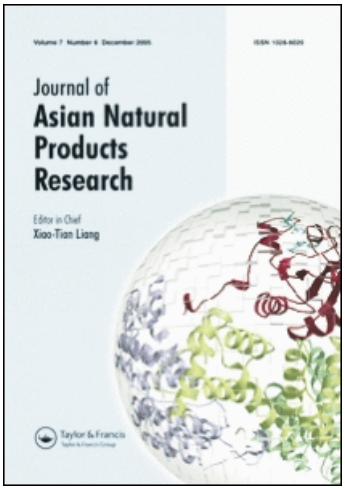


Journal of Asian Natural Products Research
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t713454007

Poriacosones A and B: two new lanostane triterpenoids from *Poria cocos*

Yan Zheng[a]; Xiu-Wei Yang[a]
[a] State Key Laboratory of Natural and Biomimetic Drugs, School of Pharmaceutical Sciences, Peking University, Beijing, China

To cite this Article Zheng, Yan and Yang, Xiu-Wei(2008) 'Poriacosones A and B: two new lanostane triterpenoids from *Poria cocos*', Journal of Asian Natural Products Research, 10: 7, 640 — 646
To link to this Article: DOI: 10.1080/10286020802133597
URL: http://dx.doi.org/10.1080/10286020802133597

Journal of Asian Natural Products Research
Vol. 10, No. 7, July 2008, 640–646

Poriacosones A and B: two new lanostane triterpenoids from *Poria cocos*

Yan Zheng and Xiu-Wei Yang*

State Key Laboratory of Natural and Biomimetic Drugs, School of Pharmaceutical Sciences, Peking University, Beijing, China

(*Received 17 January 2007; final version received 23 May 2007*)

Two new lanostane triterpenoids, poriacosones A (**8**) and B (**9**), together with eight known compounds were isolated from the sclerotia of *Poria cocos* (Schw.) Wolf (Polyporaceae), and identified by spectroscopic analysis, including IR, UV, CD, ESI-TOF-MS, HR-SIMS, 1D-, and 2D-NMR spectra. The structures of the new compounds were established as 3α,16α-dihydroxy-24-oxolanost-7,9(11)-dien-21-oic acid (**8**) and 3β,16α-dihydroxy-24-oxolanost-7,9(11)-dien-21-oic acid (**9**).

Keywords: *Poria cocos*; lanostane triterpenoids; poriacosone A; poriacosone B

1. Introduction

Dried sclerotium of *Poria cocos* (Schw.) Wolf (Polyporaceae) is a well-known traditional Chinese medicine used for the treatment of insomnia, water retention, and diarrhea [1]. Various triterpenoids of lanostane type from the sclerotia of *P. cocos* have been reported [2]. Some of them exhibit anti-inflammatory effect [3], antiemetic property [4], and cytotoxic activity [5]. The aim of our study was to further investigate the chemical constituents of the sclerotia of *P. cocos*. Herein, we describe the isolation and structural elucidation of two new triterpenoids, named poriacosones A (**8**) and B (**9**), together with eight known compounds, 3-epidehydrotumulosic acid (**1**) [6], 3-*O*-acetyl-16α-hydroxytrametenolic acid (**2**) [7], polyporenic acid C (**3**) [8], dehydropachymic acid (**4**) [7], pachymic acid (**5**) [7], dehydrotumulosic acid (**6**) [6], tumulosic acid (**7**) [9], and 3β,16α-dihydroxylanosta-7,9(11),24-trien-21-oic acid (**10**) [3] (Figure 1).

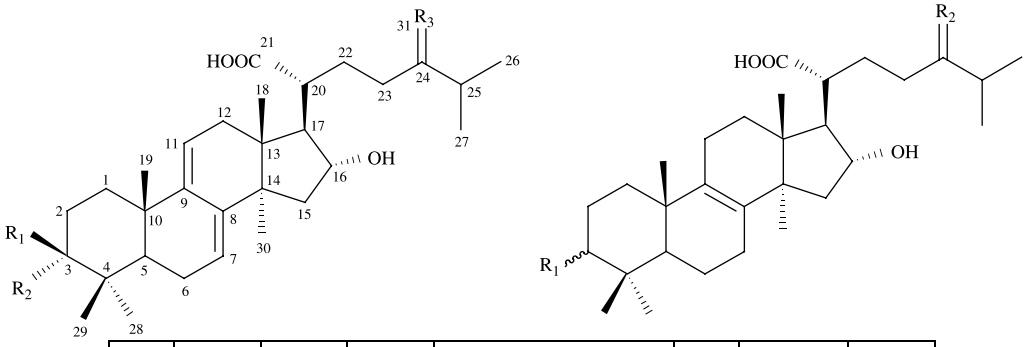
2. Results and discussion

Compound **8** was obtained as white amorphous powder with $[\alpha]_D^{20} + 41.8$ (*c* 0.0240, MeOH). The molecular formula was inferred as $C_{30}H_{46}O_5$ from HR-SIMS, DEPT, and ^{13}C NMR (Table 2) spectral data. The IR spectrum showed an absorption band at 1642 cm^{-1} and the UV spectrum showed an absorption maximum at 243 nm (log ε, 2.76), suggesting the presence of a $\Delta^{7,9(11)}$ diene moiety in **8** [6,9]. Its ^1H NMR spectrum (Table 1) showed signals of two secondary methyl groups [δ_H 0.97 (3H, d, $J = 7.0$ Hz) and 1.01 (3H, d, $J = 7.0$ Hz)], five tertiary methyl groups (δ_H 0.95, 1.05, 1.07, 1.17, and 1.41), two oxygen-bearing methines [δ_H 3.61 (1H, br s/$W_{1/2} = 8.0$ Hz) and 4.58 (1H, t, $J = 7.0$ Hz)], and two olefinic methines [δ_H 5.44 (1H, d, $J = 5.0$ Hz) and 5.60 (1H, br s)]. And the ^{13}C NMR spectrum of **8** confirmed the presence of seven methyl carbons, two oxygenated carbons (δ_C 75.0 and 76.1) and four olefinic carbons (δ_C 116.0, 121.1, 142.7, and 146.5). In addition, a ketone group (δ_C 213.7) and a

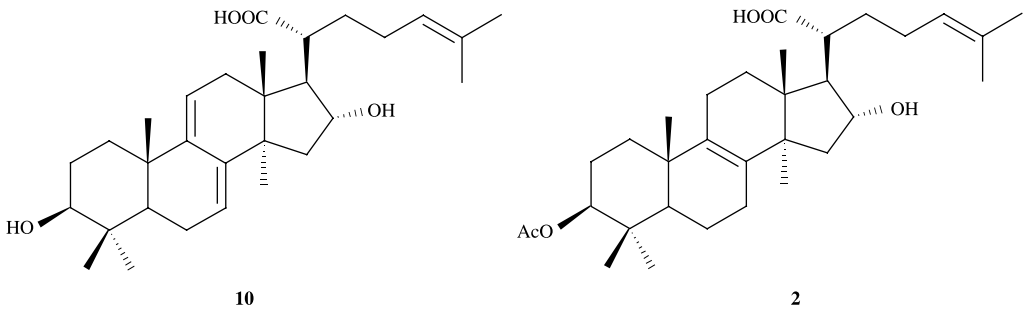
*Corresponding author. Email: xwyang@bjmu.edu.cn; xwyang@hsc.pku.edu.cn

ISSN 1028-6020 print/ISSN 1477-2213 online

DOI: 10.1080/10286020802133597
http://www.informaworld.com



	R_1	R_2	R_3			R_1	R_2
1	H	OH	CH_2		**5**	β-OAc	CH_2
3	O		CH_2		**7**	β-OH	CH_2
4	OAc	H	CH_2		**11**	α-OH	O
6	OH	H	CH_2				
8	H	OH	O				
9	OH	H	O				



10 **2**

Figure 1. Structures of compounds **1**–**11**.

carboxyl group (δ_C 178.9) were observed. The ketone group was deduced to be located at C-24 based on the HMBC correlations between C-24 and H-23, H-25, Me-26, and Me-27, and compared with the NMR spectral data of daedaleanic acid B (**11** in Figure 1) [10], which had an identical side chain at C-17. The signals observed in the ^1H and ^{13}C NMR spectra of **8** were closely related to those of compound **1** (3-epidehydrotumulosic acid) [6], indicating that **8** also had a similar lanostane structure and an 3α-axial hydroxyl group [$\delta_{H\text{-}3}$ 3.61 (1H, br s/$W_{1/2}$ = 8.0 Hz) in **8** and $\delta_{H\text{-}3}$ 3.63 (1H, br s/$W_{1/2}$ = 8.0 Hz) in **1** for H-3β, and $\delta_{H\text{-}3}$ 3.44 (1H, dd, J = 7.0, 7.5 Hz) for H-3α in dehydrotumulosic acid (**6**)] as 3-epidehydrotumulosic acid (**1**), except for the presence of the ketone group at C-24. Detailed analysis of the ^1H–^1H COSY (Figure 2), HMBC (Figure 3), and HSQC spectra of **8** led to the assignment of all proton and carbon signals of **8**. Therefore, the structure of **8** was elucidated to be 3α,16α-dihydroxy-24-oxolanost-7,9(11)-dien-21-oic acid, named poriacosone A.

Compound **9** was obtained as white amorphous powder with $[\alpha]_D^{20}$ + 26.2 (*c* 0.0765, MeOH). The molecular formula was deduced as $C_{30}H_{46}O_5$ from HR-SIMS and

Table 1. ^{1}H NMR spectral data for compounds **8** and **9** (500 MHz, in C_5D_5N).

H	**8**	**9**
1	1.71 dd (3.0, 13.0) 2.26 m	1.43 m 1.95 m
2	1.85 dd (3.0, 13.0) 2.03 m	1.66 m 1.82 m
3	3.61 br s ($W_{1/2} = 8.0$)	3.44 dd (7.0, 7.5)
5	1.99 br d (8.5)	1.28 dd (4.5, 11.5)
6	2.09 br d (8.5)	2.10 br d (17.5) 2.17 ddd (4.5, 11.5, 17.5)
7	5.60 br s	5.60 d (4.5)
11	5.44 d (5.0)	5.36 br s
12	2.34 m 2.66 dd (5.0, 18.0)	2.38 dd (5.4, 16.5) 2.65 br d (16.5)
15	1.89 d (13.0) 2.39 dd (7.0, 13.0)	1.91 br d (13.0) 2.42 dd (8.5, 13.0)
16	4.58 t (7.0)	4.59 dd (6.0, 9.0)
17	2.80 m	2.86 m
18	1.05 s	1.02 s
19	1.07 s	1.04 s
20	2.87 m	2.92 m
22	2.43 m 2.92 m	2.45 m 2.94 m
23	2.86 m 2.87 m	2.84 m 2.89 m
25	2.52 d (7.0)	2.52 d (7.0)
26	0.97 d (7.0)	0.98 d (7.0)
27	1.01 d (7.0)	1.01 d (7.0)
28	1.17 s	1.19 s
29	0.95 s	1.11 s
30	1.41 s	1.49 s

All values are in ppm, coupling constants (*J*) in Hz; assignments were made by ^{1}H–^{1}H COSY, HSQC, and HMBC spectral data.

^{13}C NMR (Table 2) spectral data. Compared with **8**, an intense UV absorption band at 243 nm (log ε, 2.43) and IR absorption band at 1642 cm^{-1} were also observed, suggesting the presence of a $\Delta^{7,9(11)}$ diene group in **9** [6,9]. The ^{1}H and ^{13}C NMR spectral data (Tables 1 and 2) of **9** were similar to those of **8** except for the signals due to ring A. Nevertheless, comparison of the ^{1}H and ^{13}C NMR spectral data of **9** with those of **6** (dehydrotumulosic acid) and daedaleanic acid B (**11** in Figure 1) [10] revealed that **9**, **6**, and **11** had identical substitution pattern in ring A, namely, having the 3β-hydroxyl group. Detailed analysis of the ^{1}H–^{1}H COSY, HMBC and HSQC spectra of **9** led to the assignment of all proton and carbon signals of **9**. Thus, the structure of **9** was determined to be 3β,16α-dihydroxy-24-oxolanost-7,9(11)-dien-21-oic acid, named poriacosone B.

Compounds **8** and **9** are a pair of epimers, and could be separated by high-pressure liquid chromatography (HPLC) with an achiral column (see the Experimental section).

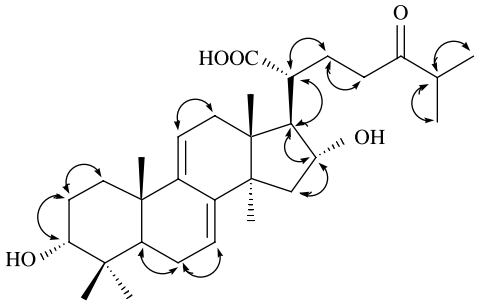


Figure 2. ^{1}H–^{1}H COSY correlations of **8**.

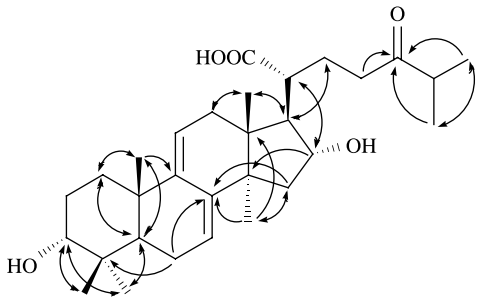


Figure 3. Key HMBC correlations of **8** (from H to C).

Table 2. ^{13}C NMR spectral data for compounds **1**, **6**, **8**, **9**, and **11** (125 MHz, in C_5D_5N).

C	**8***	**1**	**11** [10]	**9***	**6**
1	30.5 t	30.6	30.7	36.3 t	36.3
2	26.6 t	26.7	26.8	28.6 t	28.7
3	75.0 d	75.1	75.0	78.0 d	78.0
4	37.7 s	37.9	38.1	39.3 s	39.3
5	43.6 d	43.7	44.6	49.8 d	49.8
6	23.3 t	23.4	18.5	23.5 t	23.5
7	121.1 d	121.3	26.6	121.3 d	121.2
8	142.7 s	142.8	134.5	142.7 s	142.8
9	146.5 s	146.6	135.0	146.4 s	146.3
10	37.8 s	37.9	37.4	37.8 s	37.8
11	116.0 d	116.1	20.9	116.5 d	116.6
12	36.1 t	36.2	29.7	36.3 t	36.3
13	45.0 s	45.1	46.2	45.0 s	45.1
14	49.5 s	49.5	48.8	49.4 s	49.8
15	44.3 t	44.4	43.6	44.4 t	44.4
16	76.1 d	76.4	76.4	76.2 d	76.4
17	57.1 d	57.6	56.9	57.3 d	57.7
18	17.6 q	17.6	17.8	17.7 q	17.6
19	23.0 q	23.1	19.3	23.0 q	23.0
20	47.8 d	48.5	47.8	47.7 d	49.4
21	178.9 s	178.7	178.6	178.4 s	178.7
22	26.5 t	31.4	26.8	26.7 t	31.6
23	38.5 t	33.2	38.6	38.6 t	33.2
24	213.7 s	156.0	213.8	213.7 s	156.1
25	40.8 d	34.1	40.9	40.9 d	34.1
26	18.2 q	22.0	18.3	18.3 q	22.0
27	18.3 q	21.9	18.4	18.4 q	21.8
28	29.1 q	29.2	29.0	28.8 q	28.8
29	22.8 q	23.0	22.5	16.6 q	16.6
30	26.5 q	26.6	25.3	26.6 q	26.6
31		107.0			106.9

*Assignments were made by $^1H-^1H$ COSY, HSQC and HMBC data; multiplicity was established from HSQC and DEPT data; s, C; d, CH; t, CH_2; q, CH_3.

The spectral data of ^1H and ^{13}C NMR of **7** and ^1H NMR of **10** were reported for the first time in this paper.

3. Experimental

3.1 General experimental procedures

Optical rotations were measured on a Perkin-Elmer 243B polarimeter with MeOH as solvent. UV spectra were obtained on a Varian Cary-300 UV–vis photometer in MeOH solution. IR spectra were recorded on a Thermo Nicolet Nexus 470 FT-IR spectrometer. Mass spectra were recorded on a MDS SCIEX API ASTAR spectrometer (for ESI-TOF-MS) and an APEX II FT-ICR-MS spectrometer (for HR-SIMS). 1D- and 2D-NMR spectra were recorded on a Varian Inova 500 NMR spectrometer (500 MHz for ^1H NMR and 125 MHz for ^{13}C NMR) using C_5D_5N as solvent and TMS as internal standard. Preparative HPLC was performed on a P680 chromatograph (Dionex Co., Sunnyvale, CA, USA), equipped with UVD170U detector using a Phenomenex Luna 10 C18 (2) column (250 mm × 21.2 mm, 10 μm) at a flow rate of 10 ml/min. Open column chromatography was carried out using silica gel (200–300 mesh, Qingdao Marine Chemical Co., Qingdao, China) as stationary phase. TLC was conducted on silica gel GF_{254} plates (Merck, Whitehouse Station, NJ, USA) and reverse-phase C18 silica gel plates (Merck).

3.2 Plant material

The sclerotia of *P. cocos* were collected from 'The China National GAP Base of Chinese Materia Medica for *Poria cocos*' at Luotian County, Hubei Province, China, in September 2002. The fungus was identified at the site by Professor Xiu-wei Yang who is a co-author of this paper, and a voucher specimen (No. 20020920) has been deposited in the State Key Laboratory of Natural and Biomimetic Drugs, School of Pharmaceutical Sciences, Peking University, China.

3.3 Extraction and isolation

Dried sclerotia of *P. cocos* (10 kg) were powdered and extracted with 95% ethanol (40 l × 5 times, 1 h/time) under reflux. The ethanolic extract was concentrated under reduced pressure to afford an extract (130.7 g, yield 1.31%), which was suspended in water (1.25 l) and partitioned successively with cyclohexane (2.5 l × 7 times), EtOAc (2.5 l × 5 times), and *n*-BuOH (2.5 l × 5 times). The cyclohexane solution was concentrated *in vacuo* to yield a green residue (16.2 g, 0.162%), which was chromatographed on a silica gel column and eluted with cyclohexane–EtOAc mixture of increas-

ing polarity. A total of 151 fractions (*ca.* 100 ml each) were collected and combined on the basis of TLC analysis. The fractions 85–89 were purified by preparative reverse-phase HPLC with MeOH—H_2O—HCOOH (76:24:0.05) as mobile phase at a flow rate of 10 ml/min to yield compound **1** (18 mg).

The EtOAc solution was concentrated *in vacuo* to give a brown residue (36.8 g, 0.368%), and fractionated on silica gel column chromatograph, eluting with EtOAc–MeOH gradient mixtures to give 258 fractions (*ca.* 100 ml each), which were combined on the basis of TLC analysis leading to four main fractions (A–D). Fraction A was subjected to preparative reverse-phase HPLC eluting with MeOH—H_2O—HCOOH (80:20:0.05) at a flow rate of 10 ml/min to give compounds **2** (13 mg) and **3** (24 mg). Fraction B was purified by preparative reverse-phase HPLC eluting with MeOH—H_2O—HCOOH (80:20:0.05) at a flow rate of 10 ml/min to afford compounds **4** (90 mg) and **5** (240 mg). Fraction C was subjected to preparative reverse-phase HPLC using MeOH—H_2O—HCOOH (75:25:0.06) as solvent system at a flow rate of 10 ml/min to yield compounds **6** (90 mg) and **7** (44 mg). Compounds **8** (12 mg), **9** (8 mg), and **10** (10 mg) obtained from subfraction D, which were separated by preparative reverse-phase HPLC eluting with MeOH—H_2O—HCOOH (60:40:0.05) at a flow rate of 10 ml/min.

*3.3.1 3-Epidehydrotumulosic acid (**1**)*

$[\alpha]_D^{20}$ + 33.4 (*c* 0.03, MeOH); negative ESI-TOF-MS *m/z*: 483.3 $[M - H]^-$; IR, UV, and NMR spectral data were in agreement with those reported for 3-epidehydrotumulosic acid [6].

*3.3.2 3-O-Acetyl-16α-hydroxytrametenolic acid (**2**)*

Positive ESI-TOF-MS *m/z*: 515.3 $[M + H]^+$; IR and NMR spectral data were in agreement with those reported for 3-*O*-acetyl-16α-hydroxytrametenolic acid [7].

*3.3.3 Polyporenic acid C (**3**)*

$[\alpha]_D^{20}$ + 7.1 (*c* 0.14, MeOH); positive ESI-TOF-MS *m/z*: 483.3 $[M + H]^+$; IR, UV, and NMR spectral data were in agreement with those reported for polyporenic acid C [8,11].

*3.3.4 Dehydropachymic acid (**4**)*

$[\alpha]_D^{20}$ + 101.1 (*c* 0.12, MeOH); positive ESI-TOF-MS *m/z*: 527.3 $[M + H]^+$; IR, UV, and NMR spectral data were in agreement with those reported for dehydropachymic acid [7,12].

*3.3.5 Pachymic acid (**5**)*

$[\alpha]_D^{20}$ + 34.3 (*c* 0.12, MeOH); negative ESI-TOF-MS *m/z*: 527.3 $[M - H]^-$; IR and NMR spectral data were in agreement with those reported for pachymic acid [7,12].

*3.3.6 Dehydrotumulosic acid (**6**)*

$[\alpha]_D^{20}$ + 49.7 (*c* 0.12, MeOH); negative ESI-TOF-MS *m/z*: 483.3 $[M - H]^-$; IR, UV, and NMR spectral data were in agreement with those reported for dehydrotumulosic acid [6].

*3.3.7 Tumulosic acid (**7**)*

$[\alpha]_D^{20}$ + 37.8 (*c* 0.13, MeOH); ^{1}H NMR (500 MHz, C_5D_5N) δ: 1.18 (1H, m, H_a-1), 1.61 (1H, br d, J = 13.0 Hz, H_b-1), 1.60 (1H, m, H_a-2), 1.70 (1H, m, H_b-2), 3.42 (1H, dd, J = 7.5, 8.5 Hz, H-3α), 1.17 (1H, br d, J = 12.5 Hz, H-5α), 1.66 (2H, m, H-6), 2.04 (2H, m, H-7), 1.96 (2H, m, H-11), 1.97 (1H, m, H_a-12), 2.15 (1H, m, H_b-12), 1.69 (1H, br d, J = 13.0 Hz, H_a-15), 2.40 (1H, dd, J = 8.0, 13.0 Hz, H_b-15), 4.51 (1H, dd, J = 6.0, 8.0 Hz, H-16β), 2.80 (1H, dd, J = 6.0, 10.0 Hz, H-17α), 1.22 (3H, s, CH_3-18), 1.01 (3H, s, CH_3-19), 2.95 (1H, m, H-20), 2.50 (1H, m, H_a-22), 2.62 (1H, m, H_b-22), 2.40 (1H, m, H_a-23), 2.51 (1H, br t, J = 12.0 Hz, H_b-23), 2.26 (1H, m, H-25), 0.95 (3H, d, J = 7.0 Hz, CH_3-26), 0.97 (3H, d, J = 7.0 Hz, CH_3-27), 1.13 (3H, s, CH_3-28), 1.05 (3H, s, CH_3-29), 1.46 (3H, s, CH_3-30), 4.81 (1H, s, H_a-31), 4.95 (1H, s, H_b-31); ^{13}C

NMR (125 MHz, C_5D_5N) δ: 36.0 (C-1), 28.6 (C-2), 78.0 (C-3), 39.5 (C-4), 50.9 (C-5), 18.7 (C-6), 27.0 (C-7), 134.8 (C-8), 135.2 (C-9), 37.4 (C-10), 20.9 (C-11), 29.7 (C-12), 46.3 (C-13), 48.8 (C-14), 43.7 (C-15), 76.6 (C-16), 57.3 (C-17), 17.8 (C-18), 19.4 (C-19), 48.7 (C-20), 178.8 (C-21), 31.6 (C-22), 33.2 (C-23), 156.1 (C-24), 34.1 (C-25), 22.0 (C-26), 21.8 (C-27), 28.6 (C-28), 16.4 (C-29), 25.4 (C-30), 107.0 (C-31); negative ESI-TOF-MS *m/z*: 485.4 $[M - H]^-$; IR and UV spectral data were in agreement with those reported for tumulosic acid [9].

*3.3.8 Poriacosone A (3α,16α-dihydroxy-24-oxolanost-7,9(11)-dien-21-oic acid) (**8**)*

White amorphous powder; $C_{30}H_{46}O_5$; $[\alpha]_D^{20} + 41.8$ (*c* 0.02, MeOH); UV (MeOH) λ_{max} (nm, log ε): 202 (2.92), 236 (2.72), 243 (2.76), 251 (2.69); IR (KBr) ν_{max} (cm^{-1}): 3420, 2923, 2854, 1707, 1680, 1642, 1610, 1458, 1381, 1261, 1111, 1055, 863, 793, 557, 409; ^1H NMR (500 MHz, C_5D_5N) and ^{13}C NMR (125 MHz, C_5D_5N) spectral data were shown in Tables 1 and 2; negative ESI-TOF-MS *m/z*: 485.3 $[M - H]^-$; HR-SIMS *m/z*: 485.3269 $[M - H]^-$ (calcd for $C_{30}H_{45}O_5$, 485.3272).

*3.3.9 Poriacosone B (3β,16α-dihydroxy-24-oxolanost-7,9(11)-dien-21-oic acid) (**9**)*

White amorphous powder; $C_{30}H_{46}O_5$; $[\alpha]_D^{20} +$ 26.2 (*c* 0.08, MeOH); UV (MeOH) λ_{max} (nm, log ε): 202 (2.36), 236 (2.39), 243 (2.43), 252 (2.28); IR (KBr) ν_{max} (cm^{-1}): 3425, 2962, 2929, 2855, 2715, 1704, 1673, 1642, 1616, 1452, 1365, 1380, 1288, 1263, 1097, 1036, 775; ^1H NMR (500 MHz, C_5D_5N) and ^{13}C NMR (125 MHz, C_5D_5N) spectral data were shown in Tables 1 and 2; negative ESI-TOF-MS *m/z*: 485.3 $[M - H]^-$; HR-SIMS *m/z*: 485.3270 $[M - H]^-$ (calcd for $C_{30}H_{45}O_5$, 485.3272).

*3.3.10 3β,16α-dihydroxylanosta-7,9(11),24-trien-21-oic acid (**10**)*

White amorphous powder; $C_{30}H_{46}O_4$; $[\alpha]_D^{20} + 35.8$ (*c* 0.06, MeOH); UV (MeOH) λ_{max} (nm, log ε): 202 (2.53), 235 (2.27), 243 (2.30), 251 (2.13); IR (KBr) ν_{max} (cm^{-1}): 3420, 2929, 2874, 2742, 1642, 1607, 1385, 1363, 1102, 789; ^1H NMR (500 MHz, C_5D_5N) δ: 1.46 (1H, m, H_a-1), 2.12 (1H, m, H_b-1), 1.68 (1H, m, H_a-2), 1.87 (1H, m, H_b-2), 3.44 (1H, dd, $J = 7.0$, 7.5 Hz, H-3α), 1.28 (1H, dd, $J = 4.5$, 11.0 Hz, H-5α), 2.15 (2H, m, H-6), 5.61 (1H, br s, H-7), 5.37 (1H, br s, H-11), 2.38 (1H, br d, $J = 18.0$ Hz, H_a-12), 2.70 (1H, br d, $J = 18.0$ Hz, H_b-12), 1.92 (1H, br d, $J = 13.0$ Hz, H_a-15), 2.45 (1H, dd, $J = 8.0$, 13.0 Hz, H_b-15), 4.51 (1H, dd, $J = 6.0$, 8.0 Hz, H-16β), 2.86 (1H, m, H-17α), 1.05 (3H, s, CH_3-18), 1.05 (3H, s, CH_3-19), 2.92 (1H, m, H-20), 2.50 (1H, m, H_a-22), 2.40 (1H, m, H_b-22), 2.50 (1H, m, H_a-23), 2.41 (1H, m, H_b-23), 5.31 (1H, br s, H-24), 1.59 (3H, s, CH_3-26), 1.58 (3H, s, CH_3-27), 1.20 (3H, s, CH_3-28), 1.11 (3H, s, CH_3-29), 1.48 (3H, s, CH_3-30); negative ESI-TOF-MS *m/z*: 469.3 $[M - H]^-$; ^{13}C NMR spectral data were in agreement with those reported for 3β,16α-dihydroxylanosta-7,9(11),24-trien-21-oic acid [3].

Acknowledgements

This research was supported by the National Natural Science Foundation of China (20572007), the National High Technology Research and Development Program of China (2002AA 2Z343C), and the Beijing Municipal Special-purpose Science Foundation of China (Z0004105040311).

References

[1] The Pharmacopoeia Commission of PRC, *Pharmacopoeia of People's Republic of China*, Vol. 1, (Chemical Industry Press, Beijing, 2005), p. 166.

[2] Y. Zheng and X.W. Yang, in *Frontier for Drug Research*, edited by X.Y. Zheng and Q.J. Liao, Vol. 2004, (China Medical–Pharmaceutical Science & Technology Publishion House, Beijing, 2005), p. 300–321.

[3] H. Nukaya, H. Yamashiro, H. Fukazawa, H. Ishida, and K. Tsuji, *Chem. Pharm. Bull.* **44**, 847 (1996).

[4] T. Tai, Y. Akita, K. Kinoshita, K. Koyama, K. Takahashi, and K. Watanabe, *Planta Med.* **61**, 527 (1995).

[5] M. Ukiya, T. Akihisa, H. Tokuda, M. Hirano, M. Oshikubo, Y. Nobukuni, Y. Kimura, T. Tai, S. Kondo, and H. Nishino, *J. Nat. Prod.* **65**, 462 (2002).
[6] T. Tai, T. Shingu, T. Kikuchi, Y. Tezuka, and A. Akahori, *Phytochemistry* **39**, 1165 (1995).
[7] T. Tai, T. Shingu, T. Kikuchi, Y. Tezuka, and A. Akahori, *Phytochemistry* **40**, 225 (1995).
[8] Q. Shen, X.D. Xu, and H.E. Gu, *Chin. J. Med. Chem.* **9**, 271 (1999).
[9] L.A. Cort, R.M. Gascoigne, J.S. Holker, R.J. Ralph, A. Robertson, and J.J. Simes, *J. Chem. Soc.*, 3713 (1954).
[10] K. Yoshikawa, K. Kouso, J. Takahashi, A. Matsuda, M. Okazoe, A. Umeyame, and S. Arihara, *J. Nat. Prod.* **68**, 911 (2005).
[11] A.C. Keller, M.P. Maillard, and K. Hostettmann, *Phytochemistry* **41**, 1041 (1996).
[12] T. Tai, A. Akahori, and T. Shingu, *Phytochemistry* **31**, 2548 (1992).