Alkaloid Content of *Banisteriopsis Rusbyana*

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In spite of investigation for more than a hundred years, the botanical and chemical components of the Amazonian hallucinatory drink, yajé, cannot be said to be fully elucidated. It is well known that the main constituent of yajé, also called ayahuasca, caapi, etc., consists of the malpighiaceous vine *Banisteriopsis caapi* (1). Additional botanical constituents are, however, known and have been discussed (2). One such ingredient is the leaves of *Banisteriopsis Rusbyana*. While *B. caapi* and *B. inebrians* have been shown to contain harman alkaloids (3, 4), *B. Rusbyana* surprisingly enough proved to contain a very large amount of the hallucinogen N,N-dimethyltryptamine (5, 6). The occurrence of this substance in the plant is interesting for many reasons. The combination in yajé of monoamine oxidase inhibiting harman alkaloids with N,N-dimethyltryptamine might result in specific pharmacological effects (7). Another point of interest is that indole bases are typical components of other plants which have been used by the natives in many places in South America and the Caribbean for the preparation of intoxicating snuffs. The plants used for this purpose belong to the *Leguminosae (Piptadenia)* and *Myristicaceae (Virola)* families (8).

We have recently had occasion to re-examine the alkaloid content of *B. Rusbyana* using modern methods such as gas chromatography—mass spectrometry.

Leaves and stems from *Banisteriopsis Rusbyana* (Niedenzu) Morton were obtained from Mr. Homer Pinkley, Botanical Museum of Harvard University. Voucher herbarium specimens are to be found under numbers 449 and 310, respectively.

Isolation of organic bases, gas chromatography and gas chromatography—mass spectrometry were performed as previously described (8) with the exception that a 5% OV-17 phenylmethylsilicone column (2.25 m x 3.2 mm i.d. glass tube) was used for the gas chromatography.

Results

As seen from the table, the principal compound as described by Poisson is N,N-dimethyltryptamine. Minor components consist of N-methyltryptamine, 5-methoxy-N,N-dimethyltryptamine previously shown to be the main component of South American snuffs (8) and 5-hydroxy-N,N-dimethyltryptamine.

In addition, we found a compound emerging from the GLC column with a retention time between that of N,N-dimethyltryptamine and 5-methoxy-N,N-dimethyltryptamine. When analyzed in the LKB 9000 gas chromatograph—mass spectrometer, this peak proved to have a molecular weight of 186 (M+), *viz.* two mass units less than N,N-dimethyltryptamine. This alkaloid, after isolation by means of a stream splitter, pos-

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sessed a UV spectrum compatible with an indole, but gave a negative Ehrlich's reaction indicating that the unknown, if an indole, was substituted in the 2-position. The prominent peaks of the mass spectrum were m/e 143 (base peak) and m/e 128. The loss from the parent-ion are 43 and 58 mass units respectively. If a structure such as in Fig. 2 is assumed, it can be readily reconciled with the mass spectrometric data. The proposed mechanism would involve a *retro*-Diels-Alder fragmentation with expulsion of 43 mass units to a fragment m/e 143 with the ability to rearrange loosing one methyl group and yielding a fragment m/e 128. Accordingly, this compound was synthesized from N-methyltryptamine by a Pictet-Spengler reaction and found to be identical in all respects with the naturally occurring compound. Nβ-Methyltetrahydro-β-carboline has once previously been isolated from *Arthrophytum leptocladum* M.Pop. (9).

One component emerging between Nβ-methyltetrahydro-β-carboline and 5-methoxydimethyltryptamine (Fig. 1) still has to be identified. This compound, non-indolic in nature, has a molecular weight of 220 (M+) and other peaks at m/e 58 (base peak) and m/e 72. The work on its identification is in progress.

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TABLE 1.

Part of plant	*Alkaloids mg per 100 g dry plant material*	*Alkaloids*	*Per cent*
Leaves	475	N,N-Dimethyltryptamine	98
		N-Methyltryptamine	
		5-Methoxy-N,N-dimethyltryptamine	
		5-Hydroxy-N,N-dimethyltryptamine	
		Nβ-Methyltetrahydro-β-carboline	
Stem	177	N,N-Dimethyltryptamine	94
		5-Methoxy-N,N-dimethyltryptamine	2
		Nβ-Methyltetrahydro-β-carboline	2

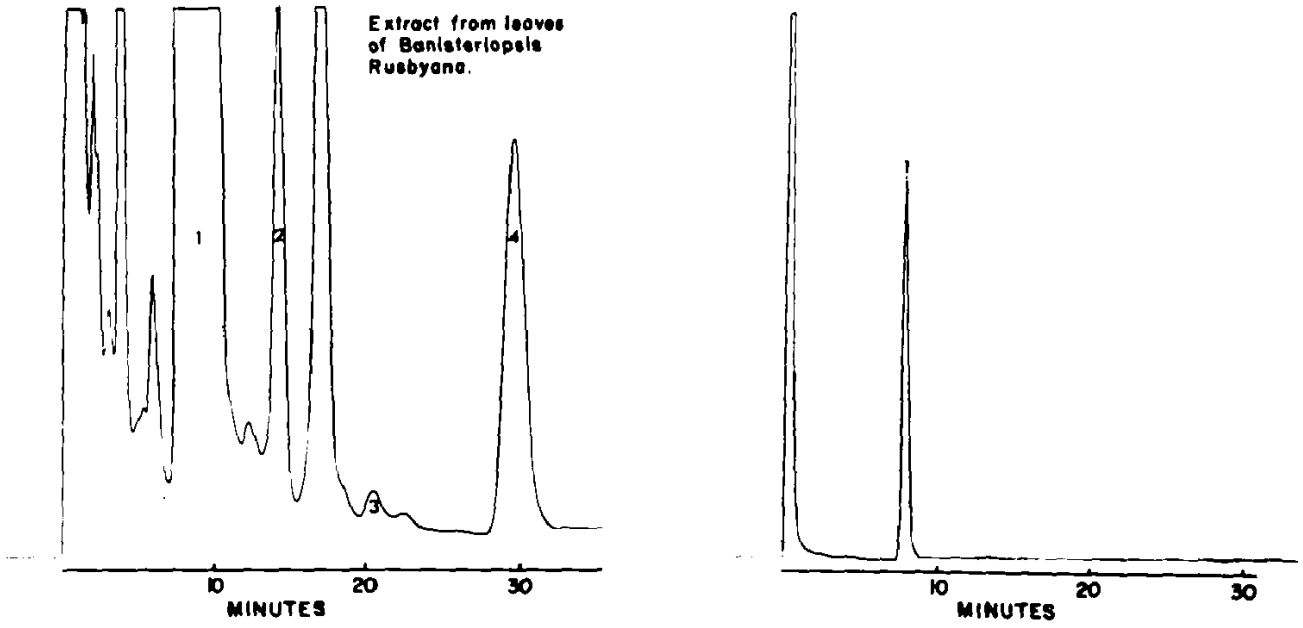

FIGURE 1.

GAS CHROMATOGRAM OF ALKALOID FRACTION FROM LEAVES OF BANISTERIOPSIS RUSBYANA.

GLC conditions: Column 2.25 m; i.d. 3.2 mm; 5% OV-17 on 100-120 mesh Gas Chrom P; temp. 195°; flow 60 ml per min. Left panel high magnification. Right panel low magnification. Peak 1 = mixture of N,N-dimethyltryptamine and N-methyltryptamine, peak 2 = Nβ-methyltetrahydro-β-carboline, peak 3 = 5-methoxydimethyltryptamine and peak 4 = 5-hydroxydimethyltryptamine (bufotenine).

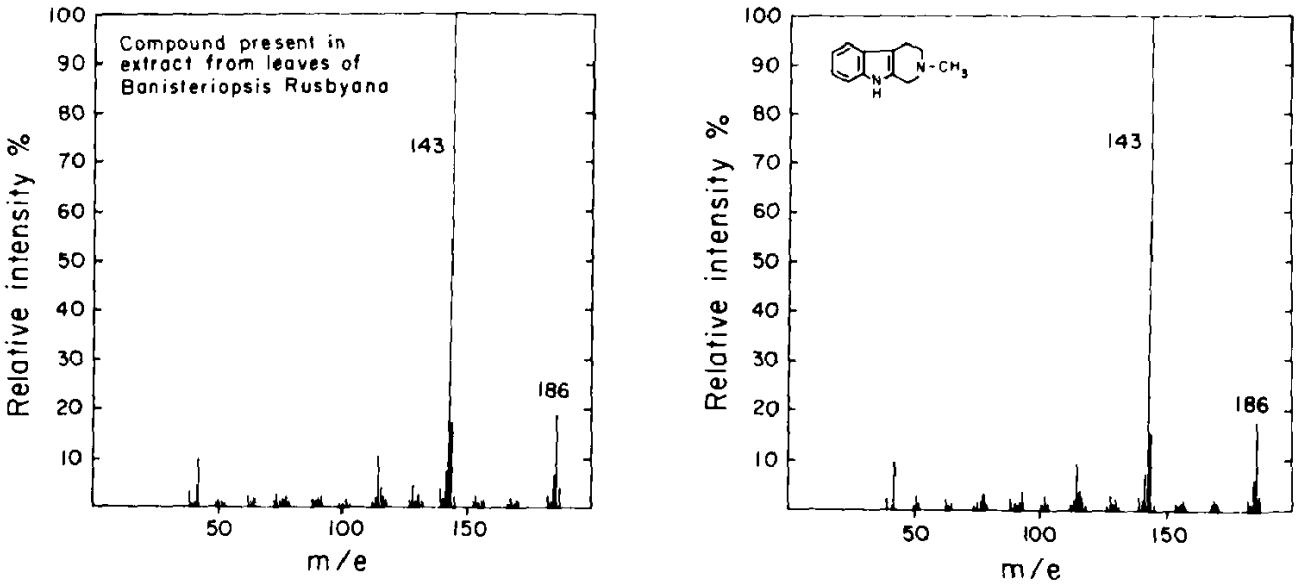

FIGURE 2.

MASS SPECTROMETRIC RECORDING OF COMPOUND IN EFFLUENT FROM PEAK 2 FROM ALKALOID FRACTION (FIG. 1) AND REFERENCE COMPOUND.

Conditions: Column 2 m; i.d. 3.2 mm; 3% PDEAS on 100-120 mesh Gas Chrom P; temp. 190°.

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