scars]. On the upper stems of *Psychotria viridis* these features are obscured by a stipule (see below), which covers the trichomes; the scar actually marks the point where this structure has fallen off.

· **Stipules.** These are leafy structures that cover and protect the young developing leaves, then fall off leaving scars on the stem. The stipules are produced in pairs, and their form is distinctive for *Psychotria viridis*: They are 5-25 x 4-12 mm, elliptic in outline, sharply angled at the apex, papery to [continued on page 22]



**Figure 4** - Vegetative characters of *Psychotria viridis*. A, Portion of upper stem showing, from top, a pair of well developed stipules, the bases of a pair of leaves, a stipule scar with a fringe of trichomes above it, the base of another leaf, and the scar of this last leaf's pair that has fallen off. B, Leaf, underside view with a pair of foveolae circled. C, Enlarged view of foveolae from leaf shown in B. D, Enlarged view of foveolae from the forensic sample discussed in this article. E, Enlarged view of foveolae from a different botanical specimen of *Psychotria viridis*. F, Enlarged view of a different botanical specimen of *Psychotria viridis*. C, D, E, F to 5-mm scale. A, B, C based on *N. Ritter and Wood 3702* (MO), from Bolivia; E, *Gentry and Jaramillo 57585* (MO), Peru; and F, *Solomon and Urcullo 14103* (MO), Bolivia.

membranaceous in texture, ciliate (i.e., fringed) along the upper margins, and longitudinally flanged or winged along the middle (Figure 4A). However, stipule shape and size is quite variable among different plants, and also depends on the stipule's developmental stage and other factors such as whether the stem that produced it is reproductive or vegetative.

· **Leaves.** These (Figure 4B) are opposite in arrangement (i.e., produced in pairs along the stems), generally 5-15 x 2-6 cm, in outline generally elliptic or often widest above the middle, usually sharply angled at base and apex, papery in texture, overall smooth or infrequently with microscopic plant hairs on the lower surface, have 5-10 pairs of secondary veins, and on the lower surface usually have foveolae (see next item). The leaves are borne on petioles (i.e., leaf stalks) generally 1-10 mm long. When dry, the leaves of *Psychotria viridis* usually are gray or reddish brown. The leaves of *Psychotria viridis* are similar to a few other New World species of *Psychotria*.

· **Foveolae.** These are small pockets found on the lower leaf surface near the junction of the secondary (i.e., side) veins with the central vein. They function as shelter for tiny invertebrates such as mites that live on the plant leaf. These mites apparently often are symbiotic with the plant, taking shelter in these structures and eating fungi and herbivorous invertebrates that can damage the leaf. The foveolae (also called domatia) are distinctive for *Psychotria viridis* and a few related species: They are generally 1.5-5 mm long and 0.5-1 mm wide at the top, conical and tapered to a closed base, open and truncate or variously ornamented at the top, and situated along the sides of the central vein with the opening usually near a secondary vein (Figure 4C). These foveolae vary in shape among different plants (Figure 4C, 4D, 4E, 4F), and in number on individual leaves, and may not even be present on some leaves. Most often each leaf bears at least one pair of foveolae, which may be close to the apex; the foveolae are often more numerous on leaves from vegetative stems than on those from reproductive stems.

### **Conclusions**

How does a U.S. Marine obtain plant material that grows in the Amazon basin? The suspect refused to cooperate, but an Internet sales contact was the most likely source. *Psychotria viridis* leaves in various forms (whole, broken, finely powdered, shredded) reportedly exported from Peru are offered for sale on the Internet.

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