Abietane Diterpene Alkaloids from *Salvia Yunnanensis*

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Nine new abietane diterpene alkaloids containing an oxazole ring, salviamines A−F (**1**−**6**) and isosalviamines C−E (**7**−**9**), together with 17 known abietane diterpenes, were isolated and characterized from the roots of *Salvia yunnanensis*. The structures of **1**−**9** were elucidated by interpretation of their spectroscopic data.

The genus *Salvia* (Lamiaceae), consisting of some 500 species, has been used worldwide in folk medicine since ancient times,[1−3] due to the wide spectrum of biological activities of the constituents as antibacterial, antiplasmodial, antituberculosis, antiphlogistic, cardioactive, antidiabetic, antiinflammatory, analgesic, antipyretic, antispasmodic, antitumor, antiviral, hallucinogenic, trypanocidal, antifungal, and antioxidant agents.[4] One of the most widely studied species, *S. miltiorrhiza*, the rhizomes of which are called "Danshen", has been used in traditional Chinese medicine (TCM) for the treatment of menstrual disorders, menostasis, menorrhalgia, insomnia, arthritis, and coronary heart diseases, particularly angina pectoris and myocardial infarction, and has been reported to contain tanshinone diterpenes.[5] Several tanshinone diterpenes were shown to possess various biological and pharmacological activities, including antitumor, antimicrobial, antioxidant, antiinflammatory, antiplatelet aggregation, and antiallergic activities.[6] Recently, Don et al. reported nitrogen-containing diterpenes from *S. miltiorrhiza*, some of which showed cytotoxicity against the HeLa, HepG2, and OVCAR-3 cell lines.[7]

Salvia yunnanensis C. H. Wright is a herbaceous perennial widely distributed over the southwest provinces Yunnan, Guizhou, and Sichuan of mainland China.[1−3] The roots of this plant have been used as a substitute for "Danshen" in traditional Chinese medicine. This plant was reported to have a higher content of tanshinone II A than that of *S. miltiorrhiza*.[8] Previous studies on this species have focused only on its water-soluble constituents, due to their high antioxidative activity.[9,10] A chemical study in our laboratory has led to the isolation of 26 abietane-type diterpenoids from the roots of *S. yunnanensis*. Among them, 10 compounds, salviamines A−F (**1**−**6**) and isosalviamines C−E (**7**−**9**), and neosalvianen contain nitrogen in an oxazole ring. Herein we report the isolation, identification, and structure elucidation of a series of new diterpene alkaloids (**1**−**9**; Chart 1).

Results and Discussion

The powdered roots of *S. yunnanensis* were extracted with MeOH, and the concentrated extract was portioned into $CHCl_3$ and H_2O solubles. The $CHCl_3$ solubles were subjected to a series of column chromatographic purification steps to afford the pure diterpene alkaloids **1**−**9**.

The UV, IR, and ^1H and ^{13}C NMR data indicated that compounds **1**−**9** belong to the abietane diterpene alkaloids with oxazole rings by direct comparison with the metabolites of *Salvia* species reported in the literature.[7]

Salviamine A (**1**) was obtained as pale yellow needles. HREIMS analysis of this compound suggested a molecular formula of $C_{19}H_{13}NO_2$, implying 14 centers of unsaturation and/or ring structures in the molecule. The ^1H NMR spectrum of **1** exhibited typical resonances for a tanshinone-type structure, with signals for an aromatic AMX system at δ 9.33 (1H, d, J = 8.4 Hz), 7.68 (1H, dd, J = 8.4, 7.2 Hz), and 7.52 (1H, d, J = 7.2 Hz), a methyl singlet at δ 2.83, a pair of ortho-coupled doublets at δ 8.15 and 8.41 (each 1H, J = 8.8 Hz), and a quartet at δ 7.69 (1H, J = 1.2 Hz) that was long-range-coupled with a methyl doublet at δ 2.65 (3H, J = 1.2 Hz) for a 3-methylfuran moiety. The ^{13}C NMR spectrum showed 19 carbon signals, including 2 methyls, 7 methines, and 10 quaternary carbons. These ^1H and ^{13}C NMR data resembled the literature values of tanshinone I, a principal constituent of several *Salvia* species,[11] except for the signals of H-1, C-11, and C-12 and an additional methine proton and its attached carbon. According to the molecular formula of **1**, and from the absence of two carbonyl groups and the appearance of an extra methine group at δ_H 8.46 (s) and δ_C 152.0, together with characteristic IR absorption bands at 1512 and 819 cm^{-1} for an OC═N group, the remaining moiety was characterized by the presence of an oxazole ring instead of an *o*-quinone group in tanshinone I. This assignment was also supported by the prominent fragment peak at *m*/*z* 245 due to a $[M - OCN]^+$ ion in the EIMS. Recently, Don et al. explained the orientation of nitrogen and oxygen atoms of oxazole rings on the basis of C-11 and C-12 chemical shift values and semisynthesis.[7] Since the C-11 (144.1) and C-12 (132.2) resonances of **1** matched well with those of neosalvianen,[7] the N atom in the oxazole ring was attached to C-11 and, thus, the O atom to C-12. On the basis of the above spectroscopic evidence, the structure **1** was assigned for salviamine A.

Salviamine B (**2**) was obtained as yellow needles, with a molecular formula of $C_{18}H_{13}NO_3$, as determined by its HREIMS. The ^1H NMR spectrum of **3** (Table 1) also displayed signals for an AMX system, a pair of ortho-coupled doublets, and a singlet at δ 8.37 for a proton in the oxazole ring similar to those of **1**. However, the absence of signals typical of a furan ring indicated that compound **2** differs from **1** in ring D. The presence of a downfield singlet at δ 14.48, attributable to a hydrogen-bonded hydroxyl group, and a methyl singlet at δ 3.14 in the ^1H NMR spectrum (Table 1) together with the corresponding carbon at δ 31.5 and a carbonyl carbon at δ 203.2 in the ^{13}C NMR spectrum implied that the $-COCH_3$ and OH groups are at ortho positions (C-13 and C-14), instead of being part of a furan ring as in **2**. In the HMBC spectrum, the ^3J correlations of H-6 (δ 8.08) to C-8 (δ 121.8) and the hydroxyl group (δ 14.48) to C-8 and C-13 (δ 107.4) and the ^2J and ^3J correlations of the methyl signal (δ 3.14) to C-16 (δ 203.2) and C-13 confirmed these assignments (Figure 1). This functional group arrangement might be formed due to the oxidative cleavage of a furan ring. Thus, structure **2** was proposed for salviamine B.

Salviamine C (**3**) was purified as yellow needles and exhibited spectroscopic data similar to those of **2**. The HREIMS of this compound showed a molecular ion at *m*/*z* 305.1055 ($C_{19}H_{15}NO_3$),

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Chart 1

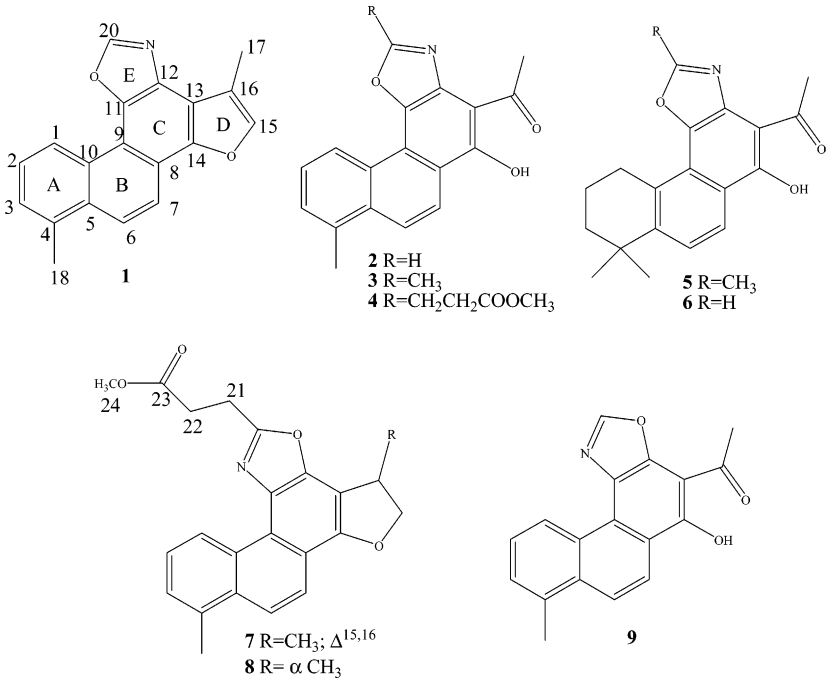

Table 1. ^{1}H NMR Data of Compounds **1**−**9**[a]

H	1	2	3	4	5	6	7	8	9
1	9.33 d (8.4)	9.25 d (8.4)	9.25 d (8.4)	9.19 d (8.4)	3.41 t (6.4)	3.45 t (6.4)	10.25 d (8.4)	10.13 d (8.4)	10.21 d (8.4)
2	7.68 dd (8.4, 7.2)	7.67 dd (8.4, 7.2)	7.65 dd (8.4, 7.2)	7.66 dd (8.4, 7.2)	1.98 m	1.98 m	7.66 dd (8.4, 7.2)	7.62 dd (8.4, 7.2)	7.69 dd (8.4, 7.2)
3	7.52 d (7.2)	7.59 d (7.2)	7.58 d (7.2)	7.58 d (7.2)	1.76 m	1.78 m	7.49 d (7.2)	7.47 d (7.2)	7.59 d (7.2)
6	8.15 d (8.8)	8.08 d (8.8)	8.04 d (8.8)	8.04 d (8.8)	8.35 d (8.8)	8.39 d (8.8)	8.11 d (8.8)	7.96 d (8.8)	8.09 d (8.8)
7	8.41 d (8.8)	8.51 d (8.8)	8.51 d (8.8)	8.51 d (8.8)	7.55 d (8.8)	7.61 d (8.8)	8.37 d (8.8)	8.01 d (8.8)	8.50 d (8.8)
14		14.48 s	14.41 s	14.36 s	14.62 s	14.70 s			14.28 s
15	7.69 q (1.2)						7.63 q (0.8)	5.00 t (8.8), 4.43 dd (8.8, 6.8)	
16								4.09 m	
17	2.65 d (1.2)	3.14 s	3.13 s	3.10 s	3.06 s	3.08 s	2.55 d (0.8)	1.56 d (9.2)	2.99 d (0.8)
18, 19	2.83 s	2.81 s	2.81 s	2.81 s	1.39 s	1.39 s	2.82 s	2.77 s	2.82 s
20	8.46 s	8.37 s				8.21 s			8.29 s
21			2.85 s	3.08 t (7.2)	2.73 s		3.13 t (7.2)	3.08 t (7.6)	
22				3.49 t (7.2)			3.47 t (7.2)	3.40 t (7.6)	
24				3.77 s			3.78 s	3.78 s	

[a] Chemical shifts are given as δ values, with coupling constants in Hz given in parentheses (in $CDCl_3$, 400 MHz; TMS as internal standard).

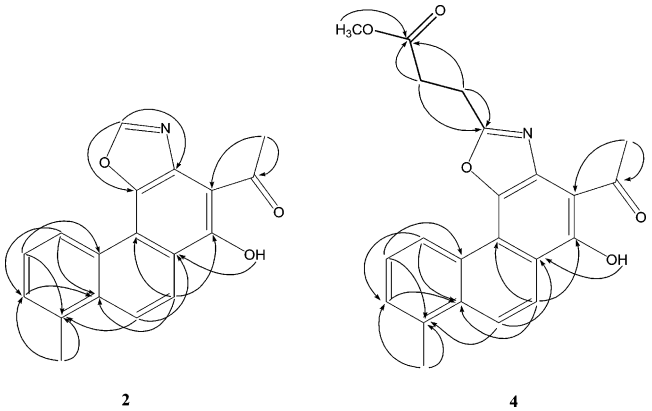

Figure 1. HMBC correlations for compounds **2** and **4**.

14 amu higher than that of **2**, suggesting the occurrence of an additional methyl group in the molecule compared to **2**. The NMR data (Table 1) of these two compounds were also closely related, indicating the presence of the same basic skeleton in **3**. However, the signals of H-20 and C-20 in the ^{1}H and ^{13}C NMR spectra of **3** were replaced by those of a methyl group (δ_H 2.85 and δ_C 15.1) and a quaternary carbon (δ_C 163.1), respectively. From this spectroscopic comparison, compound **3** could be proposed as being a 21-methyl derivative of salviamine B (**2**) and has been named salviamine C.

Salviamine D (**4**) was isolated as yellow needles with a molecular formula of $C_{22}H_{19}NO_5$, through its HREIMS data at *m*/*z* 377.1264. The spectroscopic data of **4** were clearly similar to those of **2** (Tables 1 and 2). The only significant difference indicated the obvious presence of a $-CH_2CH_2COOCH_3$ side chain at δ 3.08 (2H, t, J = 7.2 Hz), 3.49 (2H, t, J = 7.2 Hz), and 3.77 (3H, s), instead of an H-20 singlet in **2**. Signals of this side chain in the ^{13}C NMR spectrum (Table 2) were assigned with the aid of HMQC and HMBC experiments. The ^2J and ^3J correlations of H-21 (δ 3.08) and H-22 (δ 3.49) with C-20 (δ 164.6) confirmed the placement of this side chain at C-20. The proposed structure was further confirmed by the prominent ion peaks at *m*/*z* 363, 319, and 248 due to $[M - CH_3]^+$, $[M - CH_3 - COO]^+$, and $[M - CH_3 - COO - C_2H_4 - NCO]^+$ ions in the EIMS. Therefore, structure **4** was proposed for salviamine D.

Salviamine E (**5**) was obtained as a yellow powder. Its HREIMS data inferred a molecular formula of $C_{20}H_{21}NO_3$. The ^{1}H NMR spectrum exhibited two aromatic protons at δ 8.35 and 7.55 (each 1H, d, J = 8.8 Hz), three aliphatic methylene protons at δ 3.41 (2H, t, J = 6.4 Hz), 1.98, and 1.76 (each 2H, m), and three tertiary methyl signals at δ 2.73 (3H, s) and 1.39 (6H, s). The ^{13}C NMR spectrum showed 20 carbon signals, which were assigned to 4

Table 2. ^{13}C NMR Data of Compounds **1**−**8**[a]

C	1	2	3	4	5	6	7	8
1	124.7	125.7	126.0	125.8	29.4	29.3	126.1	126.2
2	127.0	127.0	127.0	127.8	19.6	19.5	126.3	126.3
3	127.6	129.6	129.6	129.5	38.5	38.4	127.4	127.3
4	134.9	134.9	135.0	134.9	34.9	34.9	134.2	134.1
5	130.6	133.0	133.2	133.1	149.1	149.5	130.8	131.3
6	123.4	123.0	122.5	122.5	122.9	123.0	118.8	122.7
7	119.0	121.4	120.9	121.6	124.9	125.6	122.5	125.6
8	117.5	121.8	121.7	121.0	121.9	122.7	116.8	115.7
9	114.3	122.5	122.4	122.4	124.3	124.3	119.7	120.0
10	128.0	126.8	126.9	126.8	129.6	130.0	130.1	129.9
11	144.1	145.9	141.4	143.6	141.2	140.9	133.0	134.1
12	132.2	136.3	138.1	137.7	136.5	135.2	143.0	143.0
13	106.3	107.4	107.6	113.9	106.4	106.4	112.2	110.8
14	149.7	160.9	160.5	160.4	161.8	164.5	150.5	151.0
15	142.1						141.6	79.5
16	116.5	203.2	204.6	204.4	204.4	204.1	114.7	51.9
17	9.3	31.5	31.7	31.5	31.5	31.4	9.3	29.7
18, 19	20.0	20.0	20.2	20.0	31.7	31.7	20.2	20.2
20	152.0	151.4	163.1	164.6	162.1	150.9	162.3	162.4
21			15.1	31.0	14.9		31.0	31.0
22				24.1			24.0	24.1
23				172.6			172.6	172.2
24				52.0			52.0	51.9

[a] Chemical shifts are given as δ values (in $CDCl_3$, 100 MHz, TMS as internal standard).

methyls, 3 saturated methylenes, 2 aromatic methines, and 11 quaternary carbons (one saturated at δ 34.9, one carbonyl at δ 204.4, and nine aromatic). Analysis of the HMQC spectrum revealed that the signals at δ_H 1.39 and δ_C 31.7 could be ascribed to two equivalent methyl groups. The COSY NMR correlations between the signals at δ 1.98, 3.41, and 1.76 inferred the presence of three consecutive methylene groups. These data were identical with those of the known compound neosalvianen.[7] Instead of D ring signals in the ^1H and ^{13}C NMR spectra of **5**, a hydrogen-bonded hydroxyl group was evident at δ 14.62 and signals for a $-COCH_3$ group at δ_H 3.06 and δ_C 31.5 and 204.4 (Tables 1 and 2) occurred as in **2**. The attachment of these groups on ortho carbons (C-14 and C-13, respectively) was confirmed by connectivities in the HMBC spectrum between OH-14 and a carbon at δ_C 161.8 (C-14) between CH_3-17 and carbons at δ_C 204.4 (C-16) and 106.4 (C-13). Accordingly, structure **5** was elucidated for salviamine E.

Salviamine F (**6**) was obtained as a yellow syrup. The molecular formula of **6** was established as $C_{19}H_{19}NO_3$ by HREIMS, suggesting the absence of a methyl group in the molecule in comparison to **5**. Accordingly, the ^1H and ^{13}C NMR spectra displayed signals very close to those of **5**, except for the absence of a C-20 methyl group. The HMQC cross-peak from a proton singlet at δ 8.21 to a carbon at δ_C 150.9 implied that **6** (salviamine F) is a C-20 demethyl derivative of **5**.

Isosalviamine C (**7**) was obtained as pale yellow needles with the molecular formula $C_{23}H_{19}NO_4$ deduced from the HREIMS. This was in good agreement with the 23 carbon atom resonances observed in the ^{13}C NMR spectrum, which were assigned to 1 methoxyl, 2 methyls, 2 methylenes, 6 methines, and 12 quaternary carbons, including one carbonyl group. The ^1H NMR spectrum (Table 1) exhibited three aromatic protons at δ 10.25 (1H, d, J = 8.4 Hz), 7.66 (1H, dd, J = 8.4, 7.2 Hz), and 7.49 (1H, d, J = 7.2 Hz), a pair of doublets at δ 8.11 and 8.37 (each 1H, d, J = 8.8 Hz), a quartet at δ 7.63 (1H, J = 0.8 Hz), and a methyl doublet at δ 2.55 (3H, J = 0.8 Hz). The absence of a singlet for H-20 and the presence of two mutually coupled methylene signals at δ 3.13 and 3.47 (each 2H, t, J = 7.2 Hz) and a methoxyl group at δ 3.78 (3H, s), assignable to a $CH_2CH_2COOCH_3$ unit as in **4**, indicated that this same group was substituted at C-20. This inference was confirmed by correlations between H-24/C-23 and H-22, H-21/C-20, C-23 in the HMBC NMR spectrum. Comparison of the ^1H and ^{13}C NMR data of the basic skeleton with those of **1** suggested that the N atom in the oxazole ring of **7** was attached to C-11, as it resonated at δ 133.0, with the C-12 signal occurring at δ 143.0 and H-1 shifted downfield to δ 10.25. The proposed structure was also supported by the prominent ion peaks at m/z 314 and 286 due to $[M - CH_3 - COO]^+$ and $[M - CH_3 - COO - C_2H_4]^+$ ions in the EIMS. Thus, the structure of this compound (isosalviamine C) was assigned as **7**.

Isosalviamine D (**8**) was isolated as an optically active pale yellow syrup. HREIMS analysis of its molecular ion at m/z 375.1470, 2 amu higher than that of **7**, indicated a molecular formula of $C_{23}H_{21}NO_4$. The ^1H NMR spectroscopic data of **8** resembled those of **7**, consistent with an abietane diterpene alkaloid with an oxazole ring substituted by a $-CH_2CH_2COOCH_3$ unit at the C-20 position. NMR analysis of the two compounds revealed differences in ring D of these molecules. Accordingly, the ^1H NMR spectrum of **8** showed a methyl doublet at δ 1.56 (3H, J = 9.2 Hz), a multiplet at δ 4.09, and a set of methylene protons at δ 5.00 (1H, t, J = 8.8 Hz) and 4.43 (1H, dd, J = 8.8, 6.8 Hz) and indicated that ring D was saturated in **8**. In the COSY spectrum, correlations of the methine signal at δ 4.09 with the oxygenated methylene protons at δ 5.00 and 4.43 and the methyl group at δ 1.56 were also observed. The absolute configuration at C-16 was determined by comparison of the optical rotation with that of (*S*)-dihydrodanshinone-I,[9] reported from *S. miltiorrhiza*. Therefore, the optical rotation of **8** was supportive of an *R* configuration at C-16. The structure of this compound (isosalviamine D) was therefore determined as **8**.

Isosalviamine E (**9**) was isolated as yellow needles. According to its HREIMS, it gave a molecular formula of $C_{18}H_{13}NO_3$, corresponding to that observed for compound **2**. The NMR spectroscopic data of **9** were consistent with the diterpene alkaloid skeleton. Nevertheless, in this molecule, the signals at δ 10.21 (1H, d, J = 8.4 Hz) for H-1 and δ 2.99 (3H, d, J = 0.8 Hz) for CH_3-17, typically shifted downfield and upfield, respectively, with respect to compounds with a nitrogen in an oxazole ring attached to C-12 as in **2** and **3**, indicated a change in the oxazole ring orientation. Thus, the structure of **9** was defined as an iso form of compound **2** and was named isosalviamine E.

Full assignments of the ^1H and ^{13}C NMR spectroscopic resonances of all the above compounds were made by thorough analysis of the COSY, HMBC, HMQC, and NOESY spectra. The detailed analysis of ^1H NMR data of salviamines and isosalviamines obtained in this study led us to formulate a method to distinguish these two series of compounds. Thus, the H-1 resonance shifts downfield to δ 10.25 and H-17 shifts upfield to 2.50 in the iso series, in comparison to the salviamine series, where the H-1 and H-17 signals occur at δ 9.25 and 2.65, respectively.

In addition, a known diterpene alkaloid, neosalvianen, and 16 known abietane diterpenoids, tanshinone I,[11] tanshinone IIA,[11] danshexinkun B,[12] isotanshinone I,[12] nortanshinone,[12] 1,2-dihydrotanshinone,[13] dihydrotanshinone I,[9] dihydroisotanshinone I,[11] cryptotanshinone,[11] salvipisone,[15] danshenspiroketalactone,[13] sugiol,[14] ferruginol,[14] 6α-hydroxy-7-oxoferruginol,[14] montbretol,[16] and dehydrosugiol,[13] were also isolated and identified from the roots of *S. yunnanensis*.

Experimental Section

General Experimental Procedures. Melting points were measured on a Yanagimoto MP-S3 micro melting point apparatus and are uncorrected. Optical rotations were determined on a JASCO DIP-370 polarimeter. The UV spectra were recorded on a Hitachi U-3210 spectrophotometer. The IR spectra were recorded on a Shimadzu FT IR-8501 spectrophotometer. The ^1H and ^{13}C NMR spectra were recorded with Varian Unity Plus and Bruker AMX-400 spectrometers. All chemical shift values are given in ppm (δ) from TMS as an internal standard. Mass spectra were obtained with a VG 70-250S spectrometer.

Plant Material. The roots of *Salvia yunnanensis* were collected in Li Jiang, Yunnan Province, People's Republic of China, in Sept 1997 by Miss S. Zhang, Institute of Materia Medica, Chinese Academy of

Medicinal Sciences, Beijing, People's Republic of China, and identified by Professor C. S. Kuoh, Department of Life Sciences, National Cheng Kung University, Tainan, Taiwan. Permission was obtained to export the plant material from the People's Republic of China into Taiwan. A voucher specimen (TSWu 97201) has been deposited in the Herbarium of the National Cheng Kung University, Tainan, Taiwan.

Extraction and Isolation. The dried roots of *S. yunnanensis* (9.1 kg) were extracted with MeOH (8 × 20 L) under reflux. The combined extracts were concentrated under reduced pressure to give a dark brown extract (980 g). This extract was suspended in H_2O and partitioned with $CHCl_3$ and *n*-BuOH, successively. The $CHCl_3$ solubles (76 g) were chromatographed over a column containing silica gel and eluted with *n*-hexane/acetone mixtures with increasing proportions of acetone to afford 16 fractions. Fraction 2 was rechromatographed over silica gel and eluted with *n*-hexane/ethyl acetate (19:1), followed by recrystallization from acetone, to afford pure **3** (0.5 mg), **9** (0.3 mg), **7** (0.8 mg), isotanshinone I (2.1 mg), and salvipisone (0.7 mg). Fractions 3 and 4 were combined and rechromatographed over silica gel by eluting with *n*-hexanes/ethyl acetate (19:1) to afford pure neosalvianen (5.4 mg), **6** (0.8 mg), **5** (0.8 mg), danshexinkun B (7.8 mg), and ferruginol (30.7 mg). A series of chromatographic separations of fraction 5 with *n*-hexane/ethyl acetate mixtures yielded pure **1** (1.2 mg), **2** (3.4 mg), tanshinone I (40.5 mg), and tanshinone IIA (37.5 mg). Fraction 6 was combined with fractions 7−9 and subjected to a series of chromatographic separations over silica gel with *n*-hexane/ethyl acetate mixtures to afford pure **4** (2.5 mg), **5** (0.6 mg), **8** (0.5 mg), dihydroisotanshinone I (5.7 mg), sugiol (23.7 mg), 6α-hydroxy-7-oxoferruginol (4 mg), cryptotanshinone (46.5 mg), montbretol (3.1 mg), dehydrosugiol (1.4 mg), nortanshinone (3.2 mg), 1,2-dihydrotanshinone I (1.58 mg), dihydrotanshinone I (5.7 mg), and danshenspiroketalactone (2.9 mg).

Salviamine A (1). Light yellow needles (acetone). Mp: 180−181 °C. UV (MeOH): λ_{max} (log ϵ) 364 (2.67), 346 (2.65), 329 (sh) (2.69), 321 (3.44), 308 (3.44), 296 (3.51), 274 (3.99), 265 (3.94), 235 nm (3.41). IR (KBr): ν_{max} 2925, 1622, 1512, 1487, 1311, 1151, 819, 769 cm^{-1}. For ^1H NMR and ^{13}C NMR data, see Tables 1 and 2. EIMS: *m*/*z* (relative intensity) 287 $[M]^+$ (100), 245 (64), 203 (8), 165 (9). HREIMS: *m*/*z* 287.0947 $[M]^+$ (calcd for $C_{19}H_{13}NO_2$, 287.0946).

Salviamine B (2). Yellow needles (acetone). Mp: 212−214 °C. UV (MeOH): λ_{max} (log ϵ) 406 (sh) (2.85), 393 (2.89), 371 (2.83), 331 (sh) (3.30), 321 (3.56), 307 (3.66), 291 (sh) (3.76), 282 (sh) (3.91), 275 (4.0), 267 (sh) (3.97), 234 (sh) (4.1), 220 nm (4.63). IR (KBr): ν_{max} 1687, 1539, 1519, 1462, 808, 759 cm^{-1}. For ^1H NMR and ^{13}C NMR data, see Tables 1 and 2. EIMS: *m*/*z* (relative intensity) 291 $[M]^+$, (100), 276 (42), 262 (2), 245 (3), 230 (2), 221(10), 205 (2), 193 (10), 177 (4), 165 (12). HREIMS: *m*/*z* 291.0892 $[M]^+$ (calcd for $C_{18}H_{13}NO_3$, 291.0895).

Salviamine C (3). Yellow needles (acetone). Mp: 178−180 °C. UV (MeOH): λ_{max} (log ϵ) 410 (3.04), 396 (sh) (3.06), 332 (sh) (3.55), 323 (3.72), 310 (3.75), 292 (sh) (3.74), 283 (sh) (3.82), 275 (3.99), 236 (3.85), 230 nm (3.84). IR (KBr): ν_{max} 2922, 2852, 1624, 1575, 1541, 1521, 1259, 1020, 867, 819, 767 cm^{-1}. For ^1H NMR and ^{13}C NMR data, see Tables 1 and 2. EIMS: *m*/*z* (relative intensity) 306 $[M + 1]^+$ (100), 290 (37), 277 (4), 257 (3), 245 (3), 237 (3), 221 (10), 193 (9), 165 (14), 97 (11), 57 (27). HREIMS *m*/*z* 305.1055 $[M]^+$ (calcd for $C_{19}H_{15}NO_3$, 305.1052).

Salviamine D (4). Yellow needles (acetone). Mp: 232−234 °C. UV (MeOH): λ_{max} (log ϵ) 411 (sh) (3.04), 393 (3.07), 331 (sh) (3.55), 317 (sh) (3.71), 311 (3.73), 289 (sh) (3.81), 274 (3.98), 242 (sh) (3.85), 237 nm (3.87). IR (KBr): ν_{max} 3423, 1740, 1716, 1638, 1527, 1452, 1244, 831, 771 cm^{-1}. For ^1H NMR and ^{13}C NMR data, see Tables 1 and 2. EIMS: *m*/*z* (relative intensity) 378 $[M + 1]^+$ (100), 363 (8), 347 (10), 319 (83), 301 (11), 280 (7), 248 (5), 165 (16), 115 (15), 57 (36). HREIMS: *m*/*z* 377.1264 $[M]^+$ (calcd for $C_{22}H_{19}NO_5$, 377.1263).

Salviamine E (5). Yellow powder (acetone). Mp: 188−190 °C. UV (MeOH): λ_{max} (log ϵ) 389 (3.17), 314 (sh) (3.18), 305 (3.50), 291 (sh) (3.58), 278 (4.04), 270 (sh) (3.98), 262 (sh) (3.87), 240 (sh) (3.85), 231 nm (3.88). IR (KBr): ν_{max} 3228, 2923, 1714, 1589, 1529, 1471, 1261, 1093, 800, 758 cm^{-1}. For ^1H NMR and ^{13}C NMR data, see Tables 1 and 2. EIMS: *m*/*z* (relative intensity) 324 $[M + 1]^+$ (13), 309 (7), 298 (18), 282 (12), 268 (13), 256 (19), 241 (21), 230 (30), 215 (51), 165 (20), 115 (31), 55 (100). HREIMS: *m*/*z* 323.1518 $[M]^+$ (calcd for $C_{20}H_{21}NO_3$, 323.1521).

Salviamine F (6). Yellow syrup. UV (MeOH): λ_{max} (log ϵ) 392 (sh) (2.97), 378 (3.05), 367 (3.04), 342 (3.09), 299 (sh) (3.58), 287 (sh) (3.73), 276 (4.0), 264 (4.05), 255 (sh) (4.02), 229 nm (4.02). IR (KBr): ν_{max} 3441, 1741, 1645, 1515, 1461, 1386, 756, 673 cm^{-1}. For ^1H NMR and ^{13}C NMR data, see Tables 1 and 2. EIMS: *m*/*z* (relative intensity) 310 $[M + 1]^+$ (100), 296 (12), 165 (15), 115 (41), 57 (83). HREIMS: *m*/*z* 309.1363 $[M]^+$ (calcd for $C_{19}H_{19}NO_3$, 309.1365).

Isosalviamine C (7). Pale yellow needles (acetone). Mp: 146−148 °C. UV (MeOH): λ_{max} (log ϵ) 362 (2.87), 344 (sh) (2.99), 332 (sh) (3.10), 320 (sh) (3.36), 300 (sh) (3.66), 282 (sh) (3.93), 274 (4.03), 268 (sh) (4.01), 259 (3.94), 221 nm (3.86). IR (KBr): ν_{max} 1596, 1514, 1462, 1386, 1168, 817, 765 cm^{-1}. For ^1H NMR and ^{13}C NMR data, see Tables 1 and 2. EIMS: *m*/*z* (relative intensity) 374 $[M + 1]^+$ (100), 343 (8), 331 (7), 315 (10), 314 (50), 301 (10), 286 (9), 262 (11), 157 (12). HREIMS: *m*/*z* 373.1311 $[M]^+$ (calcd for $C_{23}H_{19}NO_4$, 373.1314).

Isosalviamine D (8). Pale yellow syrup. $[\alpha]_D$ +55.6° (*c* = 0.028, MeOH). UV (MeOH): λ_{max} (log ϵ) 369 (2.78), 351 (3.02), 333 (sh) (3.12), 315 (sh) (3.40), 301 (sh) (3.67), 289 (3.94), 273 (4.01), 265 (sh) (4.03), 243 nm (3.87). IR (KBr): ν_{max} 1604, 1462, 1367, 1174, 819, 758 cm^{-1}. For ^1H NMR and ^{13}C NMR data, see Tables 1 and 2. EIMS: *m*/*z* (relative intensity) 375 $[M]^+$ (100), 360 (7), 344 (8), 330 (13), 315 (42), 302 (12), 285 (25), 268 (6), 239 (15), 57 (34). HREIMS: *m*/*z* 375.1470 $[M]^+$ (calcd for $C_{23}H_{21}NO_4$, 373.1470).

Isosalviamine E (9). Yellow needles (acetone). Mp: 178−180 °C. UV (MeOH): λ_{max} (log ϵ) 409 (sh) (2.84), 389 (2.89), 373 (sh) (2.70), 333 (3.32), 317 (sh) (3.40), 311 (3.51), 303 (3.51), 285 (sh) (3.68), 272 (4.01), 266 (sh) (3.93), 220 (sh) (3.56) nm. IR (KBr): ν_{max} 2922, 1625, 1299, 1153, 812, 617 cm^{-1}. For ^1H NMR data, see Table 1. EIMS: *m*/*z* (relative intensity) 291 $[M]^+$ (100), 276 (17), 220 (8), 190 (7), 57 (5). HREIMS: *m*/*z* 291.0898 $[M]^+$ (calcd for $C_{18}H_{13}NO_3$, 291.0895).

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