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Two Novel Sesquiterpene Diglycosides from *Dictamnus dasycarpus*

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Abstract: Two novel sesquiterpene diglycosides named dictamnosides F **1** and G **2** were isolated from methanol extract of the root bark of *Dictamnus dasycarpus*. Their structures were determined on the basis of spectroscopic and chemical analysis.

Keywords: *Dictamnus dasycarpus*; Rutaceae; dictamnosides F and G; sesquiterpene diglycosides.

The root bark of *Dictamnus dasycarpus* Turcz. (Chinese name "Bai-Xian-Pi") (Rutaceae) is a traditional Chinese medicine used for treatment of jaundice, cough and rheumatism. It has also been widely used to treat some skin diseases[1]. In our previous papers, we reported the isolation and structure determination of antifungal furoquinoline alkaloids and five novel sesquiterpene glycosides[2,3]. In a continuation of our investigation of chemical consitituents of this plant, we identified another two novel sesquiterpene diglycosides named dictamnosides F **1** and G **2** from methanol extract of the root bark of *D. dasycarpus*. Here we report their isolation and structure determination.

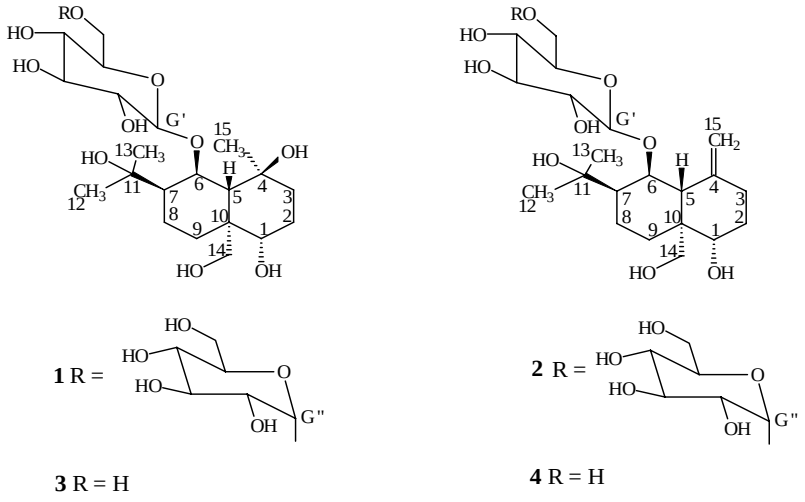
The root bark of *Dictamnus dasycarpus* (3 kg) was extracted with dichloromethane and methanol, successively. The methanol extract (85 g) was subjected to column chromatography on silica gel with a chloroform-methanol gradient (8:1→1:1). The fractions obtained from the chloroform-methanol (3:1→2:1) eluents were further chromatographed on silica gel [chloroform-methanol-water (7:3:0.5)] and RP-18 Lobar [methanol-water gradient (1:9→3:7)] columns to give compounds **1** (15 mg) and **2** (20 mg).

Compound **1** was obtained as an amorphous powder. Negative mode D/CI MS of **1** exhibited a quasimolecular ion peak at m/z 611[M-H]$^-$. In its ^{13}C NMR spectrum, 27 carbon signals were observed as three methyls, seven methylenes, fourteen methines and three quaternary carbon signals. The high polarity of **1** and the two anomeric carbon signals at δ 104.7 (d) and 100.7 (d) indicated the existence of two sugar moieties in its structure. TLC detection of its acidic hydrolysis products revealed the existence of only glucose as its sugar component. Further determination of derivative of its sugar component by gas chromatography exhibited also only glucose. It was noted that two anomeric proton signals were found at δ 5.26 (1H, d, 8.0) and 5.46 (1H, d, 3.5) in

^{1}H NMR spectrum of **1**. Therefore, the two glucose units should be in β and α glycosidic linkage, respectively.

Comparison of the ^{13}C NMR data of **1** with those of dictamnoside D **3**, a known sesquiterpene glycoside isolated from the same plant material, suggested that two compounds possess an identical aglycone[3]. Therefore, compound **1** should be a sesquiterpene diglycoside. Further analysis of ^{1}H-^{1}H COSY, TOCSY, HMQC and HMBC spectra of **1** led to confirmation of the structure of its aglycone and assignment of proton and carbon signals of both aglycone and sugar moieties (**Table 1**). According to chemical shift of $C_{G'-6}$ at δ 68.4 ppm, the two glucose units might be in 1→6 linkage. The correlation signals between $H_{G''-1}$ and $C_{G'-6}$, and between $H_{G'-1}$ and C-6 in HMBC spectrum of **1** revealed connection manner among the aglycone and the two sugar units as shown in **Figure 1**. Thus, compound **1** was determined as a new sesquiterpene diglycoside named dictamnoside F.

Scheme 1



Compound **2** was obtained as an amorphous powder. Positive mode D/CI MS of **2** showed quasimolecular ion peak at m/z 612 $[M+NH_4]^+$, 450 $[M-162+NH_4]^+$ and $[M-162-162+NH_4]^+$. TLC and GC analysis indicated glucose as the only sugar component of **2**. In its ^{13}C NMR spectrum, 27 carbon signals were observed as two methyls, eight methylenes, fourteen methines and three quaternary carbon signals. Two anomeric carbon signals exhibited at δ 102.8 (d) and 100.6 (d), while in ^{1}H NMR spectrum of **2**, two anomeric proton signals were found at δ 5.07 (1H, d, 8.0) and 5.46 (1H, d, 3.5), respectively. Therefore, the linkage of the two glucose units should also be in β and α configuration. Investigation of ^{13}C NMR data of **2** suggested that there was one more

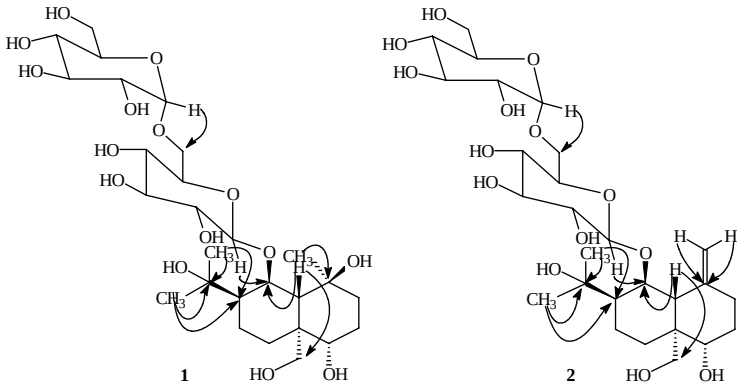
glucose unit in the structure of **2** than that of dictamnoside B **4**, a sesquiterpene glycoside previously isolated from the same plant[3]. Compound **2** was thus also a sesquiterpene diglycoside. Elucidation of ^{1}H-^{1}H COSY, TOCSY, HMQC and HMBC spectra of **2** enabled confirmation of its structure and assignment of all proton and carbon signals (**Table 1**). The two glucose units were in 1→6 connection according to correlation signals between $H_{G''-1}$ and $C_{G'-6}$, and between $H_{G'-1}$ and C-6 in its HMBC spectrum (**Figure 1**). The chemical shift of $C_{G'-6}$ at δ 68.2 also confirmed such a 1→6 linking manner. Compound **2** was determined as a new sesquiterpene diglycoside named dictamnoside G.

It should be noted that natural glycosidic compounds possessing glucose unit in α configuration are not common.

Table 1. ^{1}H NMR (500 MHz, C_5D_5N) and ^{13}C NMR (125 MHz, C_5D_5N) data of **1** and **2**.

No.	1		2	
	^{1}H	^{13}C	^{1}H	^{13}C
1	3.80, m	80.5, d	3.88, m	81.5, d
2a	1.93, m	30.0, t	2.19, m	33.8, t
2b	2.01, m		2.06, m	
3a	2.11, m	42.6, t	2.40, m	36.2, t
3b	1.94, m		2.40, m	
4		72.3, s		146.2, s
5	2.64, br s	59.2, d	2.92, d, 8.0	50.5, d
6	5.08, m	79.5, d	4.94, dd, 8.0, 6.0	76.5, d
7	2.29, m	45.9, d	2.40, m	45.6, d
8a	2.46, m	18.8, t	2.04, m	20.5, t
8b	2.24, m		1.83, m	
9a	3.01, m	29.0, t	2.76, dd, 13.0, 7.0	27.8, t
9b	1.58, m		1.79, m	
10		44.3, s		43.4, s
11		72.1, s		72.8, s
12	1.58, s	30.6, q	1.59, s	29.8, q
13	1.54, s	30.6, q	1.49, s	31.4, q
14a	4.54, d, 11.0	62.7, t	4.37, m	63.0, t
14b	4.17, m		4.00, m	
15a	1.36, s	23.5, q	5.26, br s	107.7, t
15b			5.04, br s	
Glu'-1	5.26, d, 8.0	104.7, d	5.07, d, 8.0	102.8, d
Glu'-2	3.96, m	74.9, d	3.91, m	74.9, d
Glu'-3	4.15, m	78.1, d	4.09, m	78.8, d
Glu'-4	3.79, m	71.3, d	4.11, m	71.9, d
Glu'-5	4.13, m	77.0, d	3.82, m	76.2, d
Glu'-6a	4.69, br d, 12.0	68.4, t	4.52, dd, 10.0, 4.5	68.2, t
Glu'-6b	4.24, m		4.16, m	
Glu"-1	5.46, d, 3.5	100.7, d	5.46, d, 3.5	100.6, d
Glu"-2	4.08, m	74.2, d	4.10, m	73.9, d
Glu"-3	4.64, m	75.4, d	4.56, m	75.5, d
Glu"-4	4.22, m	72.1, d	4.22, dd, 9.5, 9.0	71.9, d
Glu"-5	4.41, m	74.5, d	4.46, m	74.1, d
Glu"-6a	4.49, m	62.7, t	4.36, m	62.4, t
Glu"-6b	4.37, m		4.45, m	

Figure 1. Main ^{1}H-^{13}C long-range correlation in HMBC spectra of **1** and **2**.



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