THE STRUCTURE OF VINCARININE

Kh. T. Il'yasova, V. M. Malikov,
and S. Yu. Yunusov

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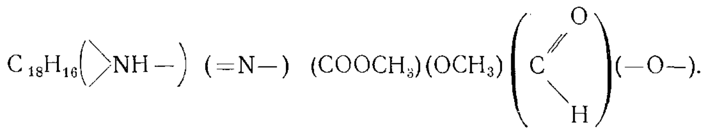
We have previously reported that the separation of the feebly basic fraction of the combined alkaloids of the epigeal part of Vinca erecta Rgl. et Schmalh. on a column of alumina yielded vincaricine and a base with mp 178-179°C [1, 2].

The base with mp 178-179°C (benzene) is optically active, $[\alpha]_D^{22} - 81.0°$ (c 0.1; methanol) and contains two methoxy groups. The elementary analysis and molecular weight determined mass-spectrometrically show that its empirical formula is $C_{22}H_{24}N_2O_5$. The IR spectrum shows the absorption bands of NH (3310 cm^{-1}) and of carbonyls of ester and aldehyde groups (1750, 1720 cm^{-1}, respectively). The presence of an aldehyde group is confirmed by the formation of an oxime and a phenylhydrazone.

The UV spectrum of the base – λ_{max} (ethanol) 238 and 312 nm (log ε 3.89, 3.53); λ_{max} (70% $HClO_4$) 260, 365 nm (log ε 3.40, 3.38) – is similar to that of vincaricine, which shows the presence of a similar chromophoric group in the substance. This is also confirmed by the production of an indole base on the reduction of the alkaloid with zinc in hydrochloric acid [2]. On the basis of the above facts, the formula of the alkaloid can be expanded in the following way:



$$C_{18}H_{16}\left(\rangle NH-\right)(=N-)\,(COOCH_3)(OCH_3)\left(C\genfrac{}{}{0pt}{}{\diagup\!\!\diagup O}{\diagdown H}\right)(-O-).$$

This alkaloid has not been described in the literature, and we have called it vincarinine.

The results of a comparison of compositions, developed formulas, and UV, IR, and NMR spectra have shown that vincarinine (I) differs from vincaricine (II) by one aldehyde group.

The NMR spectrum of the base has the signals of an ethylidene group at δ = 1.43 ppm, a doublet with J = 6 Hz and δ = 5.32 ppm, and a quartet with J = 8 Hz, which is also shown by the production of acetic acid when vincarinine is oxidized with chromic anhydride. Furthermore, the NMR spectrum of the base has the signals of two methoxy groups (δ = 3.60-3.65 ppm, singlet), of a NH group (5.06 ppm, singlet), of the proton of an aldehyde group (8.51 ppm, singlet), and of three aromatic protons (6.52-6.70 ppm).

The mass spectrum of (I) has strong peaks of ions with m/e 396 M$^+$ (95%), 367 $(M-CHO)^+$ (100), 337 $(M-COOCH_3)^+$ (23), 309 $(M-CO+COOCH_3)^+$ (25), 269 $(M-2CO+C-COOCH_3)^+$ (71), and also peaks of medium intensity with m/e 378 $(M-H_2O)^+$ (5) and an ion with m/e 212 (8), formed from the indole moiety of the molecule. Consequently, the fragmentation of vincarinine is similar to that of vincaricine, but the main peaks of the ions of (I) differ from the corresponding ions of (II) by 28 m/e. This also shows the presence of an aldehyde group in vincarinine. In view of a certain similarity with alkaloids of analogous structure and possible interrelationships of the alkaloids isolated from this plant (tombozine, akuammidine, akuammine, 11-hydroxypleiocarpamine, etc.) [3], we consider that position 16 is the most likely for the aldehyde group.

The facts given enable structure (I) to be proposed for vincarinine.

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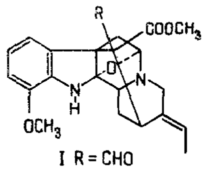

I R = CHO
II R = H

EXPERIMENTAL

The mass spectra were taken on a MKh-1303 mass spectrometer with a glass inlet system at 40 eV and 150 mA, and the NMR spectra on a JNM-4H-100/100 MHz instrument with HMDS as internal standard (δ scale).

Vincarinine crystallizes from benzene in admixture with vincaricine. After fractional recrystallization from benzene, 0.96 g (0.27% of the total) of vincarinine, $C_{22}H_{24}N_2O_5$, was obtained with mp 178-179° C $[\alpha]_D^{22}$ − 81.0° (c 0.1; methanol); R_f 0.27 on TLC in silica gel in the ethyl acetate–methanol (9 : 1) system.

The Indole Product from Vincarinine. In a similar manner to the case of vincaricine [2], the action of zinc in hydrochloric acid on 0.1 g of vincarinine gave 0.04 g of a mixture of bases with R_f 0.83 and 0.45 [chloroform–methanol (9 : 1) system]. The qualitative color reaction with cerium sulfate and the UV spectrum showed that the substance with R_f 0.83 was an indole base.

Vincarinine phenylhydrazone. A solution of 30 mg of vincarinine in one or two drops of methanol was treated with a 1% solution of 2, 4-dinitrophenylhydrazine. On standing, slightly yellowish microcrystalline vincarinine phenylhydrazone deposited with mp 217-218° C. Yield 20 mg. IR spectrum, cm^{-1}: 3310, 1740, 1620, 1450, 1280.

Vincarinine Oxime. A solution of 40 mg of the base and 0.1 g of hydroxylamine hydrochloride in 3 ml of ethanol was treated with 0.05 g of a hot solution of sodium carbonate in 5 ml of water. The hot solution was cooled and poured into a dish and allowed to evaporate at room temperature. The residue was dissolved in 5% H_2SO_4, and the acid solution was made alkaline with ammonia and extracted with ether. After the ether had been distilled off, the residue was treated with methanol and the crystalline fraction (12 mg) was separated off, mp 211-213° C (decomp.). IR spectrum, cm^{-1}: 3310, 1740, 1490, 1280.

SUMMARY

1. A new base – vincarinine – has been isolated from the epigeal part of *Vinca erecta* Rgl. et Schmalh.

2. On the basis of spectral characteristics and a comparison of some chemical reactions of vincaricine and vincarinine, the structure of vincaricin-16-al has been established for the latter.

LITERATURE CITED

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3. S. Yu. Yunusov, Khim. Prirodn. Soedin., 6, 149 (1970).