

N,N-DIMETHYL-5-METHOXYTRYPTAMINE, A COMPONENT OF A DART POISON OF THE YANOÁMA INDIANS

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Until 1965, three types of curare were known: tubo-curare, calabash-curare, and pot-curare of the Boehm's classification (1). These curares had been classified ethnologically on the basis of the containers wherein they were kept, and this roughly corresponds to different compositions. In effect, tubo-curares are made mainly from Menispermaceae and thus contain bisbenzylisoquinoline alkaloids; calabash-curares have as main ingredients *Strychnos* (Loganiaceae) *i.e.*, bisindole alkaloids; and pot-curares, prepared from Menispermaceae plus *Strychnos*, contain both groups of alkaloids.

Biocca *et al.* (2) described a fourth type, the so-called "percolation" or "dart-tip curare," which is not stored in particular containers, being used directly for the preparation of dart points. Therein, two types of active ingredients have been identified so far, *i.e.*, bisindoline alkaloids in the darts of Yanoáma tribes of Upper Orinoco (2) and bisbenzylisoquinoline alkaloids for the darts (pei-namô) collected in the area of S. Maria de los Guaiacas (3).

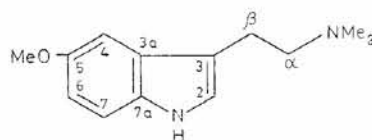
The same bisbenzylisoquinoline alkaloids (whose sole monoquaternary component was macoline) had been isolated from *Abuta grisebachii* Triana and Planchon (Menispermaceae) (4), which is the unique ingredient for the "macoli" curare of the Sanama Indians.

An ethnological study by Bauer (5) on the distribution of curare in Amazonas, mainly based on the examination of sam-

ples present in European museums, confirms the existence of this type of curare (dart-tip curare) in all the vast area from Upper Rio Negro to Upper Orinoco between the border of Brazil and Venezuela (region of Roraima and Guyana). The composition of the curares is, naturally, related to the plants available for their preparation.

The poison of dart points, prepared by Yanoáma of the Roraima territory and purchased through Ministerio do Interior, Fundação Nacional do Índio (FUNAI) Brazil was studied in the current report. The poison did not contain any curarizing alkaloid, but contained a single basic substance, rather abundant (8%, *ca.* 12 mg/dart), which was identified as *O*-methylbufotenine (**1**, *N,N*-dimethyl-5-methoxytryptamine). The alkaloid fraction was isolated as a picrate and transformed into the hydrochloride which, after chromatography, crystallized from methanol and ethyl acetate (mp, 145-146°). The base, purified by counter-current distribution (ccd), was confirmed through direct comparison with an authentic specimen, isolated by one of us (6).

The presence of bufotenine in epenà, a



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snuff drug prepared by the Yanoáma from *Virola* sp. bark (Myristicaceae), has been previously reported (7). Agurell et al. also described the presence of *O*-methylbufotenine in *Virola* bark (8), and in 1975, the bark of *Virola calophylla* Warb. yielded 5-methoxytryptamine as the main alkaloid (6).

The present finding confirms, chemically, the use of *Virola* extracts or resin in the preparation of dart poisons as reported the first time by Biocca (9), and later by Schultes and Holmstedt (10), who witnessed the preparation of poisoned darts from *Virola*. The use of this plant for hunting purposes can be explained by the fact that *N,N*-dimethyl-5-methoxytryptamine displays much higher behavioral disturbances than other indolealkylamines (dose level = 0.05 mM/kg (11)). This property, better than the toxicity, which is comparatively low [LD_{50} = 0.5 mM/kg (12)] accounts for the catch of the prey.

This indicates a particular hunting procedure worthy of adequate ethnographic investigation.

EXPERIMENTAL

GENERAL EXPERIMENTAL PROCEDURES.—

^1H and ^{13}C nmr spectra were registered with a Varian XL 100 spectrometer (TMS as standard), and a Craig Post apparatus (200 stages, 10:10 ml upper and lower phase) was used for ccd. Tlc analysis was carried out on cellulose F_{254} (solvent *n*-butanol-acetic acid-water 4:1:5, upper phase).

MATERIALS.—Twenty darts (12 in.), half-covered with a black varnish and enclosed in a quiver (n. 31840), were purchased through the Ministerio do Interior, Fundação Nacional do Índio (FUNAI), in Rio de Janeiro (Brazil).

EXTRACTION AND ISOLATION.—The darts were soaked overnight in a methanol-water mixture (3:1) to dissolve the black resin. The residue (3.1 g) was partially dissolved in water (100 ml) (the insoluble material was eliminated); the pH was adjusted to 2 with 2 *N* HCl, and the alkaloid fraction was precipitated with a saturated aqueous solution of picric acid. The picrates were transformed into chlorides by anion exchange on Amberlite IRA 400 Cl^- . The fraction of alkaloid chlorides, essentially consisting of a single substance (tlc), was purified by column chromatography (cellulose powder, methyl ethyl ketone

saturated with water + 1% methanol) to give 290 mg of crystalline *N,N*-dimethyl-5-methoxytryptamine hydrochloride (**1**, hydrochloride): mp, 145–146° (from methanol and ethyl acetate); ^1H -nmr (D_2O), δ : 2.90 (s, NMe_2), 3.12 (A_2B_2 system, $\text{CH}_2\text{-CH}_2$), 3.96 (s, OMe), 6.93 (dd, J = 2 and 8 Hz, H-6), 7.14 (d, J = 2 Hz, H-4), 7.25 (s, H-2), 7.46 (d, J = 8 Hz, H-7); ^{13}C -nmr (D_2O), δ : 20.8 $\text{CH}_2\beta$, 43.3 NMe_2 , 56.9 OMe, 58.1 $\text{CH}_2\alpha$, 101.3 C(4), 108.9 C(3), 112.2 C(6), 113.4 C(7), 125.3 C(2), 127.5 C(3a), 132.3 C(7a), 153.5 C(5). ^{13}C -nmr data of the same hydrochloride in $(\text{CD}_3)_2\text{SO}$ and trifluoroacetic acid has been reported recently (13). Hydrochloride (**1**) was submitted to ccd between chloroform and aqueous buffer at pH 6. The base obtained (K_b , $K_b = 4 \times 10^{-8}$) after alkalization with sodium hydrogen carbonate and extraction with chloroform, mp, 67–68° (*n*-hexane), was indistinguishable from an authentic specimen of *N,N*-dimethyl-5-methoxytryptamine.

LITERATURE CITED

1. R. Boehm, *Arch. Pharm.*, **235**, 660 (1896).
2. E. Biocca, D. Bovet, C. Galeffi, and G.B. Marini Bettolo, *Atti Accad. Naz. Lincei. Rend. Cl. Sci. Fis. Mat. Nat.*, **38**, 34 (1965).
3. C. Galeffi, P. Scarpetti, and G.B. Marini Bettolo, *Farmaco, Ed. Sci.*, **32**, 665 (1977).
4. C. Galeffi, P. Scarpetti, and G.B. Marini Bettolo, *Il Farmaco, Ed. Sci.*, **32**, 853 (1977).
5. W.P. Bauer, *Baessler Archiv Neue Folge*, **13**, 207 (1965).
6. D. Grossa, F. Delle Monache, F. Ferrari, and G.B. Marini Bettolo, *Atti Accad. Naz. Lincei. Rend. Cl. Sci. Fis. Mat. Nat.*, **58**, 605 (1975).
7. G.B. Marini Bettolo, E. Biocca, C. Galeffi, F. Delle Monache, and E.G. Montalvo, *Ann. Ist. Super. Sanità*, **1**, 784 (1965).
8. S.B. Agurell, B. Holmstedt, J.E. Lindgreen, and R.E. Schultes, *Biochem. Pharmacol.*, **17**, 2487 (1968).
9. E. Biocca, "Viaggi tra gli Indi," Vol. 2, C.N.R., Roma, 1966, p 173.
10. R.E. Schultes and B. Holmstedt, *Lloydia*, **34**, 61 (1971).
11. P.K. Gessner, W.M. McIsaac, and I.H. Page, *Nature*, **190**, 179 (1961).
12. B.T. Ho, W.M. McIsaac, R. An, R.T. Harris, K.E. Walker, P.M. Kralik, and M.M. Airaksinen, *Psychopharmacologia*, **16**, 385 (1970).
13. L. Ernst and S. Kang, *J. Chem. Res.*, **S**, 259 (1981).

Received 16 August 1982