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Identification of 5-hydroxy-tryptamine (bufotenine) in *takini* (*Brosimum acutifolium* Huber subsp. *acutifolium* C.C. Berg, Moraceae), a shamanic potion used in the Guiana Plateau

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Abstract

This paper is the first thorough analysis of *takini*, a hallucinogen used by the shamans of several peoples in Suriname, French Guiana, and the region east of the Para in Brazil. The drug is contained in the latex of the *Brosimum acutifolium* tree, and until now, its psychotropic properties appeared inconsistent with the more general medicinal uses of the tree in the surrounding region.

Our chemical and botanical studies reveal that the active ingredient of *takini* is bufotenine; and that this compound is only contained in the subspecies *Brosimum acutifolium* Huber subsp. *acutifolium* C.C. Berg that is found in the same area of the eastern Guianas.

Keywords: Bufotenine; 5-Hydroxy-tryptamine; Takini; Shamanism; Amerindians; Hallucinogenic beverage

1. Introduction

In the study of the medicinal and toxic plants of French Guiana, published in 1987, Grenand and Moretti reported that the shamans of the Palikur, Wayãpi, and Kali'na (Carib, Galibi) communities used the latex of the *Brosimum acutifolium* as a hallucinogen. The species is an uncommon big tree of the primary forest. The drug was called *takini* by the Kali'na, *takweni* by the Wayãpi and *tauni* by the Palikur (Grenand and Moretti, 1987) and its discovery raised several questions: the analyses carried out at the time were inconclusive regarding the psychotropic effect of the drug; and the widespread medicinal use of the species – under the name of *mururé* – to relieve rheumatisms all over the eastern Amazon region seemed incompatible with the pronounced hallucinogenic properties of the latex, with which the bark is heavily impregnated.

This article comprises an account of the ethnobotanical investigations carried out to determine the botanical status of *takini*, and our study of the chemical composition of the latex.

2. *Takini*: a historical overview

The first recorded use of the word *takini* is by Heckel (Heckel, 1897) who described "tachini" as a 'red latex, which although toxic, is used as an antirheumatic by the Galibi of French Guiana'.

The first mention of the role of *takini* in Galibi and Arawak shamanism was by De Goeje (De Goeje, 1928), who considered its role purely symbolic. He also recorded an interesting Arawak myth linking the tree with the cultural origin of shamanism. The first observations inferring hallucinogenic effects were described by Ahlbrinck in 1931 (Ahlbrinck, 1956); while according to Stahel (Stahel, 1944), 'Indian necromancers' drink the latex, which puts them into a state of 'unconsciousness' with hallucinations.

The anthropologist Kloos provided the first detailed description of the use of *takini* in the shamanism of the Carib (Galibi)

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people on the River Maroni (Kloos, 1968). In spite of excellent first-hand accounts, however, he concluded that the effects were more toxic than hallucinogenic. Furthermore, he followed Ostendorf in identifying the *takini* of the Galibi people as *Helicostylis tomentosa* (Moracae) and/or *Helicostylis pedunculata*, from oral reports that Kloss supplied to Professor Uffelie of the University of Utrecht (Kloos, 1968; Ostendorf, 1962).

This probably explains why Buckley et al. (1973) based their study of the *takini* of Suriname on samples of *Helicostylis tomentosa*. It should also be noted that their samples were collected near Belém in Brazil, a long way from the region where the species is used as a hallucinogen.

It was not until 1972 that Berg, in Flora Neotropica, and Berg and De Wolfe, in Flora of Suriname (Berg, 1972; Berg and Dewolf, 1975), established clearly that *takini* corresponds to *Brosimum acutifolium* by examining herbarium specimens bearing the vernacular names of the plants.

The samples collected by our team among the Wayãpi and Palikur people were also determined by Berg, and confirm that the plant material corresponds to *Brosimum acutifolium* (Grenand and Moretti, 1987).

3. Previous chemical studies

Tests for alkaloids in the latex and bark, which we carried out using classical chemical methods, proved negative (Grenand and Moretti, 1987). Flavanoid phenols have been isolated (Teixeira et al., 1984). Common vegetable sterols sitosterol and friedeline have been isolated from a *Brosimum* sp. called *takini* in Suriname (Hegnauer, 1973). Flavanes, including 4'-hydroxy-7,8-[2-(2-hydroxy-isopropyl)dihydrofuran]flavane, 4′,7-dihydroxy-8-(3,3-dimethylallyl)flavane, and 4′,7-dihydroxy-8-prenylflavane have been isolated from the bark of the trunk (Torres and Monteiro, 1997).

None of these compounds can account for the psychotropic effect of the drug.

4. Present chemical studies

4.1. Botanical material

The latex was collected in French Guiana, from two different trees. The reference herbarium voucher specimens are lodged in the Guyana Herbarium (CAY; Grenand 1431 and 1446). The initial milky, translucent liquid was separated from the dark red latex that flows after it and this last only, according to research, is used by the shamans.

Among the Wayãpi and the Palikur, the latex is collected by making a deep incision into the bark of the trunk. First of all a translucent liquid appears, a little like the white of an egg. This flows for a few minutes, then it is followed by the red, slightly frothy latex that the shamans use. Taking the latex and smoking the bark of the *Brosimum acutifolium* are the essential means for novice shamans of the two peoples to tame the protecting spirit of the tree. The shaman can take latex again at other times throughout his life to reinforce his alliance with the spirits he has tamed.

4.2. Analytical technique

4.2.1. Material

The gas chromatograph used was a Trace GC (Thermo Electron, Courtaboeuf, France) equipped with an AS3000 autoinjector and a Polaris Q mass spectrometer. The analytical column was a factor four capillary column 5% phenyl 95% methyl siloxane, 30 m in length, with an internal diameter of 0.25 mm (0.50 μm film thickness) from Varian (Les Ulis, France). Helium was used as carrier gas at a flow rate of 1 ml/min in constant flow mode. The temperatures were: interface 280 °C and ion source 200 °C. Pulsed injection with surge pressure (1 μl) was carried out at 280 °C and 250 KPa for 1 min. The initial oven temperature was 50 °C for 2 min and was increased to 300 °C at 15 °C/min and held for 6.33 min. The chromatographic run time was 27 min. Repetitive scans in positive mode were acquired from 29 to 600 a.m.u. at a rate of 600 a.m.u. per second from 6 to 27 min.

The liquid chromatographic system consisted of a surveyor (pump and autoinjector) system coupled to an LCQ advantage mass spectrometric (MS) detection from Thermo Electron equipped with an electrospray device operating at the positive detection mode. Chromatography was performed on an OS Uptisphere C_{18} analytical column (3 mm × 150 mm, 3 μm) from Interchim (Montluçon, France). The mobile phase was delivered at a flow rate of 190 μl/min in the gradient elution mode (i.e., 20% acetonitrile linearly increased to 90% at 10 min and held for 8 min). The column temperature was stabilized at +35 °C. The column effluent was introduced into the mass spectrometer between 4 and 18 min in full MS mode from 150 to 500 a.m.u. while MS-MS experiments were acquired in the scan mass dependant mode.

4.2.2. Extraction and injection

About 5 ml of latex were extracted using a toxi-tube A® (liquid–liquid extraction) (supplied by Varian, Courtaboeuf, France) after the addition of 50 ng (50 μl at 1 μg/ml) of decadeuterated psilocyn (psilocyn D10) (supplied by Promochem, Molsheim, France). After homogenization by shaking for 10 min, followed by centrifugation, the superior organic phase is collected, dried by evaporation and separated into several parts to be successively analysed by different analytical systems:

(1) gas chromatography combined with mass spectrometry in electronic impact mode:
   (a) derivation with N,O bis-trimethylsilyltrifluoracetamide containing 1% trimethyl chlorosilane
   (b) derivation with trifluoroacetic anhydre
   (c) derivation by acetylation
   (d) without derivation
(2) liquid chromatography combined with mass spectrometry and tandem mass spectrometry

5. Results

The extensive field and bibliographical research that we carried out among different Guianese ethnic groups confirm that