Dictamnosides F and G—Two novel sesquiterpene diglycosides with 
α-configuration glucose units from Dictamnus dasycarpus

Weimin Zhao1*, Shunchun Wang1, Guowei Qin1, Rensheng Xu1 & Kurt Hostettmann2
1Shanghai Institute of Materia Medica, Chinese Academy of Sciences, Shanghai, 200031
2College of Pharmacy, University of Lausanne, Lausanne CH-1015, Switzerland

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Two novel sesquiterpene diglycosides named dictamnosides

F (1) and G (2) have been isolated from methanol extract of the

root bark of Dictamnus dasycarpus. Their structures have been
determined on the basis of spectroscopic and chemical analysis.
The existence of α-configuration glucose units in their structures
is not very common in natural glycosidic components.

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. In our previous papers, we reported the isolation and structure determination of antifungal furoquinoline alkaloids and five novel sesquiterpene glycosides.2,3

In continuation of our investigation of chemical constituents of this plant, we identified another two sesquiterpene diglycosides named dictamnosides F (1) and G (2). In this paper, we report the isolation and structure determination of the two novel natural products.

Results and Discussion

Compound 1 was obtained as an amorphous powder, m.p. 152-540C. The negative ion mode D/Cl

mass spectrum of 1 exhibited a quasi molecular ion peak at m/z 611[M-H]-. In its 13C 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 anomic 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 also exhibited 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 1H NMR spectrum of 1. Therefore, the two glucose units should be in β and α glycosidic linkage, respectively.

Comparison of the 13C 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. Therefore, compound 1 should be a sesquiterpene diglycoside. Further analysis of 1H-1H COSY, TOCSY, HMOC and HMBC spectra of 1 led to confirmation of the structure of its aglycone an assignment of proton and carbon signals of bot aglycone and sugar moieties. According to chemical shift of C5,6 at δ 68.4 ppm, the two glucose unit might be in 1→6 linkage. The correlation signal between H1-C1 and C5,6, and between H4-C6 i HMBC spectrum of 1 revealed connection maine 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.

Compound 2 was obtained as an amorphous powder, m.p. 163-650C. The positive ion mode D/Cl

mass spectrum of 2 showed quasimolecular ion peaks at m/z 612 [M+NH4]+ and fragment ion signals at m/z 450 [M-162+NH4]+ and 288 [M-162-162+NH4]+. TLC and GC analysis indicated glucose as the only sug component of 2. In its 13C NMR spectrum, 27 carbon signals were observed as two methyls, eight methylenes, fourteen methines and three quaternary carbon signals. Two anomic carbon signal appeared at δ 102.8 (d) and 100.6 (d), while in 1H NMR spectrum of 2, two anomic proton signal were found at δ 5.07 (1H, d, 8.0) and 5.46 (1H, d, 3.5), respectively. Therefore, the linkage of the tw glucose units should also be in β and α configuration. Investigation of 13C NMR data of 2 suggested the was one more glucose unit in the structure of than that of dictamnoside B (4), a sesquiterpen glycoside previously isolated from the same plant. Compound 2 was thus also a sesquiterpene diglycoside. Elucidation of 1H-1H COSY, TOCSY, HMOC and HMBC spectra of 2 enabled confirmation of its structure and assignment of all proton and
Figure 1—Main \(^1H\)–\(^{13}C\) long-range correlation signals in HMBC spectra of 1 and 2

carbon signals. 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 \(\delta\) 68.2 also confirmed the 1→6 linkage. Compound 2 was determined as a new sesquiterpene diglycoside named dictamnoside G.

Dictamnosides F and G are both sesquiterpene diglycosides with glucose units in \(\alpha\) and \(\beta\) configuration, respectively. It was noted that natural glucosidic compounds possessing glucose unit in \(\alpha\) configuration are not common.

Experimental Section

General. Melting points were determined on an electrically heated melting point apparatus and are uncorrected. NMR spectra were recorded on a Varian 500 spectrometer using residual undeuterated pyridine signals as internal standard, and mass spectra were recorded on a Finnigan MAT 90 instrument.

Plant material. The root bark of Dictamus dasycarpos was purchased from Shanghai Medicine Materia Corporation, and identified by Prof. Jixian Guo of School of Pharmacy, Shanghai Medical University. Voucher specimens are deposited in the
Herbarium of Shanghai Institute of Materia Medica, Chinese Academy of Sciences.

**Extraction and isolation.** The root bark of *Dictamnus dasycarpus* (3 kg) was powdered and then percolated at room temperature with CH₂Cl₂ and MeOH, successively (3 x 10 l). The filtrate was evaporated to dryness to give CH₂Cl₂ (150 g) and MeOH extracts (90 g), respectively. 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).

**Dictamnside F (1).** White amorphous powder m.p. 152-54°C. Negative mode D/Cl MS mlz: 6 [M+NH₄⁺]. 450 [M-162+NH₄⁺] and 288 [M-162+NH₄⁺]. ¹H NMR (500 MHz, CD₂D₅N): δ 3.80 (IH, m, H₁) 1.93 (1H, m, H₂a), 2.01 (1H, m, H₂b), 2.11 (1H, m, H₃a), 1.94 (1H, m, H₃b), 2.64 (1H, br s, H₄), 5.08 (1H, m, H₅a), 2.29 (1H, m, H₅b), 2.46 (1H, m, H₆a), 2.24 (1H, m, H₆b), 3.01 (1H, m, H₇a), 1.58 (1H, m, H₇b), 1.58 (3H, s, H₈), 1.54 (3H, s, H₉), 4.54 (1H, d, 11.0, H₁₀a), 4.17 (1H, m, H₁₀b), 1.36 (3H, s, H₃), 5.26 (1H, d, 8.0, H₁1), 3.96 (1H, m, H₁₂), 4.15 (1H, m, H₁₃), 3.79 (1H, m, H₁₄a), 4.13 (1H, m, H₁₄b), 4.69 (1H, br d, 12.0, H₁₅), 4.24 (1H, m, H₁₆a), 5.46 (1H, d, 3.5, H₁₆b), 4.08 (1H, m, H₁₇), 4.64 (1H, m, H₁₈), 4.22 (1H, m, H₁₉a), 4.41 (1H, m, H₁₉b), 4.49 (1H, m, H₁₉c), 4.37 (1H, m, H₁₉d), 13C NMR (125MHz, CD₂D₅N): δ 80.5 (d, C₁), 30.0 (t, C₂), 42.6 (t, C₃), 72.3 (s, C₄), 59.2 (d, C₅), 79.5 (d, C₆), 45.9 (d, C₇), 18.8 (t, C₈), 29.0 (t, C₉), 44.3 (s, C₁₀), 72.1 (s, C₁₁), 30.6 (q, C₁₂), 30.6 (q, C₁₃), 62.7 (t, C₁₄), 23.5 (q, C₁₅), 104.7 (d, C₁₆), 74.9 (d, C₁₇), 78.1 (d, C₁₈), 71.3 (d, C₁₉).

1.93 12.0, 75.4 (d, C₁₉), 72.1 (d, C₂₀), 74.5 (d, C₂₁), 62.7 (t, C₂₂).

**Dictamnside G (2).** White amorphous powder m.p. 163-65°C. Positive mode D/Cl MS mlz: 6 [M+NH₄⁺]. 450 [M-162+NH₄⁺] and 288 [M-162+NH₄⁺]. ¹H NMR (500 MHz, CD₂D₅N): δ 3.4 (1H, m, H₁), 2.19 (1H, m, H₂a), 2.06 (1H, m, H₂b), 2.40 (1H, m, H₃a), 2.92 (1H, d, 8.0, H₃b), 2.04 (1H, m, H₄), 1.94 (1H, dd, 8.0, 6.0, H₅), 2.40 (1H, m, H₆), 2.0 (1H, m, H₇), 1.83 (1H, m, H₈), 2.76 (1H, dd, 13.0, 7.0, H₉), 1.79 (1H, m, H₁₀), 1.59 (3H, s, H₁₁), 1.5 (3H, s, H₁₂), 4.07 (1H, m, H₁₃), 3.04 (1H, br s, H₁₄), 5.07 (1H, d, 8.0, H₁₅), 3.91 (1H, m, H₁₆), 4.09 (1H, m, H₁₇), 4.11 (1H, m, H₁₈), 3.82 (1H, m, H₁₉), 4.52 (1H, d, 10.0, 4.5, H₂₀), 4.16 (1H, m, H₂₁), 5.46 (1H, m, H₂₂), 4.22 (1H, dd, 9.5, 9.0, H₂₃), 4.46 (1H, m, H₂₄), 4.3 (1H, m, H₂₅), 4.45 (1H, m, H₂₆). ¹C NMR (125MHz, CD₂D₅N): δ 81.5 (d, C₁), 33.8 (t, C₂), 36.2 (C₃), 146.2 (s, C₄), 50.5 (d, C₅), 76.5 (d, C₆), 45.6 (t, C₇), 20.5 (t, C₈), 27.8 (t, C₉), 43.4 (s, C₁₀), 72.8 (C₁₁), 29.8 (q, C₁₂), 31.4 (q, C₁₃), 63.0 (t, C₁₄), 107.7 (C₁₅), 102.8 (d, C₁₆), 74.9 (d, C₁₇), 78.8 (d, C₁₈), 71.9 (d, C₁₉), 76.2 (d, C₂₀), 68.2 (t, C₂₁), 100.6 (C₂₂), 73.9 (d, C₂₃), 75.5 (d, C₂₄), 71.9 (d, C₂₅), 74.1 (d, C₂₆), 6.24 (t, C₂₇).

**References**

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