ALKALOIDS OF Stephania delovayi

III. STEPHODELINE

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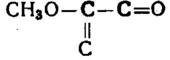
From the herb Stephania delovaya Diels (Menispermaceae) growing in Transcaucasia, by chromatography on alumina via the well-crystallizing hydrochloride with mp 198-200°C we have isolated a new amorphous base with the composition $C_{21}H_{27}O_5N$, mol. wt. 373 (mass spectrometrically), which we have called stephodeline.

The UV spectrum of stephodeline ($\lambda_{\max}^{\text{ethanol}}$ 230 and 275 nm, log ε 3.90 and 4.06) is extremely close to that of delavayine and 16-oxodelavayine [1, 2], which shows that the chromophoric groupings of these alkaloids are of the same type. The IR spectrum (Fig. 1) shows the presence in the molecule of the base of an α,β-unsaturated keto group and an aromatic nucleus (3040, 1665, 1610, and 1516 cm^{-1}).

The NMR spectrum of stephodeline ($CDCl_3$, 0—HMDS, HA-100D) is shown in Fig. 2; the values of the chemical shifts and of the spin—spin coupling constants, and also the assignments made, are given below:

Multiplicity, δ, ppm; intensity, J, Hz	Assignment
6,53, s, 1 H in CCl_4 6.49 and	Two aromatic para positions
6.55, s, 1 H 6.54 ppm)	
4.09, s, 3 H	$CH_3O-C=C-C=O$
3.64, s, 3 H	 $CH_3O-\underset{\underset{C}{\|}}{C}-C=O$
3.75, s, 3 H	2 Ar—OCH_3
3.77, s, 3 H	
2.38, s, 3 H	N—CH_3
2.55, d, 16,0; 1 H	$H-C_5-H$ C_5-H_a
2.96, d, 16.0; 1 H	C_5-H_e
2.66, q, 18,0; 6,0; 1 H	$C_{10}-H\alpha$
2.87, d, 18.0; 1 H	$C_{10}-H\beta$
3.66, d, 6.0; 1 H	C_9-H

In the 2.5-3.7 ppm region, the spectrum was analyzed by the INDOR method (Fig. 3). The two one-proton doublets with a geminal spin—spin coupling constant of 16 Hz isolated in this way are characteristic for the protons of a C_5 methylene group in the morphinan and hasubanan alkaloids containing a carbonyl group in position 6 [1-3]. Furthermore, in the same range there are the signals of a three-spin system of the AMX type, which have been assigned, in agreement with the literature [4-6], to the protons at C_9 and

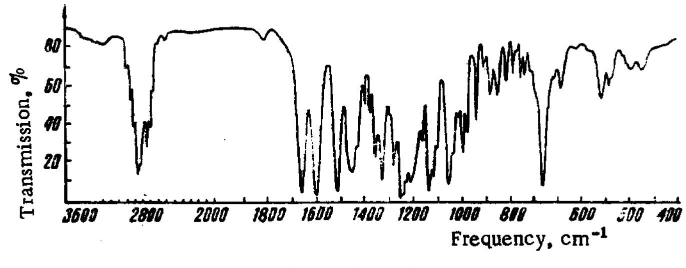


Fig. 1. IR spectrum of stephodeline (paraffin oil, UR-10).

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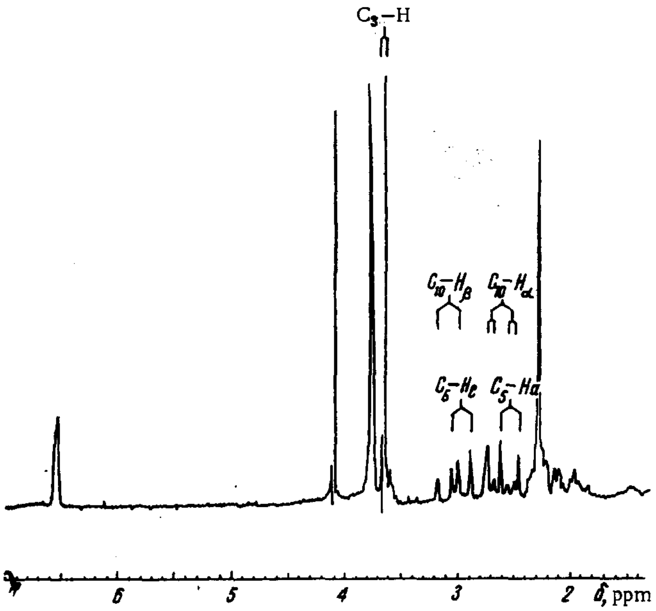


Fig. 2. NMR spectrum of stephodeline.

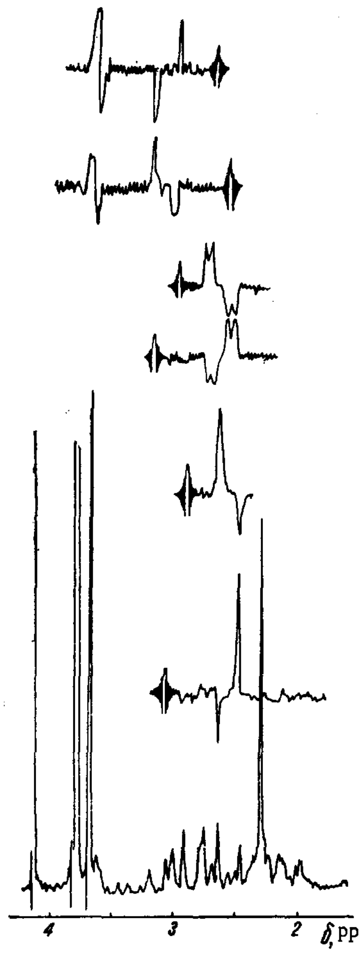
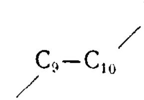


Fig. 3. Fragments of the INDOR spectrum of stephodeline.

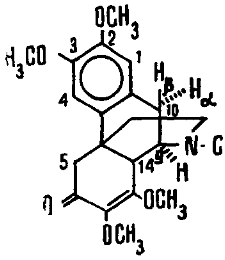
C_{10} of a morphinan skeleton. A doublet at 2.87 ppm with J = 18 Hz is due to C_{10}-Hβ; its interaction with the C_9-H is very slight and leads only to some broadening of the components of the doublet ($W_{1/2}$ = 3 Hz). The signal from C_{10}-Hβ is shifted downfield as compared with C_{10}-Hα as a result of the anisotropic influence of a tertiary nitrogen atom [7], which is possible only with the cis arrangement. The C_{10}-Hα proton gives a quartet with geminal and vicinal constants of, respectively, 18 and 6 Hz.

The signal from C_9-H is concealed by the peak of the methoxy group and is not observed directly; by the INDOR method (see Fig. 3) it is possible to detect it in the form of a doublet (J = 6 Hz) with somewhat broadened components. Obviously, J_{9-14} does not exceed 1-2 Hz. The value of the spin–spin coupling constant of the protons at C_9 and C_{10} permits the assumption that the dihedral angle



$$\overset{}{\underset{H}{C_9}}-\overset{H_\beta}{C_{10}}$$

amounts to about 90° and the corresponding angle for C_{10}-Hα is about 30°, i.e., at C_9 stephodeline has the same configuration as the alkaloids codeine, thebaine, and neopine [4-6]. Consequently, the following structural formula may be proposed for stephodeline:



In addition to stephodeline, from the mixture of alkaloids we isolated cycleanine, which has not previously been found in this plant.

EXPERIMENTAL

Stephodeline. The combined alkaloids isolated by the dichloroethane method (15 g) were chromatographed on alumina (activity grade II). The fraction obtained on elution with a mixture of ether and methanol (99:1) yielded the alkaloid delavayine [1]. The alcoholic mother liquors were evaporated to dryness, the residue was dissolved in 5% sulfuric acid, the solution was made alkaline with ammonia, and we then extracted first with benzene and then with chloroform. The benzene extracts were passed through a small column of alumina (activity grade II). The eluate was concentrated and, on standing, it deposited crystals of 16-oxodelavayine [2]. After evaporation of the benzene mother liquor, a faintly yellowish vitreous mass remained giving on TLC one clear spot; yield 0.6 g.

The addition of ether to a solution in ethanol saturated with hydrogen chloride gave the hydrochloride of the alkaloid, $C_{21}H_{27}O_5N \cdot HCl$, with mp 198-200°C.

From the crystalline hydrochloride was obtained an amorphous base with mol. wt. 373 (mass spectrometrically).

Cycleanine. The chloroform solution of alkaloids was evaporated, and the residue contained an alkaloid with mp 268-270°C (from acetone and ethanol) which was found to be identical with an authentic sample of cycleanine by TLC and IR and NMR spectroscopy.

SUMMARY

From the epigeal part of Stephania delovayi Diels (Menispermaceae) have been isolated cycleanine and a new amorphous alkaloid, stephodeline, with the composition $C_{21}H_{27}O_5N$, a structure for which is proposed.

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