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To cite this article: Lang-Ping Dong , Chang-Xiang Chen , Wei Ni , Bai-Bo Xie , Jun-Zhu Li & Hai-Yang Liu (2010) A new dinorclerone diterpenoid glycoside from *Tinospora sinensis* , Natural Product Research, 24:1, 13-17, DOI: [10.1080/14786410802253197](https://doi.org/10.1080/14786410802253197)

To link to this article: <http://dx.doi.org/10.1080/14786410802253197>



Published online: 09 Dec 2009.



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## A new dinorclerone diterpenoid glycoside from *Tinospora sinensis*

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(Received 17 July 2007; final version received 3 June 2008)

A new dinorclerone diterpenoid glycoside, named 1-deacetyltnosposide A (**1**), was isolated from the stem of *Tinospora sinensis* together with 10 known compounds. Their structures were elucidated on the basis of extensive spectroscopic techniques (MS, IR, 1D and 2D NMR experiments).

**Keywords:** *Tinospora sinensis*; Menispermaceae; 1-deacetyltnosposide A

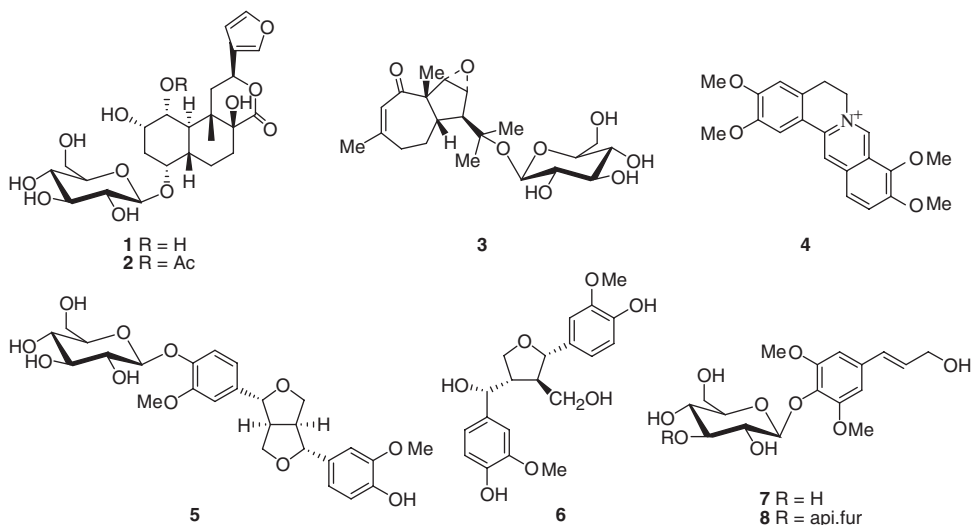
### 1. Introduction

In the Menispermaceae, the genus *Tinospora* comprises about 20 species, which are mainly distributed in the tropical parts of the eastern hemisphere (Hou, 1998). Various research groups have been working on the chemical constituents of this genus, especially *Tinospora cordifolia*, which is an important medicinal plant, and it has been widely cultivated and used in Ayurvedic preparations for treatment of various ailments throughout the Indian subcontinent (Gangan, Pradhan, Sipahimalani, Bhave, & Patil, 1997). More than 100 clerodane-type diterpenoids and their glycosides have been isolated, as well as alkaloids, sesquiterpenes, lignans and ecdysones (Gangan, Pradhan, & Sipahimalani, 1997; Guo et al., 1999; Hungerford, Sands, & Kitching, 1998; Maurya, Dhar, & Handa, 1997; Ragasa, Cruz, Gula, & Rideout, 2000) from the genus *Tinospora*.

In China, the stems of *Tinospora sinensis* Merr. have been used as folk medicine to treat strains of the lumber muscles, rheumatism and bruises (Jiangsu New Medicinal College, 1977). Its anti-inflammatory, immunomodulatory and antidiabetic activities have been demonstrated by pharmacological experiments (Li, Lin, Myers, & Leach, 2003; Manjrekar, Jolly, & Narayanan, 2000; Yonemitsu, Fukuda, & Kimura, 1993). In previous chemical studies, the isolation of two dinorditerpene glucosides, tinosines A (**2**) and B, was reported (Yonemitsu, Fukuda, Kimura, Isobe, & Komori, 1995), as well as three phenylpropanoid glycosides (Li et al., 2004; Yonemitsu et al., 1993), tinosinen (**8**), 4-allyl-2-methoxyphenyl 6-*O*- $\beta$ -D-apiofuranosyl (1  $\rightarrow$  6)- $\beta$ -D-glucopyranoside, icariside D1, seven lignan glucosides (Li et al., 2004), tinosposides A (**2**) and B, tanegoside (**6**), (–)-pinoresinol *O*- $\beta$ -D-glucopyranoside (**5**), (–)-pinoresinol monomethyl ether *O*- $\beta$ -D-glucopyranoside, (–)-syringaresinol *O*- $\beta$ -D-glucopyranoside, and (–)-isolariciresinol 3 $\alpha$ -*O*- $\beta$ -D-glucopyranoside, all from *T. sinensis*. During our chemical investigation of this plant, we obtained a

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new dinorclerone diterpenoid glycoside, named 1-deacetyltnosposide A (**1**), together with 10 known compounds: tinosineside A (**2**), tinocordifolioside (**3**), palmatine (**4**), (–)-pinoresinol 4-*O*- $\beta$ -D-glucopyranoside (**5**), 8'-epitanegool (**6**), syringin (**7**), (*E*)-1-(3-hydroxy-1-propenyl)-3,5-dimethoxyphenyl-4-*O*- $\beta$ -D-apiofuranosyl-(1  $\rightarrow$  3)- $\beta$ -D-glucopyranoside (**8**), stigmasta-5, 11 (12)-dien-3 $\beta$ -ol (**9**),  $\beta$ -sitosterol (**10**), and daucosterol (**11**). This article describes the isolation and structural elucidation of a new dinorclerone diterpenoid glycoside, 1-deacetyltnosposide A (**1**), besides the 10 known compounds.

## 2. Results and discussion

Compound **1**, a colourless amorphous powder, showed a  $[M-H]^-$  ion peak at  $m/z$  513.1956 in the negative ion HRFAB<sup>–</sup>MS, indicating the molecular formula C<sub>24</sub>H<sub>34</sub>O<sub>12</sub>. The IR spectrum showed characteristic absorptions for hydroxyl groups (3415 cm<sup>–1</sup>), a  $\delta$ -lactone (1722 cm<sup>–1</sup>), and a furan ring (1505, 1022, 875 cm<sup>–1</sup>). The UV spectrum [202 nm (log  $\epsilon$  = 3.91)] was indicative of the presence of a furan moiety. The presence of a furan ring was also confirmed by a positive Ehrlich colour test. Its negative FAB<sup>–</sup>MS spectrum gave a fragment ion at  $m/z$  351  $[M-C_6H_{10}O_5-H]^-$ , suggesting the presence of a glucopyranosyl unit in the molecule of **1**, which was supported by the presence of six carbon signals of the glucopyranosyl at  $\delta$  = 101.3 (d), 74.9 (d), 78.7 (d), 71.9 (d), 79.1 (d) and 63.1 (t) in its <sup>13</sup>CNMR spectrum. Furthermore, the coupling constant of the anomeric proton of a sugar moiety ( $J$  = 7.8 Hz) suggested the glycosidic linkage to have a  $\beta$ -glucopyranose.

The aglycone moiety of **1** has 18 carbons besides the sugar moiety. The <sup>1</sup>H NMR spectrum of this compound was very similar to that of clerodane furano-diterpenes, and the assignments are given in Table 1. The signals at  $\delta$  7.47 (d,  $J$  = 1.6 Hz, 1H), 7.42 (br s, 1H), and 6.49 (d,  $J$  = 1.6 Hz, 1H) were assigned two  $\alpha$ -protons and  $\beta$ -proton of a  $\beta$ -substituted furan moiety. A signal for the angular methyl group was observed as a singlet at  $\delta$  = 1.51. By detailed comparison of the <sup>1</sup>H, <sup>13</sup>C NMR data, and combined

Table 1.  $^1\text{H}$ - and  $^{13}\text{C}$ NMR and spectra data, HMBC correlations for **1** (in  $\text{C}_5\text{D}_5\text{N}$ ).

Position	$\delta_{\text{H}}$	$\delta_{\text{C}}$	HMBC
1	3.99 (dd, $J = 2.9, 10.8$ Hz)	74.1 (d)	C-10
2	4.33 (m)	71.7 (d)	C-1, 3, 4, 10
3	1.61 (m)	32.8 (t)	C-1, 2, 4, 5
	2.64 (d, $J = 15.2$ Hz)		C-4, 5
4	4.08 (m)	76.2 (d)	C-2, 6, 10, 1'
5	1.68 (m)	39.2 (d)	C-1, 4, 7, 10
6	1.61 (m)	26.8 (t)	C-7, 8, 10
	2.35 (m)		C-5, 7, 8
7	1.88 (m)	30.8 (t)	C-5, 6, 8, 17
	2.77 (d, $J = 12.0$ Hz)		C-5, 6
8		76.3 (s)	
9		40.8 (s)	
10	2.84 (t, $J = 10.8$ Hz)	36.4 (d)	C-1, 5, 20
11	3.04 (t, $J = 12.3$ Hz)	37.6 (d)	C-8, 9, 10, 12, 13, 20
	3.38 (dd, $J = 3.5, 13.4$ Hz)		C-8, 9, 20
12	6.11 (dd, $J = 3.5, 12.3$ Hz)	72.2 (d)	C-11, 13, 14, 16, 17
13		127.3 (s)	
14	6.49 (d, $J = 1.6$ Hz)	109.8 (d)	C-12, 13, 15, 16
15	7.47 (d, $J = 1.6$ Hz)	143.8 (d)	C-13, 14, 16
16	7.42 (br s)	140.1 (d)	C-12, 13, 14, 15
17		173.6 (s)	
20	1.51 (s)	14.4 (q)	C-8, 9, 10, 11
1'	4.94 (d, $J = 7.8$ Hz)	101.3 (d)	C-4, 3', 5'
2'	3.87 (m)	74.9 (d)	C-1', 3', 4'
3'	4.21 (m)	78.7 (d)	C-1', 2', 4'
4'	4.04 (m)	71.9 (d)	C-3', 5', 6'
5'	3.91 (m)	79.1 (d)	C-1', 4', 6'
6'	4.54 (dd, $J = 2.1, 11.8$ Hz)	63.1 (t)	C-4', 5'
	4.29 (m)		C-4', 5'

$^1\text{H}$ - $^1\text{H}$  COSY, and HMBC of **1**, compound **1** had the same skeleton as tinosineside A (**2**) (Li et al., 2004), except for the presence of a hydroxyl group and the disappearance of an acetoxy group at C-1 in **1**. The relative stereochemistry of **1** was fixed on the basis of a ROESY experiment. The important correlations of H-1 with H-2, H-5, Me-20, H-5 with H-4, Me-20, and H-10 with H-12 were observed, and indicated that H-1, H-2, H-4, H-5 and Me-20 were on the same side of the molecule whereas H-10 and H-12 were on the opposite side (Figure 1). On the basis of these data, the structure of **1** was elucidated as 1-deacetyltilnosposide A.

1-Deacetyltilnosposide A (**1**) and tinosposide A (**2**) were tested for *in vitro* cytotoxicity against HepG2 and Raji cells. However, they were non-cytotoxic.

### 3. Experimental

#### 3.1. General experimental procedures

UV spectra were obtained on a UV-210A spectrometer. IR spectra were taken in KBr on a Bio-Rad FTS-135 infrared spectrophotometer. Optical rotations were performed on a JASCO DIP-370 digital polarimeter. Negative FAB mass spectra were measured on a VG Auto spec-3000 spectrometer and high-resolution ESI mass spectra were recorded on an

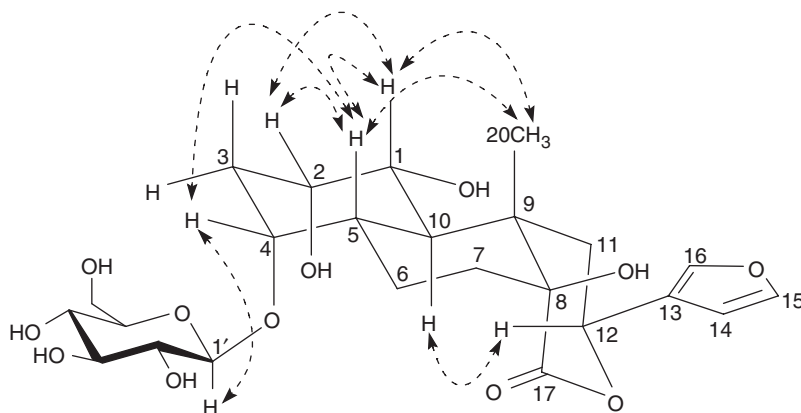


Figure 1. Key ROESY correlations of 1-deacetyltilnosposide A (**1**).

API Qstar Pulsar instrument. 1D and 2D NMR experiments were performed on Bruker AM-400 and DRX-500 instruments, with TMS as the internal standard. Column chromatography was performed on silica gel (200–300 mesh, Qingdao Marine Chemical Inc., Qingdao, P.R. China) or on silica gel H (10–40  $\mu$ m, Qingdao Marine Chemical Inc.). MPLC were performed on a BÜCHI Pump Module C-605, a BÜCHI Pump Manager C-615, and a BÜCHI Fraction Collector C-660.

### 3.2. Plant material

The stems of *T. sinensis* were collected from Xishuangbanna, Yunnan province, P.R. China, in August 2005. The plants were identified by Prof. Guo-Da Tao, Xishuangbanna Tropical Botanical Garden, Chinese Academy of Science. A voucher specimen (No. 200503) is deposited in the State Key Laboratory of Phytochemistry and Plant Resources in West China, Kunming Institute of Botany.

### 3.3. Extraction and isolation

The dried and powdered stems of *T. sinensis* (5.0 kg) were extracted with 70% Me<sub>2</sub>CO and filtered at RT. The filtrate was concentrated and partitioned successively between EtOAc and water, then *n*-BuOH and water. The EtOAc extract (20 g) was applied to column chromatography (petroleum ether : AcOEt 9:1, 8:2, 5:5 v/v) to afford **9** (14 mg), **10** (2.0 g), and **11** (1.3 g). The *n*-BuOH extract (40 g) was applied to column chromatography (CHCl<sub>3</sub>:MeOH 20:1, 9:1, 8.5:1.5, 8:2 v/v) to afford **1** (94 mg), **2** (127 mg), **3** (30 mg), **4** (7 mg), **5** (16 mg), **6** (18 mg), **7** (35 mg), and **8** (30 mg).

#### 3.3.1. 1-deacetyltilnosposide A (**1**)

C<sub>24</sub>H<sub>34</sub>O<sub>12</sub>, colourless amorphous powder;  $[\alpha]_D^{25} = -11.7$  ( $c = 0.3$ , pyridine); UV (MeOH)  $\lambda_{\max}$  (log  $\epsilon$ ): 202 nm (3.91); IR (KBr)  $\nu_{\max}$  (cm<sup>-1</sup>): 3415, 2925, 2874, 1722, 1505, 1022, 875; <sup>1</sup>H NMR and <sup>13</sup>C NMR, see Table 1; Negative FAB-MS  $m/z$ : 513 [M–H]<sup>–</sup>, 351 [M–glucose – H]<sup>–</sup>; HRESI-MS  $m/z$ : 513.1956 [M–H]<sup>–</sup> (C<sub>24</sub>H<sub>33</sub>O<sub>12</sub> Calcd 513.1972).

## References

- Jiangsu New Medicinal College. (1977). *Dictionary of traditional Chinese medicine* (p. 1393). Shanghai: Shanghai Science and Technology Press.
- Gangan, V.D., Pradhan, P., & Sipahimalani, A.T. (1997). Phytoecdysones from *Tinospora cordifolia*: Structural elucidation of ecdysterone and makisterone A by 2D NMR spectroscopy. *Indian Journal of Chemistry*, 36B, 787–792.
- Gangan, V.D., Pradhan, P., Sipahimalani, A.T., Bhawe, V.G., & Patil, A. (1997). N-trans-feruloyltyramine from *Tinospora cordifolia*. *Indian Journal of Chemistry*, 36B, 837–839.
- Guo, Y., Kojima, K., Ni, L., Fu, X., Zhao, C., Hatano, K., et al. (1999). A new N-methyltetrahydroprotoberberine alkaloid from *Tinospora hainanensis*. *Chemical and Pharmaceutical Bulletin*, 47, 287–289.
- Hou, K.S. (1998). *A dictionary of the families and genera of Chinese seed plants* (2nd ed., p. 304). Beijing: Science Press.
- Hungerford, N.L., Sands, D.P.A., & Kitching, W. (1998). Isolation and structure of some constituents of the Australian medicinal plant *Tinospora smilacina* ('snakevine'). *Australian Journal of Chemistry*, 51, 1103–1111.
- Li, W., Koike, K., Liu, L.J., Lin, L.B., Fu, X.W., Chen, Y.J., et al. (2004). New lignan glucosides from the stems of *Tinospora sinensis*. *Chemical and Pharmaceutical Bulletin*, 52, 638–640.
- Li, R.W., Lin, G.D., Myers, S.P., & Leach, D.N. (2003). Anti-inflammatory activity of Chinese medicinal vine plants. *Journal of Ethnopharmacology*, 85, 61–67.
- Manjrekar, P.N., Jolly, C.I., & Narayanan, S. (2000). Comparative studies of the immunomodulatory activity of *Tinospora cordifolia* and *Tinospora sinensis*. *Fitoterapia*, 71, 254–257.
- Maurya, R., Dhar, K.L., & Handa, S.S. (1997). A sesquiterpene glucoside from *Tinospora cordifolia*. *Phytochemistry*, 44, 749–750.
- Ragasa, C.Y., Cruz, M.C., Gula, R., & Rideout, J.A. (2000). Clerodane diterpenes from *Tinospora rumphii*. *Journal of Natural Products*, 63, 509–511.
- Yonemitsu, M., Fukuda, N., & Kimura, T. (1993). Studies on the constituents of *Tinospora sinensis*. I. Separation and structure of the new phenolic glycoside tinosinen. *Planta Medica*, 59, 552–553.
- Yonemitsu, M., Fukuda, N., Kimura, T., Isobe, R., & Komori, T. (1995). Studies on the constituents of the stems of *Tinospora sinensis*. 2. Isolation and structure elucidation of 2 new dinorditerpene glucosides, tinosineside A and tinosineside B. *Liebigs Annalen*, 437–439.