

Reassessing the Cultural and Psychopharmacological Significance of *Banisteriopsis caapi*: Preparation, Classification and Use Among the Piaroa of Southern Venezuela

Robin Rodd, Ph.D.*

Abstract—Recent attention to the monoamine oxidase inhibiting properties of *Banisteriopsis caapi*'s harmala alkaloids has precluded a balanced assessment of *B. caapi*'s overall significance to indigenous South American societies. Relatively little attention has been paid to the cultural contexts, local meanings and patterns of use of *B. caapi* among snuff-using societies, such as the Piaroa, who do not prepare decoctions containing N,N-dimethyltryptamine (DMT) admixtures. This article reviews the psychopharmacological literature on *B. caapi* in light of recent ethnographic work conducted among the Piaroa of southern Venezuela. Piaroa shamans use only *B. caapi*'s cambium, identify at least five distinct varieties of *B. caapi*, and emphasise the plant's importance for heightening empathy. Some Piaroa people also attribute a range of extra-shamanic uses to *B. caapi*, including as a stimulant and hunting aid. In light of the psychopharmacological complexity of harmala alkaloids, and ethnographic evidence for a wide range of *B. caapi* uses, future research should reconsider *B. caapi*'s cultural heritage and psychopharmacological potential as a stimulant and antidepressant-like substance.

Keywords—ayahuasca, *Banisteriopsis caapi*, β -carbolines, Piaroa yopo

Banisteriopsis caapi Spruce ex Griseb. C.V.Morton (Malpighiaceae) was first identified in 1852 by Richard Spruce when he witnessed Tukano people of the Vaupés region of Colombia using a plant referred to as "capi" in the preparation of a hallucinogenic drink (Spruce 1873). Since this time, the use of *B. caapi* has been documented among numerous ethnic groups throughout the Amazon region,

*Lecturer, Department of Anthropology, Archaeology and Sociology, James Cook University, Townsville, Australia.

Please address correspondence and reprint requests to Robin Rodd, Department of Anthropology, Archaeology and Sociology, James Cook University, Townsville, Australia 4811; email: robin.rodd@jcu.edu.au

most commonly in association with a hallucinogenic drink combining *B. caapi* and a range of tryptamine-containing plants, referred to by a range of words including *ayahuasca*, *yagé*, and *natéma* (c.f. Luna 1984; McKenna & Towers 1984; Rivier & Lindgren 1972; Schultes 1957). The indigenous use of *B. caapi* extends throughout northern South America from eastern Bolivia in the south to Venezuela and Guyana in the north, and as far east as Pará Brazil at the mouth of the Amazon. *B. caapi* use by either mestizo shamans or syncretic churches is even more extensive, and touches urban and rural areas throughout the Amazon region.

Recent attention to the monoamine oxidase (MAO) inhibiting properties of *B. caapi*'s harmala alkaloids has precluded a balanced assessment of *B. caapi*'s overall significance to the indigenous communities of South America. Relatively little attention has been paid to the cultural contexts, local meanings and patterns of use of *B. caapi* among snuff-using societies, such as the Piaroa, who do not prepare decoctions containing *N,N*-dimethyltryptamine (DMT) admixtures. This article reviews the psychopharmacological literature on *B. caapi* in light of recent ethnographic research into how Piaroa shamans of southern Venezuela conceptualise and use *B. caapi*. In many ways, Piaroa classification and preparation of *B. caapi* echo those of other ethnic groups. Unlike shamans from ethnic groups who prepare DMT-containing decoctions, however, Piaroa shamans insist on using only the cambium and elbow sections of the *B. caapi* plant, consume quantities of *B. caapi* that may go well beyond MAO inhibition, and emphasise that *B. caapi*, consumed on its own, is required for "seeing into other people" or reading minds. Piaroa men also attribute a range of extra-shamanic uses for *B. caapi*. These include its use as a hunger suppressant, stimulant and enhancer of visual acuity. Recent clinical research demonstrating that harmala alkaloids have antidepressant qualities is used to support the contention that the extra-shamanic use of *B. caapi* by indigenous peoples may have contributed to harmonising group affect and promoting social stability. In light of Piaroa usage it is suggested that future psychopharmacological and ethnographic research should consider *B. caapi*'s effects and use beyond DMT-containing decoctions.

THE PSYCHOPHARMACOLOGY OF *B. CAAPI*

The first isolation of a chemical compound from the *B. caapi* plant was made by Fischer (1923), who named the crystalline compound *telepatina* (telepathine). In 1928, Elger proved that telepathine was identical to harmine, isolated years earlier from *Peganum harmala* L. (Zygophyllaceae). Many years later, researchers found two other β -carboline alkaloids, harmaline and tetrahydroharmine, in stems of *B. caapi* (Hochstein & Paradies 1957). Early accounts of the consumption of ayahuasca decoctions identified *B. caapi* as the only or primary psychoactive ingredient. Research by botanists and pharmacologists revealed that a number of admixture plants rich in the hallucinogenic compound *N,N*-dimethyltryptamine (DMT) are used by indigenous and mestizo shamans throughout northern South America. These studies have indicated that *B. caapi*'s primary role in the decoction appears to be denaturing a gut enzyme (monoamine oxidase), making DMT orally active (McKenna & Towers 1984; McKenna, Towers & Abbott 1984).

There is a great deal of variation in the concentrations of harmala alkaloids in *B. caapi* samples, and much debate concerning the psychopharmacological and subjective effects of these alkaloids and their overall significance to

ayahuasca decoctions. The great variations in concentrations of harmala alkaloids in *B. caapi* samples and ayahuasca decoctions make generalisations about pharmacokinetics and subjective effects exceedingly difficult, if not impossible. Rivier and Lindgren's (1972) pharmacological analysis of *B. caapi* plants from Peruvian and Ecuadorian ethnic groups demonstrates a high variability of alkaloid content according to the region from which the plant was sourced and the portion of the plant tested. In all cases harmine was the alkaloid of greatest concentration, followed by tetrahydroharmine, with much lower concentrations of harmaline (Rivier & Lindgren 1972:106-9). Callaway and colleagues (2005) found a similarly broad range of alkaloid profiles, and proportions of harmine and harmaline, in 32 *B. caapi* samples sourced from 22 Brazilian sites. In both studies tetrahydroharmine showed the greatest range of concentrations. Although the root sections tended to have the highest overall alkaloid concentrations (up to 1.95% dry weight; Rivier & Lindgren 1972:106), neither the cambium nor elbow sections, the two parts of the plant used by the Piaroa, were tested in either of the above studies.

Most scholars attribute the hallucinogenic properties of the ayahuasca decoction to DMT (e.g. Stuckey, Lawson & Luna 2005; Callaway, Brito & Neves 2005; Riba et al. 2001; Callaway et al. 1999; Riba & Barbanoj 1998; McKenna & Towers 1984). Callaway and colleagues (2005) begin their phytochemical analysis of *B. caapi* and *Psychotria viridis* Ruiz & Pav. (Rubiaceae) (the DMT-containing plant most commonly used in ayahuasca decoctions) by stating that, among a range of brews tested, harmala alkaloids, but not DMT, are present in all. They go on to say that: "Although these harmala alkaloids are not particularly psychoactive on their own, they can facilitate the activity of *N,N*-dimethyltryptamine (DMT) from *P. viridis* . . ." (Callaway, Brito & Neves 2005: 146). Stuckey and colleagues (2005: 164) write that although DMT is "mainly responsible for the drug's hallucinogenic effects," harmine and harmaline act as MAO inhibitors allowing DMT to pass the blood/brain barrier, while the tetrahydroharmine (present in *B. caapi*) might "contribute to the psychoactive effects by weakly inhibiting serotonin uptake." Ott (1996) and Rivier and Lindgren (1972) argue that most ayahuasca decoctions have subthreshold doses of harmala alkaloids, and that DMT should be considered the primary psychoactive compound in the decoction.¹ This conclusion, however, does not invalidate the possibility that other ethnic groups, such as the Piaroa, may use more potent strains of *B. caapi* in a wider range of dosages, for a wider range of uses.

B. CAAPI'S PLACE IN THE MATERIA MEDICA OF PIAROA SHAMANISM

The Piaroa ethnic group (population 12,558; OCEI 2005) lives along several rivers, including the Parguaza, Cuao, Sipapo, Autana, Cataniapo and Carinagua, in the

Bolívar and Amazonas states of Venezuela. Piaroa territory spans tropical highland zones, dense lowland rainforest and savannah, and most Piaroa people live in villages of between 50 and 500 people along navigable rivers. Piaroa subsistence activities are heavily oriented around the cultivation of bitter cassava, which is primarily the domain of women. Men fish and hunt, and both men and women collect wild fruits (Overing 1975). Plant knowledge is distributed among both men and women, while men more commonly know how to prepare and use psychoactive plants (Zent 1999).

According to Piaroa shamans, four plant substances (*yuhuä*, *tuhiipä*, *dädä* and *jätte*) facilitate entry to a realm of potentially infinite understanding of past, current and future ecological, social and individual situations. *Dädä* has been identified as *Malouetia schomburgkiana* Müll. Arg. (Apocynaceae) (Colchester & Lister 1978), while *jätte* refers to the *Nicotiana tabacum* (Solanaceae) cultivar, and to a range of tobacco products that the Piaroa prepare (paste, cigars and syrup).² Of the four psychoactive plant substances consumed regularly by Piaroa shamans, *yuhuä* (a snuff derived predominantly from the pulverised seeds of the *Anadenanthera peregrina* Speg. (Leguminosae) tree, referred to in colloquial Spanish and cross-culturally as *yopo*) and *tuhiipä* (*B. caapi*, referred to in colloquial Spanish as *capi*) are the most important. A Piaroa shaman's power to heal and harm is directly related to his ability to access information, communicate with spirit helpers, and transmit or extract pathogenic agents during combined *yopo* and *capi* induced consciousness experiences.

To the Piaroa shamans who use them, *yopo* and *B. caapi* are intimately tied. According to one shaman "the force of *yopo* and the force of *capi* work together." Piaroa *yopo* preparation and consumption differ significantly from those of other ethnic groups in that *B. caapi* is added to the ground seed mix, and is always consumed prior to the inhalation of snuff (Rodd 2002; for classical interpretations of *yopo* preparation see Spruce 1908; Schultes 1979).³ Piaroa *yopo* is the only snuff yet tested that contains both tryptamine and harmala alkaloids (Holmstedt & Lindgren 1979). Beyond inclusion in the preparation of *yopo*, Piaroa shamans consume *capi* orally one to six hours prior to snuff inhalation, and on its own for a range of purposes.

PIAROA CLASSIFICATION AND PREPARATION OF *B. CAAPI*

The Piaroa distinguish five types of *capi* but it is probable that these are all *B. caapi* (Gates 1986:51). Piaroa classification is made according to the color of the plant's flesh, its potency, and whether or not the plant is cultivated or grows wild. Piaroa classification of *capi* according to color and potency echoes that of the Piro, the Shipibo-Conibo (Andritzky 1989:78), and the Tukano (Reichel-Dolmatoff 1972). The Piaroa varieties of *capi* are: *yurina*, *maë*, *kohö*, *duhui huoika* and *ubaku ukhuä*. A sixth term, *kunahua*, refers

to any variety of cultivated *capi*. *Yurina tuhiipä* is the most commonly used variety, and is cultivated by most shamans. The flesh of this variety is light brownish-yellow. *Kohö tuhiipä* has "pink flesh." *Ubaku ukhuä chamurë tuhiipä* is considered to be extremely potent, and only grows wild. *Maë tuhiipä* was simply described as being "another color." *Duhui huoika tuhiipä* is considered to be the strongest type of *capi*.

Duhui huoika refers to the elbow part of the root stock of the *B. caapi* plant, a bulbous section found only on certain very mature plants. The flesh of *duhui huoika tuhiipä* is bright yellow, and has a very strong, acrid odor and flavor. *Duhui huoika tuhiipä* is described as being "the father of all *capi*" and "so strong it is the world champion. It gives you visions that last all night." According to shamans from the Parguaza River, *duhui huoika tuhiipä* is only found on the Parguaza River, from where it used to be traded long distances to other areas of Piaroa settlement. The belief that shamans of the Parguaza River were chaotic and malevolent sorcerers is partially attributed to their use of this very potent form of *B. caapi*.

Unlike shamans from most other *B. caapi*-using ethnic groups, Piaroa shamans use only the cambium of *B. caapi*. Immediately after collection, the thin outer bark is scraped off cuttings. Fresh cuttings are then placed by the side of a fire for five to ten minutes. Heat facilitates the manual separation of the desired cambium from the unwanted pith. Sections of *capi* cambium retain their potency for several months. All other sections of the plant (e.g. bark and pith) are discarded. Although the Piaroa may not be unique in their insistence on using only the cambium of *B. caapi*, there is little cross-cultural evidence to demonstrate that other indigenous groups use only this part of the plant.

Piaroa shamans consume *B. caapi* in one of two ways: by sucking a wad (three to eight grams dried weight) for several hours or until it loses its bitterness, or by preparing a beverage from gratings of *capi* cambium. When particularly strong visions are required (for sorcery battles, divination, initiation, and occasionally for preventative rituals in which several shamans participate) a drink is prepared from numerous *capi* cuttings, and is consumed prior to *yopo* inhalation. *B. caapi* dosages in drink form are up to 30 times greater than when a small cutting of the vine is sucked. One and a half cups of gratings are sufficient to make a strong drink for two people.

VISIONS AND EMPATHY

Piaroa shamans consume *capi* prior to *yopo* in the same range of contexts that other scholars have attributed to ayahuasca decoctions (e.g. Reichel-Dolmatoff 1972: 86 for the Tukano of the Northwest Amazon, and Rivier & Lindgren 1972 for the Culina and Shagranahua Indians of Peru). These include group ceremonies such as initiation rites, funerals, and increase festivals, and individual ceremonies led by one

or more shamans for the purposes of healing, sorcery or divination. Yopo and capi are consumed together in order to “see the future” and to divine answers to practical problems: where should hunters go, who should marry, where should a swidden plot be cleared, how to make spouses happier, how to keep children in school or how to get along with the other members of their family.

Used without yopo, capi is valued by Piaroa shamans for its capacity to enhance empathy. Piaroa shamans believe that capi aids in the perception of other people’s motivations, desires, feelings, and states of mind, while yopo delivers the subsequent visionary punch. The success a shaman will have in maintaining or disrupting social harmony depends upon his ability to understand the needs of others, and to situate these needs in a social and ecological framework. When shamans assess the health of a family or community, it is often not what people say that informs the shaman’s diagnosis so much as what the shaman sees and feels when he looks at this person. In order to see as a shaman does, one must regularly suck capi. Shamans can often be identified by the bulge of capi inside their cheek, and are sometimes referred to as “the capi chewers.”

STIMULANT AND HUNGER SUPPRESSANT

The Piaroa have a range of largely extra-shamanic uses for *B. caapi*. Piaroa hunters used to, and sometimes still do, consume capi on hunting trips. Capi is believed to provide hunters with strength and the ability to see and ward off malevolent spirits. Most importantly, however, capi is consumed by hunters to enhance night vision. As one shaman put it, “capi gives you eyes of the jaguar.” The jaguar’s night vision and hunting prowess are legendary, and there is also evidence to demonstrate that jaguars consume, and become intoxicated by, *B. caapi*. (Downer 2002: 143).

Young and old Piaroa men recall a time in the recent past when capi was used regularly by men as a stimulant and hunger suppressant, particularly on long treks into the forest. Guánchez (1996: 21, trans.) notes that the Piaroa chew “small sections of the [*B. caapi*] stem . . . as a mild stimulant, in association with hallucinogens or on its own.” One young man explained capi use thus:

When we had to travel through the forest and into the mountains, we didn’t take any food with us, just capi . . . or when we had to paddle upriver, and it was raining, capi gave us the energy and kept us warm.

B. caapi may be an effective stimulant for long treks into the forest and paddling trips up river because harmaline and harmine heighten dopaminergic transmission in the central nervous system. High concentrations of dopamine produce hypertension and encourage stereotypical behaviour in rats and humans (Pimpinella & Palmery 1995: 122-3). In present-day Piaroa society, the use of capi as a stimulant is

largely restricted to men in remote areas of habitation, to shamans, and to the sons of shamans who have received some shamanic training.

There is some cross-cultural evidence to demonstrate that other ethnic groups use *B. caapi* as a stimulant. Colchester and Lister (1978) mention that *B. caapi* may be taken for its “energizing effects to aid work output” by several ethnic groups, including the Macu, Guahibo and the Piaroa. Some Guahibo, like their neighbours the Piaroa, consider that *B. caapi* taken on its own “only removes hunger and pain” but powerful visions result from consuming *A. peregrina* snuff after *B. caapi*. Coppens and Cato-David (1971: 15, trans.) note that the Cuiva use “a bark” (*ayo*) that is crushed and whose “original function appears to be hunger suppression, as well as inducing dreams.” It is uncertain, however, to what species *ayo* refers. *B. caapi* may once have played a similar role in Piaroa society that coca does among Andean peoples, and stimulants such as coffee and amphetamines do in Western cultures, boosting productivity while minimising hunger and fatigue (Dobkin de Rios 1984: 151-2). Like coca, capi use involves a cross-over between the economic and the divine, employed by ritual specialists as one element in an altered states of consciousness toolkit, as well as being a mild stimulant of extra-shamanic significance.

REASSESSING THE PSYCHOPHARMACOLOGICAL SIGNIFICANCE OF *B. CAAPI*

The contexts and meanings of Piaroa *B. caapi* use have implications for interpreting capi’s psychopharmacological significance. While harmala alkaloids manifest hallucinogenic activity on their own at dosage levels several times greater than are required for them to function as monoamine oxidase inhibitors (Buckholtz & Boggan 1977; Rivier & Lindgren 1972), it is probable that Piaroa shamans consume quantities of *B. caapi* beverage that far exceed the doses required for MAO inhibition. Piaroa insistence on the exclusive use of *B. caapi* cambium, and on the elbow sections of mature specimens, might be common to other ethnic groups; however pharmacological analyses have not taken this use pattern into consideration. Furthermore, none of the *B. caapi* sourced for analysis in the studies by Rivier and Lindgren (1972) or Callaway and colleagues (2005) were Venezuelan. It is possible that Piaroa shamans avail themselves of the most potent part of relatively potent specimens, allowing for a broader array of dose-specific applications.

Although there have been a number of clinical trials to assess the subjective effects of harmine and harmaline (Naranjo 1979; Slotkin et al. 1970; Pennes & Hoch 1957), and of ayahuasca decoctions (Stuckey, Lawson & Luna 2005; Riba et al. 2001), there have been no clinical trials to assess the psychological effects of *all three* harmala alkaloids present in *B. caapi*. Naranjo’s (1979: 388) study of the harmala alkaloids suggested that there “appeared to be”

qualitative differences in the subjective reactions to harmine, the alkaloid of greatest concentration in *B. caapi*, harmaline and tetrahydroharmine. Naranjo (1979: 388) notes, however, that "more systematic study would be needed to confirm differences such as these." Freedland and Mansbach (1999: 193) have argued that the subjective effects of ayahuasca are heavily conditioned by *B. caapi*'s β -carbolines, especially harmine. Callaway (2005: 153) notes that a Shuar (Ecuador) and União do Vegetal (UDV Church, Brazil) sample of ayahuasca had no detectable quantities of DMT. These samples, however, were held in as high regard by their users as other samples containing DMT, leading Callaway to remark that "apparently the visual phenomenon from DMT may not be the main attraction in these products." I have consumed *B. caapi* in both beverage form and as a wad sucked continuously in the side of my mouth in the company of Piaroa shamans on numerous occasions and in a range of contexts concordant with traditional use. Based on these experiences, it would appear that Piaroa shamans consume *capi* in doses ranging from threshold to those producing powerful stimulant effects lasting an entire day. Visual acuity and information processing appeared to be stimulated by larger dosages. High doses produced sensations of heightened empathy and the ability to reason about these feelings.

Although laboratory analyses of ayahuasca cannot, on their own, explain the subjective effects of harmala alkaloids, the conclusions of these ayahuasca studies may be relevant for understanding why Piaroa value *capi* for mind-reading tasks that require perceiving and reasoning about the social weave of goal pursuits resulting in emotions. While Riba and colleagues (2004) found ayahuasca to produce a dampening of slow-wave (i.e. theta and delta) activity, in line with psychostimulants, ayahuasca also produced a dampening of alpha wave activity, in line with other hallucinogens. Stuckey and colleagues (2005: 176) found that while ayahuasca tended to produce high levels of brain coherence (i.e. stronger electrical linkages among distributed cortical regions enabling heightened information processing), mood and personality played a large role in resultant EEG patterns and subjective effects. Riba and colleagues' (Riba et al 2004: 99-100) EEG studies of ayahuasca have demonstrated that "bioelectrical changes are found on cortical association areas in temporo-parietal and frontomedial areas, together with paralimbic areas such as the cingulate and the temporo-medial cortices, which play relevant roles in the neurobiology of attention, emotion and memory." As well as memory, attention and emotion, ayahuasca induces changes in EEG activity interhemispherically and across a range of brain regions associated with visual, somatic and auditory perception. According to Riba and colleagues (2004: 100):

[I]t appears reasonable to assume that effects on transmodal brain areas could account for more complex cognitive modifications which also characterise the subjective experience elicited

by ayahuasca . . . Future studies specifically addressing drug effects on these aspects of human cognition are needed in order to further our understanding of the complex psychological modifications elicited by ayahuasca.

Clinical tests of harmala alkaloids on mind-reading abilities (theory of mind) and empathy might provide valuable insights into the ways in which shamans use *B. caapi* to regulate health in the communities in which they work. It is possible that *capi* sharpens interpersonal awareness and accelerates empathetic capabilities, particularly when consumed in a nocturnal group setting during which endogenous opioids associated with social bonding are most easily produced (Freckska & Kulcsar 1989). Rivier and Lindgren (1972: 102) cite the social bonding aspect of ayahuasca rituals, whereby "a well-guided ayahuasca experience brings the participants closer together," and is a means of internally organising and understanding shifting psychosocial dynamics in the community.

Regular *B. caapi* usage within or outside a ritual shamanic context may have resulted in the coordination of group affect, and may have had a positive emotional impact on society. Farzin and Mansouri (2005) have demonstrated that β -carboline alkaloids produce antidepressant-like effects in rats. β -carboline alkaloids increase norepinephrine, dopamine and serotonin levels in several brain regions via inhibition of monoamine reuptake systems (Callaway & Grob 1998; Kleven & Woolverton 1993; Komulainen et al. 1980). Callaway and colleagues (1999) have suggested that the regular consumption of ayahuasca might induce upregulation of serotonin uptake sites on blood platelets, in turn stimulating serotonin production. It is possible that Amazonian peoples may have consumed *B. caapi* in nonritual contexts over long periods of time, and that this pattern of usage may have coordinated group affect and produced antidepressant-like effects. Although local meanings and contexts of use differ greatly to Western notions of antidepressants, given the right set and setting, *B. caapi* might be considered an indigenous antidepressant. Until there is more ethnographic research into *B. caapi* usage beyond DMT-containing decoctions, however, we will not know.

CONCLUSIONS

Despite a recent outburst of research into the social and psychopharmacological significance of *B. caapi* in relation to DMT, relatively little is known of the diversity of ways that *B. caapi* is used by the indigenous peoples of Venezuela. This study has drawn attention to Piaroa *B. caapi* use and the psychopharmacological implications of a yopo-using society's *B. caapi* practices. Piaroa *B. caapi* use differs in preparation and intention of use to other ethnic groups in several ways (e.g. exclusive use of cambium); in extra-shamanic applications (hunger suppressant, stimulant and enhancer of visual acuity); in the importance of *B. caapi* for

empathy and mind-reading; and in the potential for *B. caapi* to be used in a manner similar to Western antidepressants. The ways in which Piaroa people conceptualise and use *B. caapi* suggest that more attention should be paid to the indigenous phytochemical knowledge of other Venezuelan ethnic groups, where our knowledge of the contexts of *B. caapi* use remains limited relative to other Amazonian regions. Future psychopharmacological research into the cognitive and affective effects of *B. caapi*'s harmful alkaloids may also shed light on the range of indigenous uses for *B. caapi*. I suggest that the visionary, stimulant, empathogenic and antidepressant properties of *B. caapi* cannot easily be parsed, and that the value of this plant to indigenous societies emerges as the sum of these parts which, nonetheless, may each have been selected for by indigenous peoples such as the Piaroa who continue to experiment with dosages and contexts of use.

NOTES

1. There is a slight trend toward higher alkaloids concentrations in *B. caapi* plant matter sourced from warmer,

equatorial regions than the morphologically distinct, but botanically identical, variant that grows in the cooler climates of southern Brazil (Callaway, Brito & Neves 2005: 146).

2. *Dädä* decoctions are prepared from the grated bark of *Malouetia schomburgkiana*, although it is possible that the Piaroa, who distinguish eight varieties, use several species including *Malouetia* and *Tabernaemontana sp.* (Apocynaceae). There are no voucher samples for all eight varieties of *dädä*. *B. caapi* is not added to this decoction, although *B. caapi* is sometimes consumed prior to the *dädä* decoction. *B. caapi* is not considered to be essential for the attainment of *dädä* visions.

2. *A. peregrina* has been demonstrated to contain the psychoactive agents 5-methoxy-N,N-dimethyltryptamine (5-MeO-DMT), 5-hydroxy-N,N-dimethyltryptamine (5-OH-DMT) and N,N-dimethyltryptamine (DMT) in their seeds and bark (Fish, Johnson & Horning 1955; Stromberg 1954).

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