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Constituents of the flowers of *Punica granatum*

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Abstract

A new polyphenol compound named pomegranatate (**1**), together with, ellagic acid, 3,3′,4′-tri-*O*-methylellagic acid, ethyl brevifolincarboxylate, urolic and maslinic acids, and daucosterol were isolated from the ethanolic extract of the flowers of *Punica granatum*. The structure of compound **1** was determined by spectroscopic analysis. Maslinic acid exhibited antioxidant activity, evaluated by measurement of LDL susceptibility to oxidation.

Keywords: *Punica granatum*; Pomegranatate; Maslinic acid; Antioxidant activity

1. Introduction

Punica granatum L. (Punicaceae) is a shrub distributed originally in Iran and Afghanistan, introduced into China in the second century BC [1,2]. The flower of this plant was reported as an astringent, haemostatic, and as a remedy for diabetes in Unani and Ayurvedic medicine [3]. This flower was also used for the treatment of injuries from falls and grey hair of young man in the traditional Chinese medicine [4]. The only constituent reported was gallic acid [3]. The present paper deals with the isolation and the structure elucidation of a new compound, named pomegranatate (**1**) (Fig. 1) and six known compounds, ellagic acid, 3,3′,4′-tri-*O*-methylellagic acid, ethyl brevifolincarboxylate, urolic and, maslinic acids, and daucosterol.

2. Experimental

2.1. General

UV: Varian Cary Eclipse 300 spectrometer using methanol as solvent; IR: Thermo Nicolet Nexus 470 FT-IR spectrometer; ^{1}H and ^{13}C NMR: Bruker DRX 500 NMR; HRESIMS: Bruker APEX II. Column chromatography was carried out with silica gel (100–300 mesh) (Tsingtao Marine Chemistry Co. Ltd.), ODS (100–200 mesh) (Fuji Silysia

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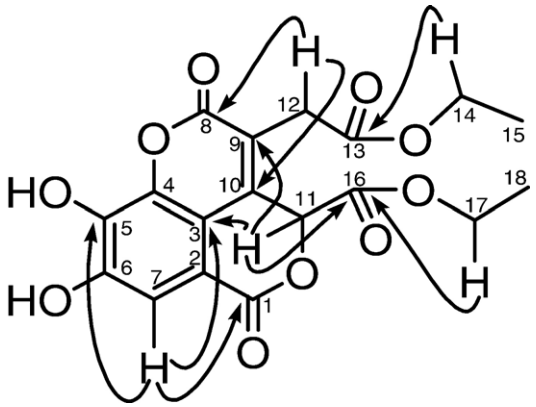

Fig. 1. Structure and HMBC correlations of pomegranatate (**1**).

Chemical Co. Ltd.) and Sephadex LH-20 (18–110 μm) (Pharmacia Co. Ltd.). Laboratory animals were obtained from the Laboratory Animal Institute, Chinese Academy of Medical Science, Beijing, China.

2.2. Plant

The flowers, collected in October 2004 from Zaozhuang City in Shandong Province of China were authenticated by Dr. R. F. Wang. A voucher specimen (No. 041005) has been deposited in the Herbarium of the Laboratory of Pharmaceutical Sciences, Department of Biological Sciences and Biotechnology, Tsinghua University.

2.3. Extraction and isolation

The flowers (3 kg) were extracted with 95% EtOH under reflux to obtain 540 g of crude extract, treated successively with petroleum ether, EtOAc, and acetone in a Soxhlet extractor. The EtOAc extract (110 g) was subjected to Si-gel CC with $CHCl_3$–MeOH (30:1 → 2:1) as eluents to afford 5 fractions (Fr. A–Fr. E). Fr. B was further subjected to Si-gel CC

Table 1
^{1}H NMR and ^{13}C NMR spectral data of compounds **1** and **2** (DMSO-d_6) [a]

C	**1**		**2**	
	δ_H (J in Hz)	δ_C	δ_H (J in Hz)	δ_C
1		159.8		163.8
2		110.3		112.2
3		109.9		112.7
4		149.6		150.9
5		138.3		139.5
6		139.4		140.9
7	7.45 (1H, *s*)	112.7	7.38 (1H, *s*)	114.2
8		160.9		162.4
9		117.3		114.8
10		137.9		143.6
11	6.77 (1H, *s*)	74.9	5.54 (2H, *s*)	68.0
12	3.81 (1H, *d*, 17.5); 3.74 (1H *d*, 17.5)	32.7	3.47 (2H, *s*)	32.3
13		167.1		173.1
14	4.18 (1H, *m*); 4.09 (1H, *m*)	60.6		
15	1.22 (3H, *t*, 7.5)	14.0		
16		169.0		
17	4.14 (1H, *m*); 4.00 (1H, *m*)	63.0		
18	1.13 (3H, *t*, 7.5)	13.5		

[a] Assignments were confirmed by 1D and 2D NMR.