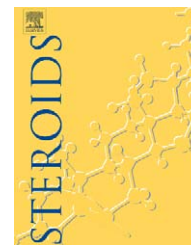




available at www.sciencedirect.com



journal homepage: www.elsevier.com/locate/steroids



Atropurosides A–G, new steroidal saponins from *Smilacina atropurpurea*

Ying Zhang^a, Hai-Zhou Li^a,
Ying-Jun Zhang^{a,*}, Melissa R. Jacob^b,
Shabana I. Khan^b, Xing-Cong Li^b, Chong-Ren Yang^{a,**}

^a State Key Laboratory of Phytochemistry and Plant Resources in West China,
Kunming Institute of Botany, Chinese Academy of Sciences, Kunming 650204, PR China

^b National Center for Natural Products Research, School of Pharmacy, University of Mississippi, MS 38677, USA

ARTICLE INFO

Article history:

Received 2 November 2005

Received in revised form 5 April 2006

Accepted 25 April 2006

Published on line 12 June 2006

Keywords:

Smilacina atropurpurea

Steroidal saponins

Atropurosides A–F

Antifungal activities

Cytotoxicity

ABSTRACT

Atropurosides A–G (1–7), seven new steroidal saponins, which possess new polyhydroxylated aglycones, were isolated from the rhizomes of *Smilacina atropurpurea* (Convallariaceae), together with a known saponin, dioscin (8). Their structures were elucidated on the basis of detailed spectroscopic analysis, including 1D and 2D NMR techniques and chemical methods. Antifungal testing of the eight compounds indicated that atropurosides B (2) and F (6) were fungicidal against *Candida albicans*, *Candida glabrata*, *Cryptococcus neoformans*, and *Aspergillus fumigatus* with minimum fungicidal concentrations (MFCs) $\leq 20 \mu\text{g/ml}$, while dioscin (8) was selectively active against *C. albicans* and *C. glabrata* (MFC $\leq 5.0 \mu\text{g/ml}$). Furthermore, the antifungal saponins 2, 6, and 8 were evaluated for their *in vitro* cytotoxicities in a panel of human cancer cell lines (SK-MEL, KB, BT-549, SK-OV-3, and HepG2) and non-cancerous Vero cells. All showed moderate cytotoxicities. It appears that the antifungal activity of these steroidal saponins correlates with their cytotoxicity against mammalian cells.

© 2006 Elsevier Inc. All rights reserved.

1. Introduction

Smilacina atropurpurea (Franch) Wang et Tang (Convallariaceae) is a perennial plant distributed mainly in the southwest region of the People's Republic of China [1]. The tender aerial part is edible and has been used as a wild vegetable by Lisu, Naxi, and Tibetan people. The rhizome, as a folk traditional medicine, has been used for the treatment of lung ailment, rheumatism, menstrual disturbance, cuts, and bruises [2]. While three nucleosides (thymidine, adenosine, and 2'-deoxyadenosine) have been isolated from the aerial part [3], no chemical study

has been reported on its rhizome. Our detailed chemical investigation on the fresh rhizome of *S. atropurpurea* led to the isolation of seven new steroidal saponins with polyhydroxylated aglycones, atropurosides A–G (1–7), together with a known saponin, dioscin (8). In the present paper, we report the isolation and structure elucidation of the seven new compounds by detailed spectroscopic analysis, including 2D NMR techniques, and chemical methods. In addition, the *in vitro* antifungal activity of the eight isolated compounds and the *in vitro* cytotoxicity of the antifungal saponins are also described.

* Corresponding author. Tel.: +86 871 5223235; fax: +86 871 5150124.

** Corresponding author.

E-mail addresses: zhangyj@mail.kib.ac.cn (Y.-J. Zhang), cryang@mail.kib.ac.cn (C.-R. Yang).

0039-128X/\$ – see front matter © 2006 Elsevier Inc. All rights reserved.

doi:10.1016/j.steroids.2006.04.005

2. Experimental

2.1. General methods

Optical rotations were measured on a SEPA-3000 automatic digital polarimeter. IR spectra were conducted on a Bio-Rad FTS-135 spectrometer with KBr pellets. NMR spectra were measured in pyridine-*d*₅ and recorded on a Bruker AM-400 (for ¹H NMR and ¹³C NMR) and DRX-500 (for 2D NMR) instrument with TMS as internal standard. FABMS (negative ion mode) and HRESIMS (negative ion mode) spectra were recorded on VG AutoSpe 3000 and API Qstar Pulsar LC/TOF spectrometers, respectively. GC analysis was run on Agilent Technologies HP5890 gas chromatograph equipped with an H₂ flame ionization detector. The column was 30QC2/AC-5 quartz capillary column (30 m × 0.32 mm) with the following conditions: column temperature: 180 °C/280 °C; programmed increase, 3 °C/min; carrier gas: N₂ (1 ml/min); injection and detector temperature: 250 °C; injection volume: 4 µl, split ratio: 1/50. Silica gel (200–300 mesh and 10–40 µm) and reversed phase silica gel RP-8 (40–63 µm) were used for column chromatography.

2.2. Plant material

The fresh rhizomes of *S. atropurpurea* were collected from Zhongdian, Yunnan, China, and a voucher specimen is deposited at the Herbarium of Kunming Institute of Botany, Chinese Academy of Sciences.

2.3. Extraction and Isolation

The fresh rhizomes (20 kg) of *S. atropurpurea* were extracted with MeOH (5 L × 3) under reflux. After removal of the solvent under reduced pressure, the concentrate (400 g) was suspended into H₂O and partitioned with CHCl₃ and *n*-BuOH, successively. The *n*-BuOH fraction (100 g) was subjected to column chromatography (CC) using silica gel (3 kg), eluting with CHCl₃–MeOH–H₂O (7:3:0.5) to give six fractions (Fr. 1–6). Fr. 3 (8 g) was subjected to silica gel CC, eluting with a gradient solvent system of CHCl₃–MeOH (12:2–10:3) to give 1 (105 mg), 3 (500 mg), 4 (23 mg) and 5 (15 mg). Fr. 4 (10 g) was subjected to silica gel CC eluting with CHCl₃–MeOH (10:2–9:2) followed with reverse phase RP-8 CC eluting with MeOH–H₂O (4:6–1:0) to afford 1 (20 mg), 2 (40 mg), 7 (1 g) and 8 (300 mg). Fr. 5 (12 g) was applied to a silica gel column and eluted with CHCl₃–MeOH–H₂O (8:2:0.2–7:3:0.5) to afford 6 (155 mg).

2.3.1. Atropurosides A (1)

White amorphous powder [α]_D = –76.5° (c = 0.22, MeOH). FABMS (negative ion mode): *m/z* 723 [M–H][–], 577 [M–146(Rha)–H][–], 445 [M–146(Rha)–132(Xyl)–H][–]. HRESIMS (negative ion mode): *m/z* 723.3930 [M(C₃₈H₆₀O₁₃)–H][–] (calcd. for 723.3955). ¹H NMR (pyridine-*d*₅): δ 0.67 (d, *J* = 5.4 Hz, CH₃-27), 0.91 (s, CH₃-18), 1.10 (d, *J* = 6.9 Hz, CH₃-21), 1.17 (m, H-14), 1.35 (s, CH₃-19), 1.51 (m, H-15 β), 1.61 (br d, *J* = 9.6 Hz, H-11 β), 1.79 (d, *J* = 6.2 Hz, Rha CH₃-6), 1.95 (m, H-20), 2.10 (m, H-15 α), 2.59 (dd, *J* = 5.7, 11.9 Hz, H-4 α), 2.76 (br t, *J* = 11.9 Hz, H-4 β), 2.88 (br d, *J* = 9.6 Hz, H-11 α), 3.48 (t, *J* = 10.5 Hz, H-26 β), 3.56 (2H, m, H-

Table 1 – ¹³C NMR spectral data for the aglycone moieties of 1–7, 1a, 3a, 3b, and 7b (in pyridine-*d*₅)

Position	1	1a	2	3	3a	3b	4	5	6	7	7b
1	88.7	82.6	89.0	92.5	82.5	82.5	93.0	93.0	93.2	92.9	93.0
2	78.4	78.2	78.5	78.3	78.1	78.2	78.3	78.3	78.3	78.3	78.3
3	73.2	73.2	73.1	72.8	73.2	73.2	72.8	72.8	72.8	72.8	72.8
4	40.8	41.3	40.8	40.7	41.2	41.2	40.7	40.2	40.8	40.3	40.3
5	138.1	139.2	138.1	138.0	139.4	139.4	138.0	138.0	138.0	138.1	138.0
6	124.9	124.5	125.1	125.2	124.3	124.4	125.1	125.2	125.3	125.2	125.2
7	31.6	31.8	31.8	31.7	31.9	31.9	31.6	31.6	31.6	31.6	30.0
8	33.0	32.4	33.6	33.7	31.7	32.1	33.0	33.1	33.0	33.0	33.0
9	50.1	51.4	49.9	50.2	51.1	51.4	50.5	50.5	50.5	50.5	50.4
10	43.3	43.6	43.4	43.5	43.5	43.6	43.4	43.5	43.5	43.5	43.5
11	24.3	24.0	23.9	23.8	23.6	23.9	24.1	24.1	24.2	24.0	24.1
12	40.4	40.5	32.2	32.5	39.3	41.2	40.2	40.5	38.0	40.8	40.3
13	40.3	40.3	45.2	45.2	41.5	40.4	40.4	40.7	40.8	40.8	40.7
14	57.1	56.8	53.1	53.1	51.3	55.6	57.2	57.3	57.2	56.9	57.0
15	32.4	32.4	31.9	31.9	37.6	34.3	32.3	32.4	32.7	31.7	32.3
16	81.2	81.1	89.9	90.0	213.3	119.3	81.5	81.9	81.4	81.5	81.6
17	63.1	63.1	90.3	90.3	66.6	70.3	63.2	62.9	64.1	64.3	63.1
18	17.0	16.6	17.8	17.9	13.1	15.7	17.1	17.1	17.3	17.0	17.0
19	16.2	15.1	16.3	16.2	15.6	15.1	16.2	16.2	16.3	16.2	15.1
20	43.0	42.0	44.8	44.9	43.8	42.7	41.9	42.1	40.8	40.5	41.9
21	15.1	15.1	10.0	9.9	15.0	15.1	14.9	14.9	16.4	16.2	16.2
22	109.3	109.3	109.9	109.9	217.8	111.1	109.4	111.9	110.5	112.5	109.5
23	31.9	32.2	32.2	32.2	40.4	34.5	33.2	67.1	40.4	32.3	33.2
24	29.3	29.3	28.9	28.9	27.6	29.5	29.0	43.6	28.4	28.1	29.0
25	30.6	30.6	30.5	30.5	36.2	30.5	144.6	149.4	147.3	146.9	144.5
26	66.9	66.9	66.7	66.7	67.4	68.8	65.0	64.7	72.2	72.1	65.0
27	17.3	17.4	17.4	17.3	17.3	17.4	108.6	106.6	110.8	111.1	108.7
OCH ₃						50.6				47.4	

Download English Version:

<https://daneshyari.com/en/article/2028955>

Download Persian Version:

<https://daneshyari.com/article/2028955>

[Daneshyari.com](https://daneshyari.com)