ALKALOIDS OF THE EPIGEAL PART OF *Aconitum karakolicum*. THE STRUCTURE OF 12-EPINAPELLINE

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A new alkaloid has been isolated from the eipgeal part of the *Aconitum karakolicum* Rapaics. and has been called 12-epinapelline. The structure of the new alkaloid has been shown by the preparation of a diacetate and an iso derivative and also by the direct passage from songorine to 12-epinapelline and a study of their spectral characteristics.

We have continued the separation of the combined alkaloids to the epigeal of the *Aconitum karakolicum* Rapaics., collected in the valley of the R. Irisu (KirghizSFR), and, in addition to the alkaloids described previously [1], we have isolated a base with the composition $C_{22}H_{33}NO_3$ (I). The IR spectrum of this alkaloid contained adsorption bands of hydroxy groups at 3200-3500 cm^{-1}.

According to its PMR spectrum the base contained a tertiary C-methyl group, a N-ethyl group, and a terminal methylene group. The mass spectrum of the alkaloid showed that it belonged to the songorine group [2] and was close to the spectrum of napelline [3]. (In [3], an error has crept into the illustration of the formula of napelline. The hydroxy group at C-12 in napelline has the α-configuration.) When (I) was acetylated with acetic anhydride in the presence of pyridine, a triacetyl derivative (II) was obtained, which showed the presence of three secondary hydroxy groups. Consequently, the alkaloid (I) has the same composition and developed formula as napelline (III), but a direct comparison showed that they were not identical.

The mass spectrum of (I) had the peak of an ion $M^+ - 17$, arising through the splitting out of a hydroxy radical from C-1 [2, 3]. In the spectrum of the triacetate (II), the peak of the $M^+ - 59$ ion due to the elimination of an acetoxy radical from C-1 had become the maximum peak just as in the case of songorine diacetate [2] and napelline triacetate [3], which confirmed the presence of a hydroxy group at C-1 in the base. The PMR spectrum of the triacetate (II) had a one-proton quartet at 4.45 ppm (J_1 = 7 Hz; J_2 = 10 Hz), which is characteristic for a proton geminal to an α-oriented acetoxy group at C-1 and is formed by the interaction of the C-1 β-proton with the protons of the methylene groups at C-2 [3]. The presence of this signal showed the α-orientation of the hydroxy group at C-1.

When the alkaloid was heated in a solution of perchloric acid, the iso derivative (IV) was obtained, in the IR spectrum of which there was an absorption band of a carbonyl group in a five-membered ring at 1730 cm^{-1}. The formation of the iso derivative indicated that there was a terminal methylene group at C-16 in the alkaloid and a hydroxy group at C-15 in the same configuration as in napelline [3].

The closeness of the spectral characteristics and chemical properties permitted the assumption that base (I) and napelline were diastereomers at the C-12 hydroxy group. When songorine (V) was reduced with sodium tetrahydroborate in methanol, two products were formed. They were separated on a column of alumina and one of them was found to be identical with napelline and the other with the alkaloid (I) according to a mixed melting point and a comparison of TLC and spectral characteristics (see following page).

Previously, [4, 5], napelline was regarded as an isomer of liciculine — the amino alcohol of the alkoloid luciduscuIine (VI), the structure and absolute configuration of which have been shown by x-ray structural analysis [6, 7]. Later, the reduction of luciduscuIine with lithium tetrahydroaluminate gave napelline [8], which ambiguously showed the identity of napelline and licicuIine.

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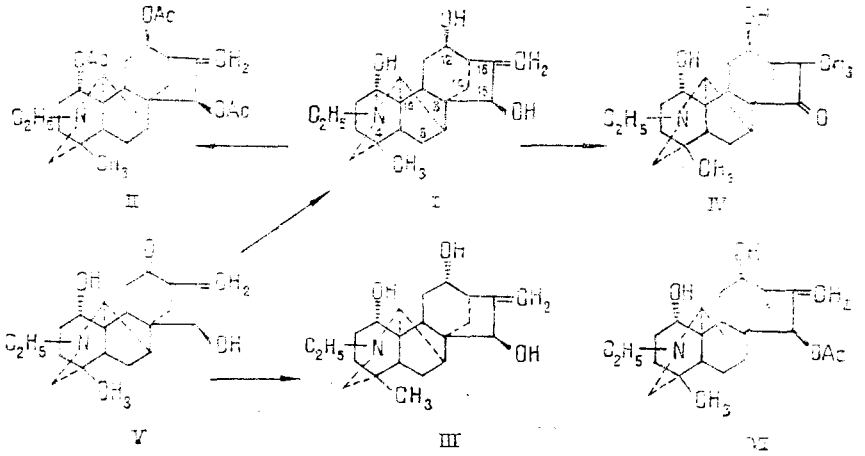

Consequently, the alkaloid that we have isolated is the β-isomer of napelline with respect to the hydroxy group at C-12 and has the structure (I).

EXPERIMENTAL

Melting points are not corrected. Mass spectra were recorded on MKh-1303 and MKh-1310 instruments fitted with systems for direct introduction into the ion source, PMR spectra on a JNM-4-100/100 MHz instrument in deuterochloroform with HMDS as internal standard (the values are given on the δ scale), and IR spectra on a UR-20 spectrophotometer in tablets with KBr. Type KSK silica gel and alumina (Brockmann activity grade II, neutral) were used for chromatography.

Isolation of 12-Epinapelline. Fraction 18 from the separation of the combined alkaloids of *Aconitum karakolicum* according to their basicities [1] was treated with acetone, and 5.6 g of a crystalline mixture was separated off. The mother liquod (3.2 g) was chromatographed on a column of alumina (ratio of sorbent to substance 100:1). Elution was begun with chloroform fractions 17-26 yielded 1.3 g of napelline, while elution with chloroform–methanol (100:1) gave 0.11 g of 12-epinapelline.

12-Epinapelline-I. $C_{22}H_{33}NO_3$ (HRMS), mp 118-121°C (chloroform). IR spectrum, cm^{-1}: 3200-3500 (OH group). PMR spectrum, ppm: 0.71 (3 H, singlet); 1.04 (3 H, triplet); 5.10 (2 H, broadened singlet). Mass spectrum m/z, %: M^+ 359 (100); $M^+ - 17$ (6); 342 (16); 300 (21).

12-Epinapelline Triacetate (II). A solution of 0.06 g of 12-epinapelline in 3 ml of acetic anhydride was treated with one drop of pyridine and the mixture was kept at room temperature for 24 h. The excess of acetic anhydride was eliminated, the residue was dissolved in water, and the solution was made alkaline with sodium carbonate and was extracted with ether. The extract was dried over sodium sulfate and was evaporated. On treatment with ether, 0.006 g of crystals was obtained with mp 168-170°C. M^+ 485; $M^+ - 59$ (100%). PMR spectrum, cm^{-1}: 0.68 (3 H, singlet); 1.01 (3 H, singlet); 1.99 (3 H, singlet); 2.06 (3 H, singlet); 4.45 (1 H, quartet, $J_1 = 7$ Hz; $J_2 = 10$ Hz). IR spectrum, cm^{-1}: 1730 (ester carbonyl).

Iso-12-Epinapelline (IV). A solution of 0.05 g of 12-epinapelline in 20 ml of methanol was treated with 0.5 ml of perchloric acid and the mixture was boiled for 6 h. The methanol was evaporated off, the residue was dissolved in water, and the solution was made alkaline with sodium carbonate and was extracted with ether. The extract was dried over sodium sulfate and evaporated. The product was chromatographed on a column of alumina. On elution with ether, fractions 1-3 gave 0.005 g of iso-12-epinapelline. M^+ 359. IR Spectrum, cm^{-1}: 1730 (carbonyl in a five-membered ring).

Reduction of Songorine with Sodium Tetrahydroborate. In portions, 0.3 g of sodium tetrahydroborate was added to a solution of 0.5 g of songorine in 30 ml of methanol. The reaction was carried on for 4 h with the reaction mixture being heated to 50°C from time to time. Then the solvent was driven off completely and the residue was dissolved in water and extracted with chloroform. After evaporation and the elimination of the solvent, the products were separated on a column of alumina. On elution with chloroform, fractions 11-19 gave 0.12 g of of 12-epinapelline.

SUMMARY

A new alkaloid has been isolated from the epigeal part of the *Aconitum karakolicum* Rapaics. and has been called 12-epinapelline.

A structure for 12-epinapelline has been suggested on the basis of the results of a study of spectral characteristics and chemical transformations.

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FEATURES OF THE MASS SPECTRA OF LYCOCTONINE BASES WITH 7,8-METHYLENEDIOXY GROUPS

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The mass-spectral properties of 21 lycoctonine bases with 1-methoxy-7,8-methylenedioxy groups have been studied and generalized. An influence of a methylenedioxy group of the nature of the substituents at C-6 and C-10, and of a $\Delta^{10(12)}$ bond on the fragmentation of the alkaloids and their derivatives has been found.

Fragmentation mass spectrometry plays an important role in structural investigations of diterpene alkaloids [1-4] and bases with 7,8-methylenedioxy groups (7,8-MDOGs) [5]. No generalization had been made of the mass-spectrometric properties of these compounds. Here we consider the spectra of 21 compounds of this series including natural bases and their derivatives and OCD_3 analogs. Our aim was to improve methods of recognizing representatives of the various subgroups of these alkaloids, to establish the main and auxiliary pathways of their fragmentation according to the nature and positions of the substituents, and also to compare them with other groups of lycoctonine bases.

All the substances studied can be divided into two groups. In the spectra of the first group, as for other lycoctonine bases, the 100% peaks are those of ions formed by the splitting out from the M^+ ion of a OCH group from the C-1 position. The second group includes all the $\Delta^{10(12)}$ compounds, for which the above-mentioned spectral feature is uncharacteristic.

We represented the distribution of the intensities of the peaks of the ions in all the spectra in the form of a table of contributions of ions to the total ion current in the range from M^+ to $(M - 130)^+$.

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