

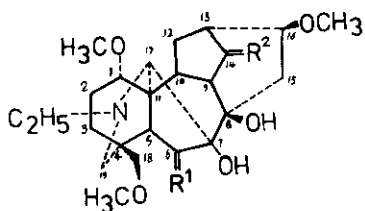
THE DITERPENOID ALKALOIDS FROM ACONITUM SCAPOSUM VAR. VAGINATUM¹

Qing Ping Jiang and Wei Liang Sung*

Institute of Materia Medica, Chinese Academy of Medical Sciences
1 Xiannongtan Street, Beijing, China

Abstract - The structure determinations of vaginatine (1), vaginaline (2) and vaginadine (3), diterpenoid alkaloids from Aconitum scaposum var. vaginatum, are reported.

We wish to report three new C₁₉-diterpenoid alkaloids isolated from the methanol extract of the root of Aconitum scaposum var. vaginatum². Vaginatine (1), vaginaline (2) and vaginadine (3) were demonstrated to possess the structures shown below.



- 1 $R^1 = \alpha H, OH; R^2 = \alpha OH, H$
- 2 $R^1 = \alpha H, OH; R^2 = O$
- 3 $R^1 = R^2 = O$
- 4 $R^1 = \alpha H, OAc; R^2 = \alpha OAc, H$
- 5 $R^1 = \alpha H, OCH_3; R^2 = \alpha OH, H$

Vaginatine, C₂₄H₃₉N₇ (M⁺ 453.2706, calc. 453.2726), colorless crystals, mp 86-88°C, [α]_D²⁸ +25.3° (c 0.1, CHCl₃), showed spectral absorptions characteristic to diterpenoid alkaloids. IR spectrum indicated OH absorption (3400 cm⁻¹, br). ¹H-NMR (δ) exhibited the presence of an NCH₂CH₃ (1.07, 3H, J = 7.2 Hz) and three OCH₃ (3.27, 3.37, 3.39, 3H each, s); the broad singlet at 4.35 and triplet (J = 5.0 Hz) centered at 4.15, attributable to C(6)- α H and C(14)- β H respectively, would indicate the presence of C(6)- β OH and C(14)- α OH³. Acetylation (Ac₂O/pyr.) of the base yielded a diacetate (4) (M⁺ 537), whose IR showed OH absorption (3590, 3540 cm⁻¹) in addition to esters (1730 and 1220 cm⁻¹, br). ¹H-NMR showed the appearance of δ 5.37 and 4.84 while devoid of those signals assigned to C(6)- α H

Table 1. ^{13}C -NMR of vaginatine (1), vaginaline (2), vaginadine (3) and brownline (5)^a

Carbons	<u>1</u>	<u>2</u>	<u>3</u>	<u>5</u>
1	85.0	85.5	84.7	85.2
2	25.1	25.2	24.8	25.0
3	32.1	32.3 ^b	32.3	32.5
4	38.8	38.8	39.2	38.4
5	45.0 ^b	46.4	46.1	45.1
6	80.2	79.8	211.6	90.1
7	88.0	88.2	83.6	89.1
8	76.9	85.3	85.6	76.3
9	45.0	53.6 ^c	56.0	49.6
10	37.4	44.1	43.9	36.4
11	47.9	48.6	45.4	48.2
12	27.7	25.2	25.8	27.5
13	46.0 ^b	53.3 ^c	52.8	46.1
14	75.4	217.0	218.6	75.3
15	34.1	32.9 ^b	29.7	33.1
16	82.1	85.5	84.5	81.7
17	65.9	66.1	64.4	65.4
18	78.9	78.9	76.5	78.0
19	54.0	54.5	55.3	52.7
N-CH ₂	51.6	51.3	50.9	51.3
CH ₃	14.4	14.3	14.0	14.3
1'	55.8	55.7	56.2	56.0
6'	-	-	-	57.5
16'	56.4	56.1	57.7	56.5
18'	59.5	59.5	59.2	59.1

a. Chemical shifts in ppm are given downfield from TMS; solvent - CDCl_3 .

b, c. These assignments may be interchanged in any vertical column.

and C(14)- βH for the base itself. Periodate oxidation of 4 offered a product (M^+ 535) showing multiple carbonyl ($1755\text{-}1713\text{ cm}^{-1}$) and the absence of hydroxyl absorption in IR spectrum; this demonstrated the glycol structure in 4. Vaginatine gave in MS m/z 422 (M^+ -31) as the base peak which suggested the presence of C(1)- OCH_3 ⁴. ^{13}C -NMR (Table 1) 78.9 ppm (t) was assigned to $\text{H}_2\text{C}(18)\text{-OCH}_3$, and 82.1 ppm (d) ascribed to

C(16)- β OCH₃ on the biogenetic considerations of diterpenoid alkaloids. Thus structure 1 was assigned to vaginatine. The ¹³C-NMR chemical shift values of vaginatine (1) and that of browniine (5) were compared and listed in Table 1. Vaginaline, C₂₄H₃₇NO₇ (M⁺ 451.2532, calc. 451.2570), colorless crystals, mp 209-213°C (decomp.), [α]_D^{18.5} +28.6° (c 0.1, EtOH). The presence of a ketone group was evidenced by IR (1745 cm⁻¹, cyclopentanone) and ¹³C-NMR (217.0 ppm) spectra. ¹H-NMR (1) showed 1.06 (3H, t, J = 7.2 Hz, NCH₂CH₃), 3.30, 3.35, 3.35 (3H each, s, 3 X OCH₃) and 4.45 (1H, d, turned to a singlet upon addition of D₂O; and shifted to 5.28 (s) in the ¹H-NMR spectrum of vaginaline monoacetate (M⁺ 493)) (HO-C(6)-αH). In ¹³C-NMR, 88.2 and 85.3 ppm, both singlet, indicated two tertiary alcohol groups, and 78.5 ppm (t) CH₂-OCH₃. The data cited above strongly suggested that vaginaline was the C(14)-keto analogue of its coexisting congener vaginatine (1). Reduction (NaBH₄) of the former indeed yielded a product which was shown (R_F, mp, IR, MS) to be identical with the latter. As the result, vaginaline was shown to possess the structure 2.

Vaginadine, C₂₄H₃₅NO₇ (M⁺ 449.2354, calc. 449.2414), colorless needles, mp 147-149°C, [α]_D^{18.5} -49.4° (c 0.1, EtOH). IR and ¹³C-NMR (1750, 1740 cm⁻¹ and 211.9, 218.6 ppm) revealed two cyclopentanone moieties. ¹H-NMR (1) showed the presence of NCH₂CH₃ (1.14, 3H, t, J = 7.2 Hz), three OCH₃ (3.40, 3.39, 3.39, 3H each, s), but devoid of the broad singlet for C(6)-αH as those found in the spectra of 1 and 2. Considering that vaginadine has a molecular weight 2 (m/z) less than that of vaginaline (2) and one more keto group than the latter, vaginadine could very well be the C(6)-keto analogue of 2. This postulation was confirmed by the identity (MS, R_F, mp, IR) exhibited between vaginadine and the oxidation product of vaginaline (2). It was thus demonstrated that the structure of vaginadine was 3.

REFERENCES AND NOTES

1. Preliminary report was presented at the China-Japan Symposium on the Naturally Occuring Drugs, Beijing, November 1984 (Abstr., p. 12).
2. W.T. Wang in Flora Reipublicae Popularis Sinicae, Science Publishing House, Beijing, 1979, Vol. 27, p. 164, collected in southern Sichuan Province, August 1982.
3. N.V. Aiyar, P.W. Coddington, K.N. Kerr and M.H. Benn, Tetrahedron Lett., 1981, 22, 483.
4. S.W. Pelletier, N.V. Mody and R.S. Sawhney, Can. J. Chem., 1979, 57, 1652.

Received, 28th October, 1985