STRUCTURE OF SEVELINE

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From the epigeal part of *Korolkowia sewerzowii* collected in Katrantau have been isolated a base with mp 200-202°C and the new alkaloid seveline the structure and configuration of which has been established on the basis of a study of IR, NMR, and mass spectra and its transformation products as 3α-20β-dihydroxycevanin-6-one.

From the epigeal part of *Korolkowai sewerzowii* by separating the mother liquor from severine and the base with mp 145-147°C [1] we have isolated a base with mp 200-202°C and the new alkaloid seveline with mp 267-269°C, $[\alpha]_D$ −48.8°, $C_{27}H_{43}NO_3$ (I).

Seveline is a tertiary base, and its IR spectrum has absorption bands at (cm^{-1}) 3470-3340 (OH), 2970-2860 ($-CH_3$; $-CH_2-$), 2750 (trans-quinolizidine), and 1690 (C=O). The UV spectrum of (I) [λ_{max} 290 nm (log ε 2.31)] is similar to that of imperialine [2]. The mass spectrum of seveline shows the peaks of ions with m/e 98, 111, 112 (100%), 124, 125, 138, 140, 149, 150, 166, 178, 180, 223, 234, 235, 260, 271, 290, (M − 71), (M − 56), (M − 33), (M − 29), (M − 18), (M − 17), (M − 15), 429 M^+, which are characteristic for the imperialine C-nor-D-homosteroid alkaloids [2-4]. With acetic anhydride in pyridine, seveline formed monoacetylseveline (II). The IR spectrum of (II) showed absorption bands at (cm^{-1}) 3400 (OH), 1740, 1245 (ester C=O), and 1710 (C=O).

The oxidation of seveline with chromium trioxide formed the ketone sevelinone, $C_{27}H_{41}NO_3$ (III). The UV spectrum of the ketone [λ_{max}, nm: 250, 300 (log ε 2.64, 2.15)] is characteristic for diketones. The reduction of seveline with sodium tetrahydroborate led to dihydroseveline (IV). The IR spectrum of (IV) lacked the absorption band of a carbonyl group. Diacetyldihydroseveline (V) was obtained. When (II) and (V) were saponified with alcoholic alkali, the starting materials were reformed.

Details of the NMR spectra of (I-V) are given below [s) singlet; d) doublet; m) multiplet]:

Substance	Chemical shifts (δ, ppm)				
	19-CH_3, s	*21*-CH_3, s	*27*-CH_3, d	$OCOCH_3$, s	H. $\underline{CH}$-$OCOCH_3$. m
I	0,71	0,88	0,85		
II	0,72	0,87	0.84	1,98	5,09
III	0,92	0,86	0,83		
IV	0,95	0,87	0,84		
V	1,00	0,86	0.83	1,98; 1,96	5,05; 4,89

Thus, seveline is based on a cevanine skeleton containing one secondary and one tertiary hydroxy group and a carbonyl group [4, 5].

It can be seen from the NMR spectra of (I-V) that with a change in the substituents in the seveline molecule the CSs of the 19-CH_3 protons change, but no appreciable changes can be seen in the CSs of the 21-CH_3 and 27-CH_3 protons. Consequently, in seveline the secondary hydroxyl and the carbonyl group can be present only in rings A, B, and C [6, 7].

The downfield shifts of the resonance signal of the 19-CH_3 group in the NMR spectra of acetylseveline (II) and sevelinone (III) by 1 and 21 Hz, respectively, as compared with the 10-CH_3 signal in seveline show that the secondary hydroxyl is in the C_3 position. This is confirmed by the presence of a multiplet at 5.09 ppm from the C-3β H atom in the NMR spectrum of acetylseveline [8, 9]. Consequently, the OH group at C_3 has the α-axial orientation.

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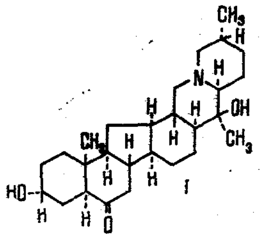
When the CSs of the protons of the C-19 methyl groups of dihydroseveline and of edpetisidine and korseveline [10, 11] are compared, it is possible to suggest for the newly appearing hydroxy group a location at C_6 and the β-orientation, which is shown by the presence in the NMR spectrum of diacetyldihydroseveline of a multiplet at 4.88 ppm from the 6αH atom [6]. Consequently, in seveline the carbonyl group is located at C_6. This is also confirmed by the downfield shift of the 19-CH_3 resonance signal in the NMR spectrum of (IV) by 24 Hz as compared with the 19-CH_3 signal in (I) [7, 11].

Under the conditions of mass spectrometry, seveline and the products of its transformation undergo a fragmentation that is characteristic for imperialine, and in the NMR spectra of (I-V) the CSs of the protons of the 21-CH_3 group appear in the form of a singlet, showing that the tertiary hydroxy group is located at C_{20}, as in imperialine [3].

To judge from the CSs of the protons of the secondary and tertiary methyl groups in seveline, rings A/B are linked with the trans-quinolizidine part of the molecule in the same way as in korseverilіne and edpetisinine, and the 21-CH_3 and 27-CH_3 groups are oriented equatorially in the α position [10-12] while the hydroxyl at C_{20} has the β-axial orientation as in imperialine [3, 6]. According to these facts, seveline has the most probable structure and configuration of 3α,20β-dihydroxycevanin-6-one (I).



I

EXPERIMENTAL

The IR spectra (KBr) were taken on a UR-20 spectrometer, the NMR spectra on a JNM-4H-100/100 MHz instrument (substances (I-V) were taken in $CDCl_3$ + CD_3OD (1:1)) with MHDS as internal standard (the figures are given in the δ scale), and the mass spectra were recorded on an MKh-1303 instrument fitted with a glass system for direct introduction into the ion source. Thin-layer chromatography was performed on Al_2O_3 in the chloroform—methanol (10:0.5) system with the Dragendorff reagent to reveal the spots.

Isolation of Seveline. The mother liquors from seveline and from the base with mp 145-147°C [1] were combined (0.62 g) and were rechromatographed on a column of silica gel with elution by chloroform. This gave a base with mp 200-202°C (acetone), R_f 0.47, $[\alpha]_D$ —97.7° (c 1.504; ethanol) and seveline with mp 267-269°C (acetone), $[\alpha]_D$ —48.8° (c 1.76; ethanol—chloroform (1:1)), R_f 0.55.

Acetylseveline. A mixture of 80 mg of seveline, 1 ml of pyridine, and 1.5 ml of acetic anhydride was kept at room temperature for 3 days. After the pyridine had been driven off, the residue was dissolved in 5% sulfuric acid, the solution was made alkaline with ammonia and extracted with chloroform, and the chloroform was distilled off. This gave amorphous diacetylseveline with R_f 0.74.

Mass spectrum: m/e 98, 111, 112 (100%), 124, 138, 150, 164, 166, 178, 180, 234, 235, 260, 290, (M — 71), (M — 60), (M — 59), (M — 43), (M — 42), (M — 33), (M — 29), (M — 18), (M — 17), (M — 15), 471 M^+.

Sevelinone. A solution of 90 mg of seveline in 1.5 ml of pyridine was treated with 45 ml of chromium trioxide in 2 ml of pyridine. The reaction mixture was kept at room temperature for 3 days. Then the solvent was driven off in vacuum, the residue was dissolved in 5% sulfuric acid, and the solution was made alkaline with ammonia and extracted with chloroform. The residue after the chloroform had been evaporated off was chromatographed on a column of alumina with elution by chloroform. This gave sevelinone with mp 234-236°C (acetone), R_f 0.64.

IR spectrum, ν_{max}, cm^{-1}: 3512 (OH), 2975-2845, 1457 (—CH_3; —CH_2—), 2750 (trans-quinolizidine), 1710, 1693 (C=O).

Mass spectrum: m/e 98, 111, 112 (100%), 124, 125, 138, 149, 150, 164, 166, (M — 29), (M — 17), (M — 15), 427 M^+.

Dihydroseveline. Over 30 min, 400 mg of sodium borohydride was added to a solution of 100 mg of seveline in 3 ml of methanol. Then the reaction mixture was kept at room temperature for 1 h. The solvent was evaporated off and the residue was diluted with water and extracted with chloroform. Treatment with acetone yielded dihydroseveline with mp 259-261°C (acetone), R_f 0.28.

Mass spectrum: m/e 98, 111, 112 (100%), 124, 125, 138, 149, 150, 162, 164, 166, 178, 180, 218, 234, 260, 272, 290, (M − 71), (M − 56), (M − 33), (M − 29), (M − 18), (M − 17), (M − 15), 431 M^+.

Deacetyldihydroseveline. Dihydroseveline (68 mg) was acetylated with 1 ml of pyridine and 1 ml of acetic anhydride as in the case of seveline. This gave amorphous diacetyldihydroseveline with R_f 0.78.

IR spectrum, ν_{max}, cm^{-1}: 3440 (OH), 2750 (trans-quinolizidine), 1737, 1250 (ester C=O).

Mass spectrum: m/e 98, 111, 112 (100%), 124, 125, 138, 149, 150, 162, 164, 166, 178, 234, 247, 394, 412, 428, 438, (M − 60), (M − 59), (M − 33), (M − 18), (M − 17), (M − 15), 515 M^+.

SUMMARY

1. The epigeal part of *Korolkowia sewerzowii* collected in Katrantau, has yielded a base with mp 200-202°C and a new alkaloid — seveline.

2. On the basis of a study of the IR, NMR, and mass spectra of seveline and the products of its transformation, the structure and conformation of seveline have been established as 3α,20β-dihydroxycevanin-6-one.

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