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ISOPRENOID-SUBSTITUTED FLAVONOIDS FROM *GLYCYRRHIZA GLABRA**

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Key Word Index—*Glycyrrhiza glabra*; Leguminosae; licorice; kanzoh; roots; isoflavone; kanzonol T.

Abstract—A new isoprenoid-substituted isoflavone, kanzonol T, was isolated from Chinese licorice, *Glycyrrhiza glabra*, along with eight known flavonoids. The structure of the new compound was elucidated by spectroscopic methods. Copyright © Elsevier Science Ltd

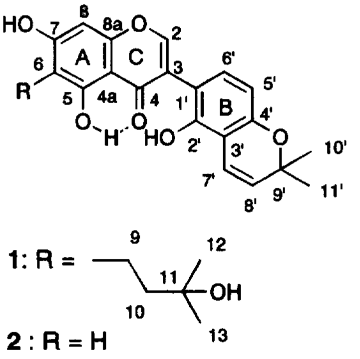
INTRODUCTION

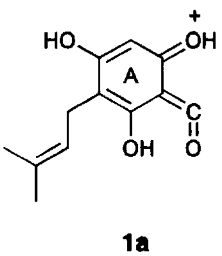
In the course of our study of phenolic constituents of Chinese licorice [1, 2], we isolated 3′,6- and 3′,8-diprenylated dalbergioidin (2′,4′,5,7-tetrahydroxy-isoflavanone) and kanzonol R from *Glycyrrhiza glabra* [3, 4]. We report herein the isolation of another eight known flavonoids, glyasperin M [5], licochalcone A [6], gancaonins G and H [7], 6,8-di-(dimethylallyl)-genistein [8], 3′,6-di-(dimethylallyl)-genistein [8], licoisoflavone B (**2**) [9] and licoisoflavanone [9], along with a new isoprenoid-substituted isoflavone, named kanzonol T (**1**), from Chinese *G. glabra*.

RESULTS AND DISCUSSION

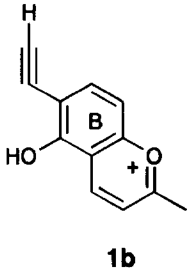
Kanzonol T (**1**), $C_{25}H_{26}O_7$, was positive to the methanolic ferric chloride test on a TLC plate. Its UV spectrum indicated that the compound is an isoflavone derivative. In the ^{1}H NMR spectrum of **1** (acetone-d_6), the following signals were observed: protons in a 3-hydroxy-3-methylbutyl group, protons in a 2,2-dimethylpyran group, protons in a hydrogen-bonded hydroxyl group (δ 12.75) and two hydroxyl groups, a singlet olefinic proton (H-2), a singlet aromatic proton (A ring) and AX type aromatic protons ($J = 8$ Hz, B ring). In the ^{13}C NMR spectrum of **1** (Table 1), the chemical shifts of the carbon atoms were similar to those of the relevant atoms of licoisoflavone B (**2**), except those of the A ring and the side-chain. The mass spectrum gave fragment ion peaks at m/z 221 (**1a**, H_2O was eliminated from the side-chain and then retro-Diels–Alder type cleavage occurred) and 185 (**1b**). The presence of the 3-hydroxy-3-methylbutyl group at the C-6 position was deduced from the following: (1) the resistance to give an aluminium-induced shift in the UV spectrum of **1** [10], (2) the coupling pattern of the unsubstituted carbon signals of A ring (C-8, *d*, J = 168 Hz), (3) the chemical shift of the A ring proton (δ 6.55) [11] and (4) the chemical shift of 5-OH signal [10]. Thus, the structure of kanzonol T was elucidated as formula **1**.

It is noteworthy that the flavonoids obtained from Chinese licorice were quite different from the phenolic compounds isolated from Russian and Spanish licorice [12, 13].





1a



1b

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*Part 20 in the Series 'Phenolic constituents of *Glycyrrhiza* species'. For Part 19 see T. Fukai, Z. Zeng, T. Nomura, R. Zhang and Z. Lou, *Nat. Med.* (1996), **50**, 247.

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Table 1. ^{13}C NMR spectral data of compounds **1** and **2** (in acetone-d_6)

C	**1**	**2**	C	**1**	**2**
2	157.1	157.3	1′	113.2	112.9
3	123.0	123.1	2′	152.9	152.8
4	182.8	182.8	3′	112.1	112.1
4a	105.8	106.1	4′	155.9	155.9
5	160.5	163.8	5′	109.7	109.8
6	114.7	100.6	6′	131.7	131.7
7	162.8	165.9	7′	118.3	118.2
8	94.5	94.9	8′	130.1	130.0
8a	157.1	159.4	9′	76.9	76.8
9	18.3	—	10′, 11′	28.4	28.3
10	43.3	—	—	—	—
11	70.8	—	—	—	—
12, 13	29.8	—	—	—	—

EXPERIMENTAL

General procedures and instruments used are as described in our previous paper [1].

Isolation of flavonoids. The plant materials, their identification, extraction, and fractionation using CC on silica gel were as reported in previous papers [3, 4]. The flavonoids reported here were isolated from frs of the column B [4]. Fr. 1 was consequently purified by prep. TLC (silica gel) using benzene–$CHCl_3$ (7:1), then $CHCl_3$–Et_2O (4:1), to give kanzonol T (**1**, 2 mg) and glyasperin M (1 mg). Licochalcone A (22 mg) was obtained from fr. 2 by recrystallization from benzene–Me_2CO. Fr. 5 was purified by prep. TLC, using the above solvent systems, to give 6,8-di-(dimethylallyl)-genistein (4 mg). Gancaonins G and H (each 4 mg), 3′,6-di-(dimethylallyl)-genistein (2 mg), licoisoflavone B (**2**, 23 mg) and licoisoflavanone (2 mg) were isolated from frs 10 and 11 by prep. TLC in benzene–Me_2CO (9:1), hexane–EtOAc (9:1), hexane–Et_2O (5:3) and $CHCl_3$–Me_2CO (14:1).

Kanzonol T (**1**). Granules, mp 205–209° (from benzene–Me_2CO). UV λ_{max}^{MeOH} nm (log ε): 214 (4.22), 225 (sh 4.18), 268 (4.23), 305 (sh 3.86); the spectrum did not shift immediately after addition of $AlCl_3$, but the spectrum shifted after 2 hr as follows: 203 (4.42), 220 (4.37), 275 (4.27), 314 (3.90), 378 (3.22). EI-MS *m/z* (rel. int.): 439 $[M + 1]^+$ (9), 438 $[M]^+$ (30), 423 (57), 420 (17), 405 (100), 365 (26), 349 (93), 221 (16), 185 (56), 175 (31), 165 (34). HR-MS *m/z* 438.1678 $[M]^+$ ($C_{25}H_{26}O_7$ requires: 438.1678). ^1H NMR (400 MHz): δ 1.25 (6H, *s*, Me_2-11), 1.41 (6H, *s*, Me_2-9′), 1.70 (2H, *m*, H_2-10), 2.78 (2H, *m*, H_2-9), 5.69 (1H, *d*, $J = 10$ Hz, H-8′), 6.38 (1H, *dd*, $J = 0.7$ and 8 Hz, H-5′), 6.55 (1H, *s*, H-8), 6.77 (1H, *dd*, $J = 0.7$ and 10 Hz, H-7′), 7.02 (1H, *d*, $J = 8$ Hz, H-6′), 8.23 (1H, *s*, H-2), 8.42 (1H, *br*, OH-2′), 9.25 (1H, *br*, OH-7), 12.75 (1H, *s*, OH-5).

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