CACTUS ALKALOIDS. XLVI. 3-METHOXYTYRAMINE AND LEMAIREOCEREINE FROM *BACKEBERGIA MILITARIS*

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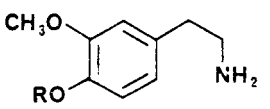
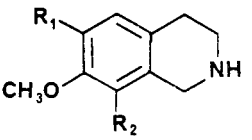
Screening extracts of the Mexican cereoid cactus, *Backebergia militaris* (Andot) Bravo ex Sanchez Mejorada, by mass-analyzed ion kinetic energy spectrometry (MIKES), showed the presence of alkaloids of $(M+H)^+$ 194 and 208; alkaloids of molecular weight less than 193 were not sought in the MIKES screen (1). In a subsequent isolation study, 3,4-dimethoxy-β-phenethylamine, (**1**) (m. wt. 181), and heliamine, (**2**) (6,7-dimethoxy-1,2,3,4-tetrahydroisoquinoline) (m. wt. 193), were crystallized in respective yields of 0.025% and 0.75% from the plant material (2).

In a closer screening of extracts of this species with analytical thin layer chromatography (tlc) (3), an additional secondary amine, **3**, was detected in small quantity in the alkaloid extracts. Column adsorption chromatography successfully resolved **3** from **1** and **2**. Comparisons with reference cactus alkaloids identified the crystalline hydrochloride of **3** as that of lemaireocereine (7,8-dimethoxy-1,2,3,4-tetrahydroisoquinoline), an aromatic substitution isomer of **2** at m.wt. 193. Thus, the MIKES screen had detected not one but two alkaloids at $(M+H)^+$ 194. Though the MIKES technique is useful in identifying methyl isomers at the 1 vs. 2 positions of the cactus tetrahydroisoquinolines, the MIKE-spectra cannot differentiate between substitution isomers on the aromatic rings (1).

In addition, 3-methoxytyramine, (**4**) (m. wt. 167), has been crystallized as the hydrochloride from the phenolic alkaloid fraction. Cyclizations of primary β-phenethylamines, such as **1** and **4**, at positions 2 and 6 to form lemaireocereine and heliamine, respectively, are likely part of the biogenesis of these two isomeric cactus tetrahydroisoquinolines. Sufficient plant material for the isolation of the trace alkaloids at $(M+H)^+$ 208 was not available; however, these most probably comprise a mixture of the 2-methyl derivatives of **2** and **3**.





1: $R = CH_3$ **2**: $R_1 = CH_3O$, $R_2 = H$

4: $R = H$ **3**: $R_1 = H$, $R_2 = CH_3O$

EXPERIMENTAL[1]

PLANT MATERIAL.—Cuttings of fresh *B. militaris* were obtained from Dr. Arthur C. Gibson, Department of Ecology and Evolutionary Biology, University of Arizona, Tucson, Arizona 85721. The sample was collected June 25, 1978, 10 km west of Apatzingan on Highway 120, state of Michoacán, Mexico, from plants approximately 8 m in height. A voucher specimen is filed at the University of Arizona Herbarium: Gibson 3433 (ARIZ). The plants conformed to published descriptions of the species (5) and were sliced, frozen, freeze-dried, and reduced to a powder through a 2 mm screen in a Wiley mill.

ISOLATION OF CRUDE ALKALOID FRACTIONS.—Powdered plant material (100 g) was moistened with chloroform-methanol-ammonium hydroxide (2:2:1) and then extracted by repeated macerations with chloroform. The chloroform residue was processed as previously described to yield fractions A (alkaloids), B (nonalkaloidal materials), and C (water soluble alkaloids) (6). Fraction A was dissolved in ethanol and resolved into phenolic and nonphenolic fractions with 60 g of Amberlite IRA-401S in the hydroxide form (7).

ISOLATION AND IDENTIFICATION OF LEMAIREOCEREINE HYDROCHLORIDE (**3**).—Upon concentration the nonphenolic alkaloid fraction yielded 3.4 g. A portion (1.0 g) was dissolved in absolute ethanol and acidified with 5% hydrochloric acid in ethanol. Upon addition of ethyl ether, 300 mg of heliamine hydrochloride (**2**) was obtained. The mother liquor was evaporated to dryness (0.6 g) and was separated by column adsorption chromatography (88 g of silica gel, particle size 0.063–0.22 mm, E. Merck); chloroform-methanol-ammonium hydroxide (100:5:0.5) was the mobile phase. A total of 48 fractions of 60 ml each were obtained. Analytical tlc in solvent system A (8) demonstrated that fractions 18–21 contained lemaireocereine (**3**), and fractions 25–36 contained heliamine (**2**).

The residue from fractions 18–21 yielded 10 mg (0.034% yield) of **3** hydrochloride crystallized from ethanol-ethyl ether. Analytical tlc in solvent systems A, C, E, F, and G (3, 8) identified **3** as lemaireocereine hydrochloride:mp, mmp, 190° (lit. mp 180–185°) (4), ir and eims essentially identical to authentic lemaireocereine hydrochloride.

ISOLATION AND IDENTIFICATION OF 3-METHOXYTYRAMINE HYDROCHLORIDE (**4**).—Analytical tlc demonstrated that the phenolic alkaloid fraction (0.2 g) contained one major primary amine alkaloid (3). Crystallization of the hydrochloride from ethanol-ethyl ether yielded 20 mg (0.020% yield) of **4** hydrochloride. Analytical tlc in solvent systems A, C, E, F, and G (3, 8) identified **4** as 3-methoxytyramine hydrochloride:mp, mmp, 209–212° (lit. mp 202–206°) (9), ir and eims essentially identical to 3-methoxytyramine hydrochloride.

[1]Melting points were determined with a Mel-Temp apparatus and are uncorrected. KBr pellets were used in a Beckman IR-33 spectrophotometer to obtain ir spectra. Electron impact mass spectra (eims) were produced on a Hitachi RMU-6 spectrometer. Reference 3-methoxytyramine hydrochloride was purchased from Calbiochem, and reference lemaireocereine hydrochloride was isolated from *Pachycereus weberi* (4).

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