Pergamon

0031-9422(95)00918-3

Phytochemistry, Vol. 42, No. 4, pp. 1253–1255, 1996

0031-9422/96 $15.00 + 0.00

NORDITERPENOID ALKALOIDS FROM ROOTS OF *ACONITUM FINETIANUM*

GONG WU, SHANHAO JIANG and DAYUAN ZHU

Department of Phytochemistry, Shanghai Institute of Materia Medica, Academia Sinica, Shanghai, 200031, P.R. China

(*Received in revised form* 4 *October* 1995)

Key Word Index—*Aconitum finetianum*; Ranunculaceae; roots; diterpenoid; alkaloid; NMR spectroscopy.

Abstract—One novel and two known diterpenoid alkaloids were isolated from the roots of *Aconitum finetianum*. The new one was isolated as a minor component and its structure determined from spectroscopic evidence.

INTRODUCTION

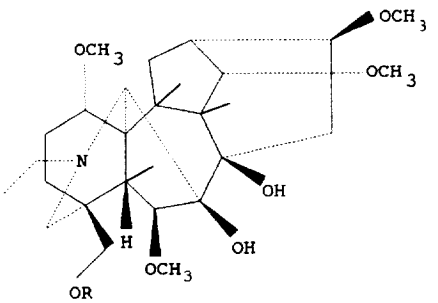
The roots of *Aconitum finetianum* Hand-Mazz are used in Chinese herbal medicine for the treatment of enteritis, poisonous snake-bites and fractures. Several C_{19}-diterpenoid alkaloids have already been reported [1–3]. In this paper, we describe the isolation and structural elucidation of a new diterpenoid alkaloid, finetiadine (**3**).

RESULTS AND DISCUSSION

An ethanolic extract of the dried roots of *A. finetianum* was purified by repeated column chromatography on silica gel to give a diterpenoid alkaloid (**3**), together with the known compounds, anthranoyllycoctonine (inuline) (**1**) and lycoctonine (**2**). Alkaloids **1** and **2** were identified by comparison of their properties with literature data [1, 4].

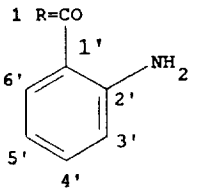
Compound **3**, a minor component, was assigned the molecular formula $C_{38}H_{52}O_{12}N_2$. The EI mass spectrum showed *m/z* 728 $[M]^+$ and fragmentation peaks at *m/z* 713 $[M-15]^+$, 697 $[M-31]^+$. The IR spectrum suggested the presence of a hydroxyl group or an amino group (3450 cm^{-1}) and carbonyl groups (1735 and 1685 cm^{-1}). The ^1H NMR spectrum indicated an ethylamino δ 1.07 (3H, *t*, $J = 7.0$ Hz) and four methoxyl groups (δ 3.27, 3.33, 3.37 and 3.71, each 3H, *s*). Comparison of its ^{13}C NMR spectral data with those of **1** and **2** revealed that these three compounds have the same skeleton. The signal at δ 4.75 (1H, *t*, $J = 4.8$ Hz, 14-H) indicated acetylation of the C-14 hydroxyl group. A group of signals at δ 8.71 (1H, *d*, $J = 8.4$ Hz), 7.96 (1H, *d*, $J = 8.0$ Hz), 7.56 (1H, *t*, $J = 8.4$ Hz) and 7.13 (1H, *t*, $J = 8.0$ Hz) are indicative of the aromatic protons of an anthranoyl group [5]. In the downfield region, the spectrum also showed a signal at δ 11.11 (1H, *s*) attributable to a secondary amide proton.

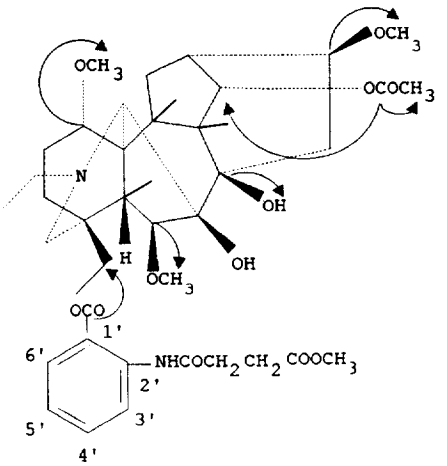
In order to determine the positions of the four



2 R=H

1 R=CO





3

Table 1. NMR spectral data for compound **3**

Atom	δ ^{13}C	δ ^{1}H	J (Hz)	HMBC (C to H)
1	83.67	3.05		1-OCH$_3$
2	25.99	2.20		
3	32.25	H3a 1.55		
		H3b 1.73		
4	37.51	—		H19, H5
5	49.95	1.75		H19, H17
6	90.61	3.90		H17, H5
7	88.25	—		H5, H15
8	77.14	—		H17, H10, H15
9	42.42	3.23		H15b, H13, H10
10	45.67	2.05		H1, H17, H12, H13, H5
11	48.92	—		H1, H17, H12b, H9, H5
12	28.07	H12a 1.90		H9, H16
		H12b 2.50		
13	38.17	2.40		H15b, H12b
14	75.86	4.75	*t*, 4.8	H12b, H13
15	33.67	H15a 1.55		H13
		H15b 2.65		
16	83.67	3.25		H15, H13, H12b
17	64.45	2.95		H1, H19b, NC$\underline{H}_2$CH$_3$
18	69.50	4.15	13.6	H5, H19a
19	52.17	H19a 2.45		H5, NC$\underline{H}_2$CH$_3$
		H19b 2.75		
-NCH$_2$	51.02	2.80		
CH$_3$	14.07	1.07	*t*, 7.2	-NC$\underline{H}_2$CH$_3$
1-OCH$_3$	55.80	3.26		C1
6-OCH$_3$	58.04	3.37		C6
16-OCH$_3$	56.26	3.33		C16
14-CO	171.91	—		H14, COCH$_3$
CH$_3$	21.52	2.06		
Ar-CO	167.95	—		H2′, H5′, H18
Ar-1′	141.66	—		H2′, H5′, H3′
2′	120.60	8.70	*d*, 8.0	H4′
3′	135.00	7.56	*t*, 8.0	H5′
4′	122.62	7.13	*t*, 8.0	H2′
5′	130.23	7.96	*d*, 8.0	H3′, H4′
6′	114.42	—		H2′, H4′
-NHCO	170.25	—		-NHCOC$\underline{H}_2$CH$_2$CO-
CH$_2$	28.86	2.74		
CH$_2$	32.63	2.74		
CO	173.03	—		-NHCOCH$_2$C$\underline{H}_2$CO-
OCH$_3$	51.88	3.70		-CH$_2$C$\underline{O}$OOCH$_3$

methoxyl groups and other substituent groups on the skeleton of the norditerpenoid alkaloid, a series of ^{1}H–^{1}H COSY, HMQC and HMBC experiments were carried out. As shown in Table 1 and structure **3**, long-range correlation peaks were detected between proton signals of each methoxyl group and the carbon which linked H-18, H-3′, H-6′ and a carbonyl signal, indicating that the anthranoyl group was located at the C-18 position. All ^{1}H and ^{13}C NMR assignments were supported by extensive NMR spectral data.

EXPERIMENTAL

General. Mps: uncorr. NMR: 400 MHz, $CDCl_3$, TMS as int. standard. MS: 70 eV. CC: 300 mesh alumina and 200–300 mesh silica gel (Shanghai Fifth Reagent Factory). TLC: silica gel GF_{254} (Haiyang Chemical Industry Factory, Qingdao).

The herb was collected from Lu Shan, Jiangxi province, China. It was identified by Prof. Jiang Shanhao, Department of Phytochemistry, Shanghai Institute of Materia Medica, Academia Sinica. A voucher specimen is deposited in this department.

Extraction and isolation. Powdered roots (5 kg) were extracted ×3 with 95% EtOH at room temp. After removal of EtOH under red. pres., 150 g of a syrup remained. This was dissolved in 5% HCl. The acid soln, after extracting with CH_2Cl_2, was made alkaline with conc. NH_4OH (pH 10) and extracted with $CHCl_3$. From the combined $CHCl_3$ extract, 50 g crude alkaloid was obtained. This was subjected to CC on alumina eluting with a petrol–Me_2CO gradient. Frs were combined according to TLC (cyclohexane–Et_2NH, 4:1)

composition and sepd on a silica gel column (200–300 mesh) with petrol–EtOAc or by prep. TLC (cyclohexane–Et_2NH, 4:1). This gave **1** (20 mg), **2** (35 mg) and **3** (5 mg).

Anthranoyllycoctonine (**1**). Needles (Me_2CO–petrol), mp 133–135°. $[\alpha]_D^{22}$ 56.86 ($CHCl_3$; *c* 0.2). MS *m/z* (rel. int.): 586 $[M]^+$ (9), 555 $[M - OMe]^+$ (100). UV λ_{max} nm: 219, 248, 340. IR ν_{max}^{KBr} cm $^{-1}$: 3530, 3509, 3420, 3315 (–OH, –NH–), 1690 (OCOR), 1625, 1590 (Ar). ^1H NMR ($CDCl_3$): δ 7.80 (1*H*, *d*, $J = 8.4$ Hz), 7.29 (1H, *t*, $J = 8.0$ Hz), 6.66 (2H, *dd*, $J = 8.0$, 8.4 Hz, Ar–H), 3.41, 3.37, 3.34, 3.26 (each 3H, s, –OMe), 1.07 (3H, *t*, $J = 7.2$ Hz, $-NCH_2CH_3$).

Lycoctonine (**2**). Needles (Me_2CO–petrol), mp 93–95°. $[\alpha]_D^{22}$ 51.52 ($CHCl_3$; *c* 0.4). MS *m/z* (rel. int.): 467 $[M]^+$ (7), 436 $[M - OMe]^+$ (100). UV λ_{max} nm: 219, 248, 340. IR ν_{max}^{KBr} cm^{-1}: 3500, 3415, 3315 (–OH, –NH–). ^1H NMR ($CDCl_3$): δ 3.45, 3.42, 3.34, 3.26 (each 3H, *s*, –OMe), 1.05 (3H, *t*, $J = 7.2$ Hz, $-NCH_2CH_3$).

Finetiadine (**3**). Amorphous powder (Me_2CO) mp 116–117°. $[\alpha]_D^{18}$ 31.63 ($CHCl_3$; *c* 0.1). HRMS calc. for $C_{37}H_{49}O_{11}N_2$ $[M - OMe]^+$ *m/z* 697.3309, found *m/z* 697.3336; EIMS *m/z* (rel. int.): 728 $[M]^+$ (6.86), 710 $[M - H_2O]^+$ (12.95), 679 $[M - OMe]^+$ (100). UV λ_{max} nm: 232, 251, 312. IR ν_{max}^{KBr} cm^{-1}: 3450 (–OH, –NH–), 1735, 1685 (–OCOR), 1606, 1590, 1525 (Ar). ^1H and ^{13}C NMR: Table 1.

REFERENCES

1. Chen, Y. Z. and Wu, A. G. (1990) *Phytochemistry* **29**, 1016.
2. Chen, B. R., Yang, Y. F., Tian, R. M., Zhang, C. P., Xiao, Y. Z. and Liu, M. X. (1981) *Acta Pharm. Sin.* **16**, 70.
3. Tian, R. M., Jiang, S. H., Zheng, P. J., Cheng, Y. M., Zhou, B. N., Wang, M., Chen, B. R. and Liu, P. (1987) *Acta Chim. Sin.* **45**, 776.
4. Jiang, S. H., Hong, S. H., Song, B. Z., Zhu, Y. L. and Zhou, B. N. (1988) *Acta Chim. Sin.* **46**, 26.
5. Pelletier, S. W., Sawhney, R. S. and Aasen, A. J. (1979) *Heterocycles* **12**, 377.