The Aconite Alkaloids. XXXII[1]. *On Lucidusculine. Part II*[2]

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In the previous report[2] the extended formula of lucidusculine (I) has been proposed as follows:

$$C_{18}H_{23}\begin{cases}(OH)_2\\OCOCH_3\\>N-C_2H_5\\>C=CH_2\end{cases}$$

Some new derivatives of lucidusculine are described in the present paper.

Catalytic hydrogenation[3] of I with platinum oxide in glacial acetic acid yielded dihydrolucidusculine(II), $C_{24}H_{37}O_4N$, m. p. 192~198°C, $[\alpha]_D^{18}$ −58.6°. On acetylation with acetic anhydride in pyridine, II gave dihydrolucidusculine diacetate(III), $C_{28}H_{41}O_6N$, m. p. 140~144°C, $[\alpha]_D^{18}$ −55.5°.

The infrared absorption spectrum of compound I gave two peaks at 6.06 and 11.26 μ and that of lucidusculine diacetate (IV)[4,5], $C_{28}H_{39}O_6N$, gave peaks at 6.08 and 11.32 μ due to presence of a terminal methylene group. Compounds II and III, on the other hand, showed no peak near the above-mentioned wavelengths. Therefore, it seems very probable that the hydrogenation of compound I proceeds as:

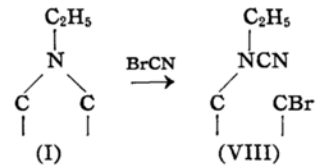
$$>C=CH_2 \xrightarrow{2H} >\overset{*}{C}H-CH_3$$

On account of a newly formed asymmetric carbon atom (asterisked) the formation of an epimer of compound II might be suspected[6].

Luciculine(V), $C_{22}H_{33}O_3N\cdot H_2O$, obtained from compound I upon hydrolysis with alcoholic potassium hydroxide[5], also showed two peaks in the infrared spectrum at 6.09 and 11.27 μ characteristic of a terminal methylene group.

Hofmann degradation of luciculine methiodide(VI) yielded a basic substance, named isomesoluciculine[7](VII), $C_{21}H_{31}O_3N\cdot H_2O$, m. p. 123~127°C (decomp.), $[\alpha]_D^{19}$ −17.0°. Compound VII showed peaks in the infrared spectrum at 6.08 and 11.28 μ characteristic of a terminal methylene group.

On treatment of compound I with cyanogen bromide, two reaction products were obtained. One of them was easily isolated because of its high solubility in water; it was named bromolucidusculine cyanamide (VIII), $C_{24}H_{35}O_4N(CN)Br\cdot 2H_2O$, m. p. 157~162°C (decomp.), $[\alpha]_D^{17}$ −76.0°, in which cleavage of the N-containing ring was noticed. It showed a peak in the infrared spectrum at 4.74 μ due to presence of a cyano group. The other was easily soluble in acetone but found to crystallize with difficulty. This cyanogen bromide degradation may proceed as follows:



(I) (VIII)

The ultraviolet absorption spectra of all these compounds showed only end absorptions and are reminiscent of those of aconite alkaloids, i.e., atisine, dihydroatisine, aconine, delphonine[8] and lycoctonine[9].

Experimental

Lucidusculine (I).—The ultraviolet absorption spectrum of this compound in methanol showed end absorption and no maximum. The infrared absorption spectrum in Nujol showed the presence of hydroxyl groups (2.95 μ), an acetoxyl group (5.82 and 8.10 μ) and a terminal methylene group (6.06 and 11.26 μ).

Dihydrolucidusculine (II).—Lucidusculine (1 g.)

1) This constitutes a part of a series entitled "The Aconite Alkaloids" by H. Suginome. Part XXXI: T. Shima and T. Amiya, This Bulletin, **31**, 657 (1958).

2) Part I: H. Suginome, T. Amiya and T. Shima, ibid., **32**, 824 (1959).

3) Cf. H. Suginome and F. Shimanouchi, *Ann.*, **545**, 220 (1940), Foot Note 4).

4) H. Suginome, S. Kakimoto and J. Sonoda, *J. Fac. Sci., Hokkaido Univ., Ser. III. Chem.*, **4**, 25 (1950).

5) R. Majima and S. Morio, *Ber.*, **65**, 599 (1932).

6) This point will be mentioned later.

7) By the same treatment, H. Suginome and S. Umezawa obtained mesoluciculine, $C_{21}H_{31}O_3N\cdot H_2O$, m.p. 199~200°C with sintering point 114°C, $[\alpha]_D^{15}$ −12.8°, H. Suginome and S. Umezawa, *J. Fac. Sci., Hokkaido Univ., Ser. III. Chem.*, **4**, 44 (1950). The relation between mesoluciculine and isomesoluciculine seems to be that of polymorphism.

8) L. C. Craig, L. Michaelis, S. Granick and W. A. Jacobs, *J. Biol. Chem.*, **154**, 293 (1944).

9) O. E. Edwards and Léo Marion, *Canad. J. Chem.*, **30**, 627 (1952).

was dissolved in 16 cc. of glacial acetic acid and hydrogenated with 0.5 g. of platinum oxide for six hours. After removal of platinum, the solution was evaporated to dryness. On treatment of the residue with water and then with aqueous ammonia, a precipitate was obtained. On recrystallization from ethyl acetate, crystals were yielded, which melted at 192~198°C. $[\alpha]_D^{18}$ −58.6° (methanol). Yield, 0.5 g. The ultraviolet absorption spectrum of this compound in methanol showed end absorption and no maximum. The infrared absorption spectrum in Nujol showed the presence of hydroxyl groups (2.96 μ) and an acetoxyl group (5.80 and 8.12 μ).

Anal. Found: C, 70.61; H, 9.15. Calcd. for $C_{24}H_{37}O_4N$: C, 71.43; H, 9.24%.

Dihydroluciduscuiline Diacetate (III). — A mixture of dihydroluciduscuiline (0.6 g.), acetic anhydride (1 cc.) and pyridine (4 cc.) was allowed to stand in a sealed tube at room temperature for two days. After removal of the solvents, the residue was dissolved in water and then precipitated with aqueous ammonia. The precipitate was recrystallized from ethanol. Crystals melted at 140~144°C. $[\alpha]_D^{18}$ −55.5° (methanol). Yield was quantitative. The ultraviolet absorption spectrum of this compound in methanol showed end absorption and no maximum. The infrared absorption spectrum in Nujol had no peak attributable to a hydroxyl group but showed the presence of acetoxyl groups (5.82 and 7.95 μ).

Anal. Found: C, 68.45; H, 8.84. Calcd. for $C_{28}H_{41}O_6N$: C, 68.96; H, 8.48%.

Luciduscuiline Diacetate (IV). — A mixture of luciduscuiline (0.6 g.), acetic anhydride (1 cc.) and pyridine (4 cc.) was allowed to stand in a sealed tube at room temperature for two days. After removal of the solvents, the residue was dissolved in water and then precipitated with aqueous ammonia. The precipitate was recrystallized from ethanol. Crystals melted at 159~167°C alone and on admixture with luciduscuiline diacetate prepared according to the direction of Majima and Morio[4,5]. Yield was quantitative. The ultraviolet absorption spectrum of this compound in methanol showed end absorption and no maximum. The infrared absorption spectrum in Nujol showed the presence of acetoxyl groups (5.82 and 8.01 μ) and a terminal methylene group (6.08 and 11.32 μ).

Luciculine (V). — The ultraviolet absorption spectrum of this compound in methanol showed end absorption and no maximum. The infrared absorption spectrum in Nujol showed the presence of hydroxyl groups (2.98 μ) and a terminal methylene group (6.09 and 11.27 μ).

Luciculine Methiodide (VI).—The ultraviolet absorption spectrum of this compound in methanol showed end absorption and no maximum. The infrared absorption spectrum in Nujol had a peak at 2.98 μ attributable to hydroxyl groups and peaks at 6.11 and 11.22 μ attributable to a terminal methylene group.

Isomesoluciculine (VII). — The base was prepared from luciculine methiodide (0.5 g.) by Hofmann degradation. Recrystallization from acetone gave crystals, which melted at 123~127°C (decomp.). $[\alpha]_D^{19}$ −17.0° (methanol). The ultraviolet absorption spectrum of this compound in methanol showed end absorption and no maximum. The infrared spectrum in Nujol showed the presence of hydroxyl groups (2.98 μ) and a terminal methylene group (6.08 and 11.28 μ).

Anal. Found: C, 68.79; H, 9.31; (N)CH_3, 4.52; H_2O, 5.04. Calcd. for $C_{21}H_{31}O_3N \cdot H_2O$: C, 69.39; H, 9.15; (N)$CH_3$, 4.13; H_2O, 4.95%.

Bromoluciduscuiline Cyanamide (VIII). — To cyanogen bromide (0.25 g.) dissolved in 7.5 cc. of benzene, luciduscuiline (0.45 g.) dissolved in benzene (16 cc.) was added. The reaction mixture, which became turbid after 10 min., was allowed to stand at room temperature for 24 hr. and then was filtered. The crystalline precipitate collected by filtration was hygroscopic and then treated with water. The residue, obtained from the water-soluble portion, was crystallized from acetone and melted at 157~162°C (decomp.). $[\alpha]_D^{17}$ −76.0° (methanol). The ultraviolet absorption spectrum of this compound in methanol showed end absorption and no maximum. The infrared absorption spectrum in Nujol showed the presence of hydroxyl groups (2.94 and 3.10 μ), a cyano group (4.74 μ), an acetoxyl group (5.88 and 7.97 μ) and a terminal methylene group (6.06 and 11.23 μ).

Anal. Found: C, 55.92; H, 7.89; N, 4.52; Br, 13.66; (N)C_2H_5, 4.94; H_2O, 5.5. Calcd. for $C_{24}H_{35}O_4N(CN)Br \cdot 2H_2O$; C, 55.23; H, 7.23; N, 5.13; Br, 14.70; (N)C_2H_5, 5.34; H_2O, 6.62%.

The water-insoluble portion did not crystallize from acetone. These portions were nearly equal in amounts.

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