New Diterpene Alkaloids from *Aconitum sungpanense* var. *leucanthum*

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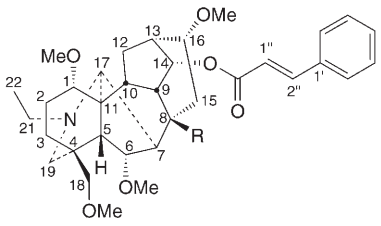
Five new C_{19} diterpene alkaloids, leucanthumsines A (**1**), B (**2**), C (**3**), D (**4**), and E (**5**), were isolated from the Chinese medicinal herb *Aconitum sungpanense* var. *leucanthum*, together with the known C_{19} diterpene alkaloids pseudaconine, neoline, 1-*O*-methyldelphisine, crassicaudine, chasmanine, talatisamine, indaconitine, ezochansmanine, and leueantine D. The structures of these new alkaloids were elucidated by HR-MS and advanced NMR methods, including ^{1}H- and ^{13}C-NMR (DEPT), ^{1}H,^{1}H-COSY, HMQC, and HMBC experiments.

Introduction. – *Aconitum sungpanense* var. *leucanthum* W. T. WANG, which belongs to Subgen. *Aconitum*, is mainly distributed in the southwestern part of China and especially abundant in Sichuan province. Many plants of the species have been used as a folk remedy for the treatment of arthritic pain in China and had anti-inflammatory and antipyretic effects [1].

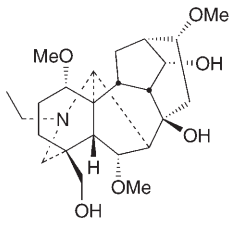
To the best of our knowledge, no details on the chemical constituents of the plant have been reported. In our ongoing research for the novel bioactive diterpene alkaloids from *Aconitum* and *Delphinium* plants, five new diterpene alkaloids, leucanthumsines A (**1**), B (**2**), C (**3**), D (**4**), and E (**5**), together with nine known alkaloids pseudaconine [2], neoline [2], 1-*O*-methyldelphisine [3], crassicaudine [4], chasmanine [5], talatisamine [5], indaconitine [5], ezochansmanine [6], and leueantine D [7], were isolated from the roots of *A. sungpanense* var. *leucanthum*. The structures of these alkaloids were determined on the basis of spectral data (1D- and 2D-NMR, HR-ESI-MS) and chemical methods. In this paper, the isolation and structure elucidation of these new alkaloids are reported.

Results and Discussion. – The powdered roots of *A. sungpanense* var. *leucanthum* were percolated with HCl. The filtrate was then alkalinized with aqueous NH_4OH solution and extracted with AcOEt. The AcOEt extract was purified by successive column chromatography (silica gel) to afford the above compounds.

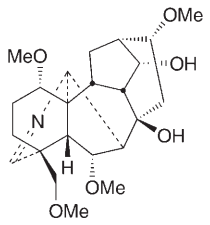
Leucanthumsine A (**1**) was obtained as white amorphous power, giving the molecular formula $C_{36}H_{49}NO_8$ from HR-ESI-MS ($[M+H]^+$ at m/z 624.3534). The IR spectrum showed absorptions for CO (1715 cm^{-1}), CH=CH (1637 cm^{-1}), and Ph (1452 cm^{-1}) moieties. From the analysis of the 1D- and 2D-NMR experiments, the structure was identified as **1**.



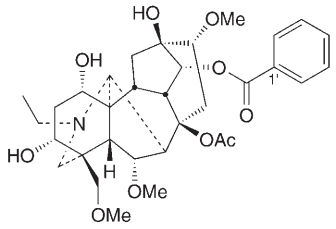
Leucanthumsine A (**1**) R = AcO
Leucanthumsine B (**2**) R = OH



Leucanthumsine C (**3**)



Leucanthumsine D (**4**)



Leucanthumsine E (**5**)

The ^{13}C-NMR (DEPT) spectrum of **1** (*Table 1*) exhibited 19 signals of the C_{19} diterpene core: six CH_2 (δ (C) 26.4, 34.8, 29.0, 37.8, 80.3, and 53.7) and ten CH groups (δ(C) 84.9, 49.4, 83.5, 49.2, 44.0, 44.8, 39.3, 75.4, 82.8, and 61.5), and three quaternary C-atoms (δ(C) 39.0, 85.9, and 50.3). The ^{1}H-NMR spectrum of **1** showed the presence of one CH=CH moiety at δ(H) 6.42 (*d*) and 7.68 (*d*), typical of an *AB* spin system, together with those of five aromatic protons at δ(H) 7.37–7.39 (*m*) and 7.49–7.52 (*m*), which were assigned to a cinnamoyl group. Additionally, in the ^{1}H-NMR spectrum, four MeO groups (δ(H) 3.21 (*s*), 3.24 (*s*), 3.29 (*s*), and 3.37 (*s*)), an acetyl group (δ(H) 1.80 (*s*)) and one *N*-ethyl group (δ(H) 1.07 (*t*), 2.53–2.56 (*m*), and 3.20 (hidden)) were identified.

The ^{1}H,^{1}H-COSY and HMQC experiments indicated the presence of four structural fragments: $CH(OR)CH_2CH_2$ (fragment A), CHCH(OR)CH (fragment B), $CHCHCH_2CHCH(OR)$ (fragment C), and $CHCH_2$ (fragment D) (R = H or Me) (*Fig. 1*). In the HMBC experiment (*Table 1*), long-rang correlations between H–C(1) and the quaternary C(11) and between H–C(3) and the quaternary C(4) identified fragment A as the C(1) to C(3) part of the molecule (*Fig. 1* and *Table 1*). Similarly, two-bond correlations between H–C(5) and the quaternary C(4) and C(11), and between H–C(7) and C(8) and C(17) confirmed that fragment B is identical to the C(5) to C(7) part of the C_{19} diterpene core. The

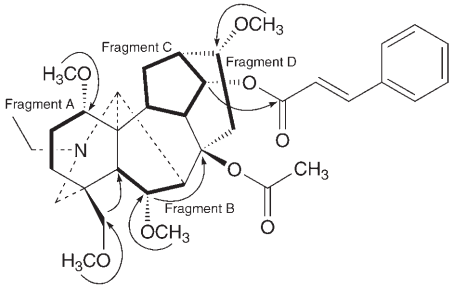


Fig. 1. *Key ^{1}H,^{1}H-COSY* (—) *and key HMBC* (→) *correlations of leucanthumsine A* (**1**)

Table 1. *^1H- (400 MHz) and ^{13}C-NMR (100 MHz) Data of* **1** *and* **2** *in $CDCl_3$.* δ in ppm, J in Hz.

	1			**2**
	δ(H)	δ(C)	HMBC ($^1H \rightarrow {}^{13}C$)	δ(C)
H–C(1)	3.04 (*t*)	84.9 (*d*)	C(2), C(11), C(17), MeO	85.9 (*d*)
H_α–C(2)	1.91–1.94 (*m*)	26.4 (*t*)	C(1), C(11)	26.3 (*t*)
H_β–C(2)	2.35 (*t*, J = 5.2)		–	
CH_2(3)	1.64 (hidden)	34.8 (*t*)	C(1), C(2), C(4)	35.0 (*t*)
C(4)	–	39.0 (*s*)	–	39.2 (*s*)
H–C(5)	2.08 (*d*, J = 6.8)	49.4 (*d*)	C(4), C(11), C(17), C(18)	49.7 (*d*)
H–C(6)	4.06 (*d*, J = 6.8)	83.5 (*d*)	C(7), C(8), C(17), MeO	82.7 (*d*)
H–C(7)	3.04 (*t*)	49.2 (*d*)	C(6), C(8), C(9), C(17)	47.0 (*d*)
C(8)	–	85.9 (*s*)	–	73.8 (*s*)
H–C(9)	2.72 (*t*)	44.0 (*d*)	C(7), C(8), C(10), C(12)	53.5 (*d*)
H–C(10)	1.96–1.98 (*m*)	44.8 (*d*)	C(1), C(11)	44.9 (*d*)
C(11)	–	50.3 (*s*)	–	50.3 (*s*)
H_α–C(12)	2.57–2.59 (*m*)	29.0 (*t*)	C(10), C(14), C(17)	29.3 (*t*)
H_β–C(12)	1.96–1.98 (*m*)		C(10), C(11), C(16)	
H–C(13)	2.36 (*t*, J = 5.2)	39.3 (*d*)	C(10), C(14), C(16)	36.6 (*d*)
H–C(14)	4.94 (*t*, J = 5.2)	75.4 (*d*)	C(8), C(9), OCn	76.9 (*d*)
H_α–C(15)	2.16–2.18 (*m*)	37.8 (*t*)	C(8), C(16)	29.7 (*t*)
H_β–C(15)	2.85–2.91 (*m*)		C(8)	
H–C(16)	3.32 (hidden)	82.8 (*d*)	C(12), C(14), MeO	81.8 (*d*)
H–C(17)	2.84 (*s*)	61.5 (*d*)	C(12)	61.8 (*d*)
CH_2(18)	3.14, 3.64 (*AB*'*q*', J = 8.4)	80.3 (*t*)	C(3), C(4), C(5), C(19), MeO	80.7 (*t*)
CH_2(19)	2.42–2.47 (*m*)	53.7 (*t*)	C(4), C(17), C(18)	53.9 (*t*)
CH_2(21)	2.53–2.56 (*m*), 3.20 (hidden)	49.0 (*t*)	C(17), C(22)	49.1 (*t*)
Me(22)	1.07 (*t*, J = 6.8)	13.4 (*q*)	–	13.6 (*q*)
MeO–C(1)	3.24 (*s*)	56.0 (*q*)	C(1)	56.0 (*q*)
MeO–C(6)	3.21 (*s*)	57.9 (*q*)	C(6)	57.6 (*q*)
MeO–C(16)	3.37 (*s*)	56.6 (*q*)	C(16)	56.1 (*q*)
MeO–C(18)	3.29 (*s*)	59.1 (*q*)	C(18)	59.2 (*q*)
AcO	1.80 (*s*)	22.3 (*q*)		–
	–	169.7 (*s*)	–	
C(1′)	–	134.3 (*s*)	–	134.4 (*s*)
H–C(2′,6′)	7.49–7.52 (*m*)	128.0 (*d*)	C(1′), C(3′), C(4′), C(5′), C(2″)	128.1 (*d*)
H–C(3′,5′)	7.37–7.39 (*m*)	128.9 (*d*)	C(1′), C(2′), C(6′)	128.8 (*d*)
H–C(4′)	7.37–7.39 (*m*)	130.3 (*d*)	C(3′), C(5′), C(2′), C(6′)	130.3 (*d*)
H–C(1″)	6.42 (*d*, J = 16)	118.5 (*d*)	C(1′), C(2″), O=C	118.0 (*d*)
H–C(2″)	7.68 (*d*, J = 16)	144.9 (*d*)	C(1′), C(3′), C(1″), O=C	145.1 (*d*)
O=C	–	166.7 (*s*)	–	166.5 (*s*)

HMBC correlations H–C(10)/C(11), H–C(10)/C(17), H–C(9)/C(8), and H–C(10)/C(8) verified that fragment C constitutes the five-member C ring of the C_{19} skeleton. According to the CH_2(15)/C(8), CH_2(12)/C(16), and H–C(14)/C(16) long-rang ^1H,^{13}C correlations, fragment D could be identified as the C(15)–C(16) part of the molecule. Additionally, the two isolated CH_2 groups were identified as C(18) and C(19) by the ^1H,^{13}C correlations CH_2(18)/C(4), CH_2(19)/C(4), and CH_2(19)/C(17). The above analysis strongly suggested that the compound was an aconitine-type structure [8]. Four MeO groups could be assigned as being bonded to C(1), C(6), C(16), and C(18), due to the correlations MeO–C(1)/C(1), MeO–C(6)/C(6), MeO–C(16)/C(16), and MeO–C(18)/C(18) in the HMBC experiment (*Fig. 1*).

The *t* at δ(H) 4.94 ($J = 5.2$ Hz, 1 H) could be assigned to H_β–C(14) [8], suggesting the presence of an ester function at C(14). In the HMBC plot, H–C(14) (δ(H) 4.94) and H–C(1″) (δ(H) 6.42, *d*, $J = 16$ Hz) showed long-rang correlations with a C=O signal at δ(C) 166.7 (s), suggesting the presence of the cinnamoyl group at C(14) (*Fig. 1*). The chemical shift of C(8) at δ(C) 85.9 (*s*) suggested an AcO–C(8) substitution since C(8) should resonate in the range δ(C) 85.5–86.0 in the case of AcO–C(8) [8].

Leucanthumsine B (**2**) was obtained as a white amorphous powder. The HR-ESI-MS of **2** exhibited a pseudo-molecular ion peak at *m*/*z* 582.3435 corresponding to a molecular formula $C_{34}H_{47}NO_7$ (42 mass units less than that of **1**), suggesting that **2** is a hydrolysis derivative of **1**. The ^{13}C-NMR spectra of **2** were very similar to those of **1**, except for C(7), C(8), C(9), C(13), C(15), and C(16) (*Table 1*), indicating that there is no AcO group in **2**. The fact that the signal of C(8) in **1** was shifted upfield in **2** from δ(C) 85.9 to 73.8 established that the AcO–C(8) was hydrolyzed to OH–C(8). Consequently, the structure of leucanthumsine B was deduced as **2**.

Leucanthumsine C (**3**) exhibited a pseudo-molecular-ion peak at *m*/*z* 438.2845 ($[M+H]^+$) in the HR-ESI-MS, corresponding to the molecular formula $C_{24}H_{39}NO_6$. The IR spectrum showed absorption bands for OH (3397 cm^{-1}), and Me (2918 cm^{-1}) groups. According to the analysis of the 1D-NMR experiments and comparison with the spectra of chasmanine, the compound was determined as **3**.

The ^{13}C-NMR (DEPT) spectrum of **3** showed 19 signals of the C_{19} diterpene core: six CH_2 (δ(C) 26.1, 36.4, 28.5, 39.1, 53.9, and 71.9) and ten CH groups (δ(C) 85.9, 48.7, 82.0, 52.0, 51.7, 38.0, 45.5, 75.5, 82.0, and 62.7), and three quaternary C-atoms (δ(C) 39.7, 72.6, and 50.3). Additionally, in the ^{1}H-NMR spectrum, three MeO groups (δ(H) 3.25 (*s*), 3.35 (*s*), and 3.35 (*s*)), and one *N*-ethyl group (δ(H) 1.08 (*t*)) were identified. From these spectroscopic data and by comparison with the spectra of chasmanine (=(1α,6α,14α,16β)-20-ethyl-1,6,16-trimethoxy-4-(methoxymethyl)aconitane-8-14-diol) [5], the compound had an additional OH group instead of a MeO group. The ^{13}C-NMR spectra of **3** and chasmanine were very similar, except for C(18) due to the substituent effect (MeO *vs.* OH), suggesting that this extra OH group could be located at C(18). This was supported by the loss of 14 mass units as compared with chasmanine.

Leucanthumsine D (**4**) was obtained as a white amorphous powder and gave a molecular-ion peak at *m*/*z* 422, corresponding to a molecular formula $C_{23}H_{35}NO_6$, as confirmed by the HR-ESI-MS ($[M+H]^+$ at *m*/*z* 422.2548). From further data, the structure of leucanthumsine D was elucidated as **4**.

The NMR spectra of **4** (*Table 2*) implied an imine group (δ(H) 7.45, *s*, 1 H; δ(C) 166.6 (*d*)), four MeO groups (δ(H) 3.20, 3.25, 3.34, and 3.36 (each *s*); δ(C) 59.0 (*q*), 55.6 (*q*), 56.9(*q*), and 56.3 (*q*)). The positions of the MeO groups were established by means of HMBC correlations observed between the MeO protons (δ(H) 3.20, 3.25, 3.34, and 3.36) and C(1), C(6), C(16), and C(18). In the ^{1}H-NMR spectrum of **4**, the *t* at δ(H) 4.15 (1 H) was assigned to H_β–C(14), suggesting the presence of an OH–C(14) [8]. The IR (3476 cm^{-1}) and ^{13}C-NMR (δ(C) 71.5 (*s*), 75.2 (*d*)) spectra also showed that a secondary (OH–C(14)) and a tertiary OH group (OH–C(8)) were present [8]. According to the HMBC plot, the imine group could be at C(19) due to the correlations between H–C(19) (δ(H) 7.45) and C(18) (δ(C) 78.2 (*t*)), C(17) (δ(C) 61.6 (*d*)), and C(4) (δ(C) 47.3 (*s*)) (*Fig. 2*).

Leucanthumsine E (**5**), an amorphous powder, showed a pseudo-molecular-ion peak $[M+H]^+$ at *m*/*z* 616.3102 in the HR-ESI-MS, in agreement with the molecular formula $C_{33}H_{45}NO_{10}$. The IR spectrum (KBr) of **5** showed absorption bands at 3446,

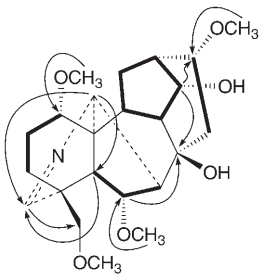


Fig. 2. *Key $^1H,^1H$-COSY (—) and key HMBC (→) correlations of leucanthumsine D* (**4**)

Table 2. *^1H-* (400 MHz) *and ^{13}C-NMR* (100 MHz) *Data of* **4** *in $CDCl_3$.* δ in ppm, J in Hz.

	δ(H)	δ(C)	HMBC ($^1H \rightarrow {}^{13}C$)
H–C(1)	3.14–3.17 (*m*)	84.0 (*d*)	C(2), C(11), C(17), MeO
H_α–C(2)	1.48–1.51 (*m*)	28.8 (*t*)	C(1), C(3), C(4), C(12)
H_β–C(2)	1.81–1.83 (*m*)		C(1), C(4), C(11)
H_α–C(3)	1.54 (*t*, J = 2.0)	24.5 (*t*)	C(1), C(4)
H_β–C(3)	1.84 (hidden)		C(1), C(4), C(11)
C(4)	–	47.3 (*s*)	–
H–C(5)	2.18 (*d*, J = 1.6)	48.0 (*d*)	C(4), C(11), C(17), C(19)
H–C(6)	4.14 (hidden)	82.7 (*d*)	C(7), C(8), C(17), MeO
H–C(7)	2.04 (*t*, J = 5.2)	47.2 (*d*)	C(8), C(9), C(12), C(14)
C(8)	–	71.5 (*s*)	–
H–C(9)	2.12 (*t*, J = 7.6)	57.6 (*d*)	C(6), C(7), C(8), C(10)
H–C(10)	2.35–2.39 (*m*)	37.8 (*d*)	C(7), C(13), C(16)
C(11)	–	50.3 (*s*)	–
H_α–C(12)	1.85–1.86 (*m*)	27.7 (*t*)	C(10), C(11), C(13), C(16)
H_β–C(12)	1.71–1.75 (*m*)		C(8), C(10), C(14), C(17)
H–C(13)	1.76–1.78 (*m*)	45.7 (*d*)	C(10), C(12), C(14), C(16)
H–C(14)	4.15 (*t*, J = 4.8)	75.2 (*d*)	C(8), C(10), C(16)
H_α–C(15)	2.14 (*t*, J = 7.6)	37.8 (*t*)	C(8), C(16)
H_β–C(15)	2.57–2.64 (*m*)		C(8), C(9), C(16)
H–C(16)	3.47 (br. *d*, J = 8.8)	81.8 (*d*)	C(8), C(14), MeO
H–C(17)	4.03 (*s*)	61.6 (*d*)	C(5), C(6), C(9), C(19)
CH_2(18)	3.67, 3.82 (*AB*'*q*', J = 8.8)	78.2 (*t*)	C(4), C(19), MeO
H–C(19)	7.45 (*s*)	166.6 (*d*)	C(4), C(17), C(18)
MeO–C(1)	3.36 (*s*)	56.3 (*q*)	C(1)
MeO–C(6)	3.25 (*s*)	56.9 (*q*)	C(6)
MeO–C(16)	3.20 (*s*)	55.6 (*q*)	C(16)
MeO–C(18)	3.34 (*s*)	59.0 (*q*)	C(18)

1724, and 1453 cm^{-1} assignable to the OH, C=O, and Ph groups, respectively. Based on further spectral analyses, the structure of leucanthumsine E was assigned as **5**.

The 1D- and 2D-NMR spectra of **5** (*Table 3*) revealed the distinctive characteristics of an aconitine-type alkaloid [8]. An *N*-ethyl group (δ(H) 1.18 (*t*, J = 7.2 Hz, 3 H); δ(C) 48.4 (*t*) and 12.8 (*q*)), three MeO groups (δ(H) 3.18, 3.30, and 3.57 (each *s*); δ(C) 57.9 (*q*), 59.1 (*q*), and 59.1 (*q*)), one acetyl group

(δ(H) 1.32 (*s*, 3 H); δ(C) 169. 8 (*s*) and 21.4 (*q*)) and a benzoyl group (δ(H) 7.45, 7.56, and 8.06; δ(C): see *Table 3*) were present in the structure according to the NMR spectra. In the HMBC plot, the correlations MeO–C(6)/C(6), MeO–C(16)/C(16), and MeO–C(18)/C(18) showed that the three MeO groups could be positioned at C(6), C(16), and C(18) (*Fig. 3*). The *d* at δ(H) 4.92 (J = 5.2 Hz, 1 H) in the ^{1}H-NMR spectrum of **5** was assigned to H_β–C(14), suggesting the presence of a benzoyl group. The upfield signal at δ(H) 1.32 of the acetyl group which was affected by BzO–C(14), together with a signal at δ(C) 85.5 (*s*), suggested that the acetyl group was attached to C(8) [8]. In the 1D-NMR, the fact that the chemical shift of MeO–C(16) was shifted downfield to δ (H) 3.57, besides the *d* for the H–C(14) signal, indicated the presence of an OH group at C(13). The other two OH groups were located at C(1) and C(3) based on the chemical shifts of these two C-atoms and the HMBC correlations (*Fig. 3*).

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Table 3. *^{1}H-* (600 MHz) *and ^{13}C-NMR* (150 MHz) *Data of* **5** *in $CDCl_3$.* δ in ppm, J in Hz.

	δ(H)	δ(C)	HMBC (^{1}H → ^{13}C)
H–C(1)	3.75 (br. *s*)	72.2 (*d*)	–
H_α–C(2)	1.81 – 1.83 (*m*)	37.9 (*t*)	–
H_β–C(2)	1.95 (br. *d*, J = 8.0)		–
H–C(3)	4.12 (br. *d*, J = 4.8)	71. 8 (*d*)	C(1), C(18)
C(4)	–	44.2 (*s*)	–
H–C(5)	2.10 (hidden)	39.1 (*d*)	C(4), C(6), C(10), C(17)
H–C(6)	4.0 (br. *d*, J = 6.8)	83.3 (*d*)	C(5), C(8), MeO
H–C(7)	3.09 (*s*)	48.2 (*d*)	C(5), C(6), C(8), C(11), C(17)
C(8)	–	85.5 (*s*)	–
H–C(9)	2.84 (hidden)	43.6 (*d*)	C(6), C(7), C(8), C(10), C(11)
H–C(10)	2.13 (hidden)	46.0 (*d*)	C(7), C(9), C(11), C(17)
C(11)	–	49.8 (*s*)	–
H_α–C(12)	2.25 (br. *s*)	36.2 (*t*)	C(10), C(13)
H_β–C(12)	2.06 (*d*, J = 4.4)		C(10)
H–C(13)	–	74.6 (*s*)	–
H–C(14)	4.92 (*d*, J = 5.4)	79.0 (*d*)	C(8), C(13)
H_α–C(15)	2.42 (*d*, J = 8.8)	40.3 (*t*)	C(7)
H_β–C(15)	3.07 (*d*, J = 8.8)		C(13)
H–C(16)	3.50 (hidden)	83.3 (*d*)	C(12), C(14), MeO
H–C(17)	2.84 (hidden)	63.1 (*d*)	C(7), C(10), C(11)
CH_2(18)	3.45, 3.48 (hidden, *AB*'*q*')	79.3 (*t*)	C(3), C(19), MeO
CH_2(19)	2.40 (*s*), 3.15 (*s*)	47.9 (*t*)	C(3), C(4), C(5), C(17), C(21)
CH_2(21)	2.58 – 2.63 (*m*), 3.09 (br. *s*)	48.4 (*t*)	C(17), C(19)
Me(22)	1.18 (*t*, J = 7.2)	12.8 (*q*)	C(21)
MeO–C(6)	3.18 (*s*)	57.9 (*q*)	C(6)
MeO–C(16)	3.57 (*s*)	59.1 (*q*)	C(16)
MeO–C(18)	3.30 (*s*)	59.1 (*q*)	C(18)
AcO	1.32	169.8 (*s*), 21.4 (*q*)	–
O=C	–	166.1 (*s*)	–
C(1′)	–	130.0 (*s*)	–
H–C(2′,6′)	8.06 (*d*, J = 6.8)	129.6 (*d*)	C(4′), O=C
H–C(3′,5′)	7.45 (*t*, J = 8.0)	128.6 (*d*)	C(1′)
H–C(4′)	7.56 (*t*, J = 7.6)	133.2 (*d*)	C(2′), C(6′)

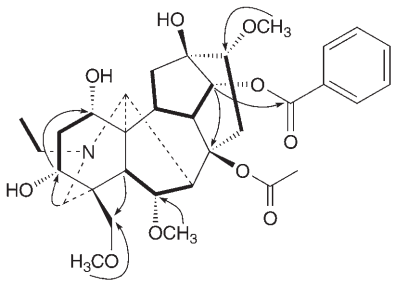

Fig. 3. *Key* $^1H,^1H$*-COSY* (—) *and key HMBC* (→) *correlations of leucanthumsine E* (**5**)

Experimental Part

General. TLC: silica-gel plates; detection by spraying with *Dragendorff* reagent. Column chromatography (CC): silica gel (300–400 mesh, 10–40 μm; *Qindao Sea Chemical, Inc.*). M.p.: thermal-values analysis with a microscope; uncorrected. Optical rotations: *Perkin-Elmer 341* polarimenter. IR Spectra: *Nicolet FT-IR 200S* spectrometer; KBr pellets; in cm^{-1}. ^1H- and ^{13}C-NMR Spectra: *Varian Unity-INOVA-400/54* and *Bruker AV-600* spectrometers: at 400/100 or 600/150 MHz, resp.; δ in ppm rel. to $SiMe_4$, *J* in Hz. ESI-MS: *Finnigan LCQ*; in *m/z* (rel.%). HR-ESI-MS: *Micromass Auto-Ultima-Tof* spectrometer.

Plant Material. The *Aconitum sungpanense* var. *leucanthum* W. T. WANG was collected by *Wen-Jing Zhang* in Chengkou County of Chongqing, China, in September 2002, and authenticated by Prof. *Qing-Er Yang* of the Institute of Botany, Chinese Academy of Sciences. A voucher specimen was deposited in the West China College of Pharmacy, Sichuan University.

Extraction and Isolation. Powder roots of *Aconitum sungpanense* var. *leucanthum* (5.0 kg) were percolated with 0.1M HCl (50 l). The filtrate was then alkalinized with 28% aq. NH_4OH soln. (2.0 l) to pH ≥ 10 and extracted with AcOEt (each 20 l) for 4 cycles, the extract concentrated, and the crude alkaloids (28 g) subjected to CC (silica gel, cyclohexane/Me_2CO 15:1 → 10:1): *Fr. A* (3.0 g), *B* (5.8 g), *C* (8.4 g), *D* (2.0 g), and *E* (5.0 g). *Fr. A* (3.0 g) was subjected to CC (silica gel, cyclohexane/Me_2CO 8:1): *crassicaudine* (20 mg), *chasmanine* (1.5 g), *talstisanmine* (30 mg), *1*-O-*methyldelphisine* (20 mg), and *leucanthumsine A* (**1**; 40 mg). CC (silica gel, $CHCl_3$/Me_2CO 6:1) of *Fr. C* afforded *ezchasmanine* (20 mg), *indaconitine* (1.0 g), and *leucanthumsine B* (**2**; 10 mg). *Fr. D* was subjected to CC (silica gel, $CHCl_3$/Me_2CO 3:1): *pseudaconine* (50 mg), *leueantine D* (4 mg), *leucanthumsine C* (**4**; 30 mg), *neoline* (30 mg), *leucanthumsine D* (**3**; 20 mg), and *leucanthumsine E* (**5**; 5 mg). The known alkaloids were confirmed by comparison with authentic samples (TLC (silica gel GF_{254}, cyclohexane/Me_2CO 2:1; $CHCl_3$/Me_2CO 6:1), chemical methods, and ^1H- and ^{13}C-NMR data).

Leucanthumsine A (=*(1α,6α,14α,16β)-8-(Acetyloxy)-20-ethyl-1,6,16-trimethoxy-4-(methoxymethyl)-aconitan-14-yl (2*E*)-3-Phenylprop-2-enoate*; **1**): White amorphous power. M.p. 100–102°. $[\alpha]_D^{20} = +12.1$ ($c = 1.0$, $CHCl_3$). IR (KBr): 2925, 1715, 1637, 1452, 1239, 1090. ^1H- and ^{13}C-NMR: *Table 1*. ESI-MS: 624 (100, $[M+H]^+$), 564 (22), 532 (10). HR-ESI-MS: 624.3534 ($[M+H]^+$, $C_{36}H_{50}NO_8^+$; calc. 624.3531).

Leucanthumsine B (=*(1α,6α,14α,16β)-20-Ethyl-8-hydroxy-1,6,16-trimethoxy-4-(methoxymethyl)-aconitan-14-yl (2*E*)-3-Phenylprop-2-enoate*; **2**): White amorphous powder. M.p. 97–98°. $[\alpha]_D^{20} = +41.7$ ($c = 1.0$, $CHCl_3$). IR (KBr): 3446, 2924, 1714, 1094. ^{13}C-NMR: *Table 1*. HR-EI-MS: 582.3435 ($[M+H]^+$, $C_{34}H_{48}NO_7^+$; calc. 582.3425).

Leucanthumsine C (=*(1α,6α,14α,16β)-20-Ethyl-4-(hydroxymethyl)-1,6,16-trimethoxyaconitane-8,14-diol*; **3**): White amorphous powder. M.p. 152–154°. $[\alpha]_D^{20} = +53.0$ ($c = 1.0$, $CHCl_3$). IR (KBr): 3397, 2918. ^1H-NMR (400 MHz, $CDCl_3$): 1.08 (*t*, *J* = 7.2, *Me*CH_2N); 3.25, 3.35, 3.35 (3*s*, 3 MeO); 3.60 (*s*, H–C(17)); 3.48, 3.73 (*AB*'*q*', *J* = 4.4, 2 H); 4.14 (*t*, *J* = 4.4, H_β–C(14)); 4.28 (*d*, *J* = 6.8, H_β–C(6)). ^{13}C-NMR (100 MHz, $CDCl_3$): 13.6 (*q*, C(22)); 26.1 (*t*, C(2)); 28.5 (*t*, C(12)); 36.4 (*t*, C(3)); 38.0 (*d*, C(10)); 39.1 (*t*, C(15)); 39.7 (*s*, C(4)); 45.5 (*d*, C(13)); 48.7 (*d*, C(5)); 49.4 (*t*, C(21)); 50.3 (*s*, C(11)); 51.7 (*d*, C(9)); 52.0 (*d*, C(7)); 53.9 (*t*, C(19)); 55.9 (*q*, *Me*O–C(16)); 56.3 (*q*, *Me*O–C(1)); 57.3 (*q*, *Me*O–C(6)); 62.7 (*d*, C(17)); 71.9 (*t*, C(18)); 72.6 (*s*, C(8)); 75.5 (*d*, C(14)); 82.0 (*d*, C(6)); 85.9 (*d*, C(1)).

ESI-MS: 438 (100, $[M+H]^+$), 406 (10, $[M-HOCH_3+H]^+$). HR-ESI-MS: 438.2845 ($[M+H]^+$, $C_{24}H_{40}NO_6^+$; calc. 438.2850).

Leucanthumsine D (=*(1α,6α,14α,16β)-1,6,16-Trimethoxy-4-(methoxymethyl)aconitan-19-ene-8,14-diol*; **4**): White amorphous power. M.p. 150–152°. $[\alpha]_D^{20} = +64.1$ ($c = 1.0$, $CHCl_3$). IR (KBr): 3476, 2933, 1635, 1097. ^{1}H- and ^{13}C-NMR: *Table 2*. ESI-MS: 422 (100, $[M+H]^+$), 390 (11, $[M-MeOH+H]^+$). HR-ESI-MS: 422.2548 ($[M+H]^+$, $C_{23}H_{36}NO_6^+$; calc. 422.2537).

Leucanthumsine E (=*(1α,3α,6α,14α,16β)-20-Ethyl-6,16-dimethoxy-4-(methoxymethyl)aconitane-1,3,8,13,14-pentol 8-Acetate 14-Benzoate*; **5**): White amorphous powder. M.p. 95–96°. $[\alpha]_D^{20} = +13.2$ ($c = 1.0$, $CHCl_3$). IR (KBr): 3446, 2925, 1724, 1453, 1282. ^{1}H- and ^{13}C-NMR: *Table 3*. ESI-MS: 616 (100, $[M+H]^+$), 578 (16), 556 (12). HR-ESI-MS: 616.3102 ($[M+H]^+$, $C_{33}H_{46}NO_{10}^+$; calc. 616.3116).

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