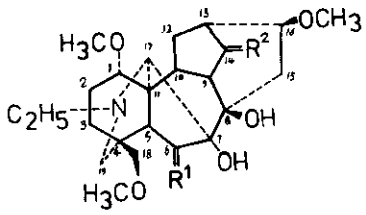
THE DITERPENOID ALKALOIDS FROM ACONITUM SCAPOSUM VAR. VAGINATUM[1]

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 C_{19}-diterpenoid alkaloids isolated from the methanol extract of the root of Aconitum scaposum var. vaginatum[2]. Vaginatine (1), vaginaline (2) and vaginadine (3) were demonstrated to possess the structures shown below.



1 R^1= αH, OH; R^2= αOH, H
2 R^1= αH, OH; R^2 = O
3 R^1= R^2= O
4 R^1= αH, OAc; R^2= αOAc, H
5 R^1=αH, OCH_3; R^2= αOH, H

Vaginatine, $C_{24}H_{39}NO_7$ (M^+ 453.2706, calc. 453.2726), colorless crystals, mp 86-88°C, $[\alpha]_D^{28}$ +25.3°(c 0.1, $CHCl_3$), showed spectral absorptions characteristic to diterpenoid alkaloids. IR spectrum indicated OH absorption (3400 cm^{-1}, br). ^{1}H-NMR (δ) exhibited the presence of an $NCH_2\underline{CH}_3$ (1.07, 3H, J = 7.2 Hz) and three OCH_3 (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)-αH and C(14)-βH respectively, would indicate the presence of C(6)-βOH and C(14)-αOH[3]. Acetylation (Ac_2O/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). ^{1}H-NMR showed the appearance of δ5.37 and 4.84 while devoid of those signals assigned to C(6)-αH

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

Carbons	1	2	3	5
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 (1755-1713 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 H_2C(18)-OCH_3, and 82.1 ppm (d) ascribed to

C(16)-βOCH$_3$ on the biogenetic considerations of diterpenoid alkaloids. Thus structure 1 was assigned to vaginatine. The ^{13}C-NMR chemical shift values of vaginatine (1) and that of browniine (5) were compared and listed in Table 1.

Vaginaline, $C_{24}H_{37}NO_7$ (M^+ 451.2532, calc. 451.2570), colorless crystals, mp 209-213°C (decomp.), $[\alpha]_D^{18.5}$ +28.6° (c 0.1, EtOH). The presence of a ketone group was evidenced by IR (1745 cm^{-1}, cyclopentanone) and ^{13}C-NMR (217.0 ppm) spectra. ^{1}H-NMR (δ) showed 1.06 (3H, t, J = 7.2 Hz, $NCH_2\underline{CH_3}$), 3.30, 3.35, 3.35 (3H each, s 3 X OCH_3) and 4.45 (1H, d, turned to a singlet upon addition of D_2O; and shifted to 5.28 (s) in the ^{1}H-NMR spectrum of vaginaline monoacetate (M^+ 493)) (HO-C(6)-α$\underline{H}$). In ^{13}C-NMR, 88.2 and 85.3 ppm, both singlet, indicated two tertiary alcohol groups, and 78.5 ppm (t) $\underline{CH_2}$-OCH_3. The data cited above strongly suggested that vaginaline was the C(14)-keto analogue of its coexisting congener vaginatine (1). Reduction ($NaBH_4$) 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, $C_{24}H_{35}NO_7$ (M^+ 449.2354, calc. 449.2414), colorless needles, mp 147-149°C, $[\alpha]_D^{18.5}$ -49.4° (c 0.1, EtOH). IR and ^{13}C-NMR (1750, 1740 cm^{-1} and 211.9, 218.6 ppm) revealed two cyclopentanone moieties. ^{1}H-NMR (δ) showed the presence of $NCH_2\underline{CH_3}$ (1.14, 3H, t, J = 7.2 Hz), three OCH_3 (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. Codding, 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