Tetrahedron Letters No. 52, pp 4887 - 4890, 1976. Pergamon Press. Printed in Great Britain.

VINCARPINE AND DIHYDROVINCARPINE - TWO NEW ZWITTERIONIC INDOLE ALKALOIDS FROM VINCA ELEGANTISSIMA HORT.[1]

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(Received in UK 2 November 1976; accepted for publication 14 November 1976)

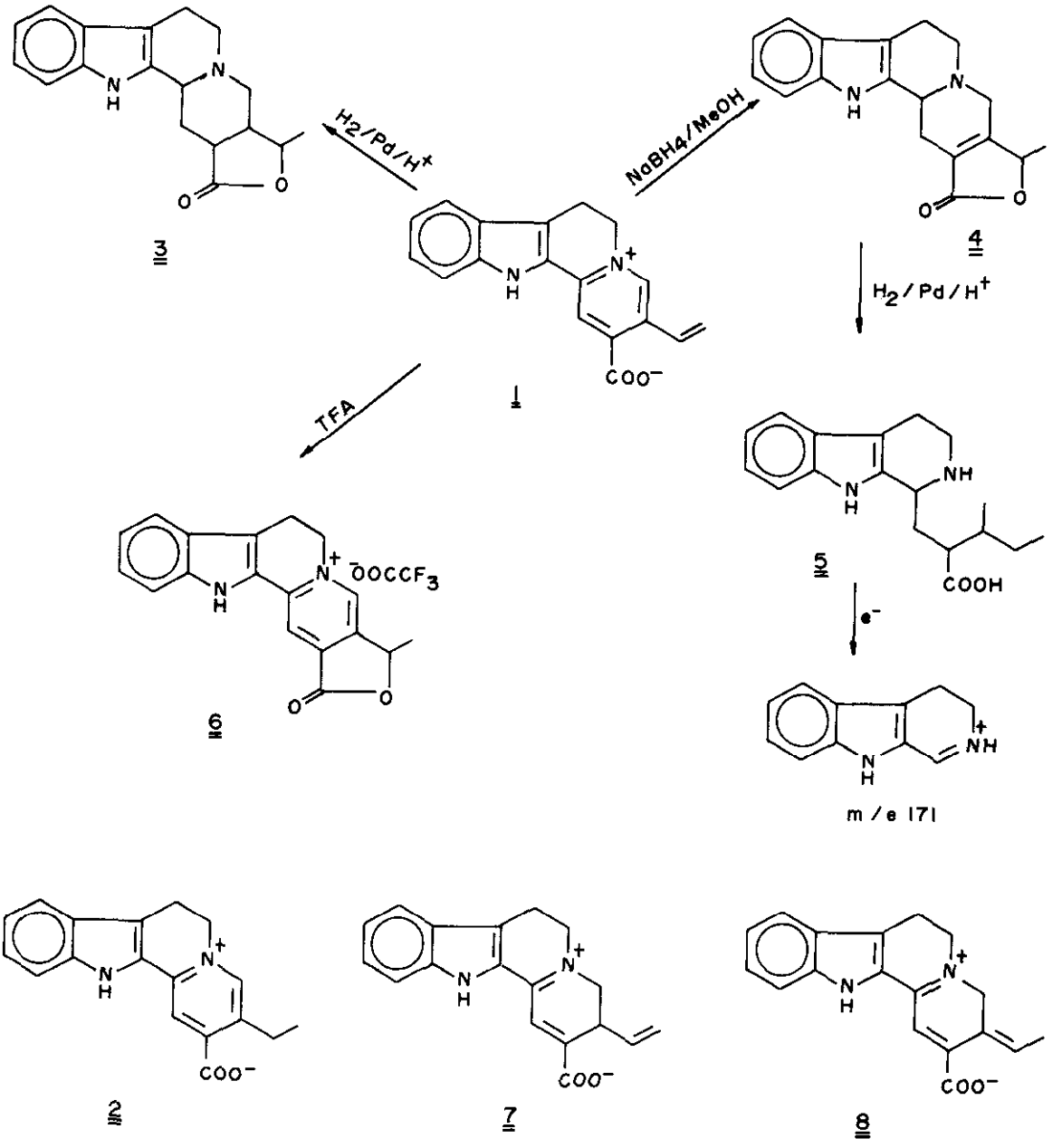
The isolation of a number of indole[2], oxindole and glycosidic alkaloids[3] from Vinca major L. var. elegantissima Hort. was reported earlier from this laboratory. We now report the structure of two minor indole alkaloids designated as vincarpine (1) and dihydrovincarpine (2) isolated from the same plant.

Vincarpine, m.p.300°(d), $C_{18}H_{14}N_2O_2$ (M^+: Found 290.10513; calcd. 290.10552) and dihydrovincarpine, m.p.280°(d), $C_{18}H_{16}N_2O_2$ (M^+: Found 292.12248; calcd. 292.12117) were obtained as yellow needles (MeOH:$CHCl_3$) by direct chromatography (silica gel) of the defatted methanolic extract of the whole plant. Both the compounds exhibited IR (nujol) absorptions at 3250-2600 and 1600 cm^{-1} assignable to strongly bonded OH/NH and $-COO^-$ groups respectively. The UV spectrum of vincarpine with λ_{max}(log ε), 222sh(4.22), 250sh(3.77), 315(3.81), 395(3.73) nm in EtOH; 225(4.17), 247sh(3.81), 332(3.89), 402 (3.70) nm in 0.1N HCl and 292(3.81), 318(3.68), 390(3.86) nm in 0.1N NaOH was compatible with a 6,7-dihydro-indolo [2,3-a] quinolizine system[4,5]. The UV spectra of dihydrovincarpine in neutral, acidic and alkaline solutions were almost superimposable with those of 1.

Catalytic hydrogenation of vincarpine yielded the hexahydroderivative 3 [$\nu_{max}^{CHCl_3}$: 3450(NH), 1760(CO) cm^{-1}; λ_{max}^{EtOH}(log ε): 225(4.7), 278(4.1) nm; m/e (%): 296(M^+, 84), 295(100), 170(22), 169(30)] while sodium borohydride reduction gave the tetrahydroderivative 4 [$\nu_{max}^{CHCl_3}$: 3400(NH), 1750(CO);

λ_{max}^{EtOH}(log ε): 225(4.6), 274(3.8) nm; m/e (%): 294(M^+, 58), 293(48), 170(60), 169(100)_7. The structure of the two compounds could be deduced from the characteristic tetrahydro-β-carboline fragments in the mass, carbonyl absorption for the γ-lactones in the IR and indole absorption in the UV spectra. Of particular interest was the high intensity peaks at m/e 169 and 170 in the mass spectrum of 4, clearly indicative of the influence of the isolated double bond in the facile collapse of ring D (cf. fragmentation of hexahydroflavocarpine methyl ester[4]). Further catalytic hydrogenation of 4 unexpectedly yielded a decahydroderivative, the spectral data of which were consistent with structure 5. Thus, the UV spectrum of the compound with λ_{max}^{EtOH}(log ε): 227(4.38), 275(3.8) nm, indicated the presence of an indole chromophore; the mass spectrum showed a prominent peak at m/e 171, besides the peaks at m/e 300 (M^+), 299(M-H), 255(M-COOH), 170 and 169 compatible with a 1-mono-substituted and not a 1,2-disubstituted tetrahydro-β-carboline structure. Finally, the structure 1 for vincarpine was supported by its NMR spectrum (220 MHz) in TFA solution. It showed signals for a $-CH_2-CH_2-$ (δ 3.57t and 5.09t, J = 7 Hz) and a CH_3-CH- (δ 1.87d and 6.05q, J = 7 Hz) grouping which could be accommodated in structure 6 clearly derived by lactonisation of 1 in presence of acid.

The NMR (100 MHz) spectrum of dihydrovincarpine also in TFA showed signals for the $-CH_2-CH_2-$ (δ 3.51t and 4.92t, J = 7 Hz) group of ring C and for an $Ar-CH_2-CH_3$ (δ 1.42t and 3.18q, J = 6.5 Hz) grouping. Considering further the close correspondence of the UV and IR spectra of the compound with those of 1, dihydrovincarpine could be assigned structure 2. The possibility that structure 2 might have arisen by rearrangement of an isomer like 7 or 8 in TFA solution was ruled out from the following observations: Dihydrovincarpine was recovered unchanged after heating with glacial acetic acid at 100° for 3 hr, and treatment with CH_3COOD under the same condition and subsequent working up with water did not lead to any incorporation of deuterium as ascertained by mass spectrometry.


H2/Pd/H+
NaBH4/MeOH
H2/Pd/H+
TFA
e-
m/e 171

Acknowledgement. The authors are grateful to Prof. K. Nakanishi of Columbia University and Dr. R. A. Spragg of Perkin Elmer Ltd., for the NMR spectra, to Dr. C. E. Costello of Massachusetts Institute of Technology for the high resolution mass spectra and to CSIR, New Delhi for a Research Fellowship to V.S.G.

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