

A NEW CERAMIDE FROM A NEW SPECIES OF *Spongia* SPONGE

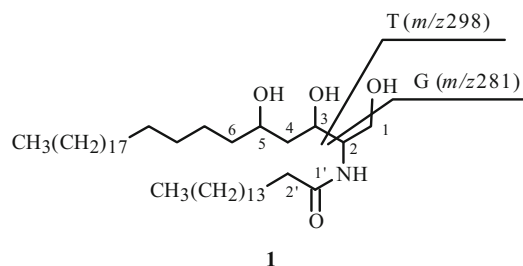
Zhi Guan^{1*} and Longmei Zeng²

UDC 547.29+547.917

Sphingolipids have been isolated from various marine organisms including algae, coelenterates, echinoderms, sponges, and tunicates. They are increasingly becoming important compounds because of their marked biological activity. It has been recently found that ceramides inhibit cholesteryl ester transfer protein (CETP) [1]. Elevation of CETP leads to atherosclerotic cardiovascular diseases [2]. A literature survey showed that ceramides are antifungal [3], and some of these showed antimicrobial and cytotoxic activities [4, 5]. In our continuing studies on chemical constituents of marine organisms, we have examined a new species of *Spongia* sponge, collected from Sanya shore of Hainan Province, China, and it led to the isolation of a new ceramide, *N*-palmitoyl-heptacosane-1,3,5-triol (**1**).

The sponge (3 kg, after extraction) was collected in ethanol (10 L). After soaking the sponge for several weeks, the solvent was decanted and the sponge extracted five more times with ethanol. Solvent was removed from the extracts under reduced pressure, and the combined brown colored residue was extracted with chloroform several times. The chloroform-soluble portion (10 g) was chromatographed over a column of silica gel with increasing polarities of solvent mixture starting from petroleum ether to ethyl acetate. The fraction obtained with petroleum ether–ethyl acetate, 20:80 (v/v) contained compound **1**. It was further purified by crystallization from petroleum ether–ethyl acetate to obtain **1** as an amorphous white solid. FAB-MS showed the fragment peak at m/z 682 $[M + 1]^+$. Combined with ^{13}C NMR DEPT spectra, the molecular formula of **1** was established as $\text{C}_{43}\text{H}_{87}\text{NO}_4$. The IR spectrum showed absorptions at 3302, 1643, 1544, and 1378 cm^{-1} and ^1H NMR signals at δ 6.33 (1H, d, $J = 7.3$ Hz, exchangeable), together with ^{13}C NMR DEPT signals at δ 174.5 ppm (C), suggesting that **1** contains a $-\text{CO}-\text{NH}-$ moiety. ^1H NMR signals at δ 0.86 ppm (6H, t, $J = 6.5$ Hz) and ^{13}C NMR DEPT signals at δ 14.1 ppm (2CH_3), combined with the very strong signal at δ 1.25 (br.s, many H) in the ^1H NMR spectrum, but lack of upfield methine and tertiary carbon signals in the ^{13}C NMR DEPT spectrum, revealed that **1** must be derived from two long-chain fatty acid precursors [6]. The ^{13}C NMR DEPT spectrum of **1** further furnished $1 \times \text{C}$, $3 \times \text{CH}$, $n \times \text{CH}_2$, and $2 \times \text{CH}_3$ (Table 1), with one quaternary carbon at δ 174.5 (CONH) and three methines at δ 54.6, 76.6, and 72.8 ppm.

The FAB-MS fragmentation of **1** showed strong peaks at m/z 281 and 298. According to the nomenclature of sphingolipid mass fragmentation patterns, these peaks corresponded to the G and T fragments, respectively [7], which revealed that **1** is a ceramide of *N*-palmitoyl-heptacosane-1,3,5-triol. This interpretation was further supported by hydrolysis of **1** with H_2SO_4 –MeOH [8]. Compound **1** was hydrolyzed with 2 mol/L H_2SO_4 –MeOH, and the hexane extract gave methyl palmitate as a unique product, which was detected by GC-MS analysis.



1) School of Chemistry and Chemical Engineering, Southwest University, Chongqing 400715, P. R. China, e-mail: guanzhi@swu.edu.cn; 2) School of Chemistry and Chemical Engineering, Sun Yat-sen (Zhongshan) University, Guangzhou 510275, P. R. China. Published in Khimiya Prirodnykh Soedinenii, No. 2, pp. 241–242, March–April, 2010. Original article submitted September 23, 2008.

TABLE 1. ^1H and ^{13}C NMR Spectral Data for **1** (500 MHz, CDCl_3 , δ , ppm, J/Hz)

C atom	δ_{C} (DEPT)	δ_{H}	^1H - ^1H COSY
1	61.9 (CH_2)	3.92 (dd, $J = 10, 3.8$) 3.75 (dd, $J = 10, 3.8$)	H-2
2	54.6 (CH)	3.98 (m)	H-1, H-3, NH
3	76.6 (CH)	4.15 (m)	H-2, H-4
4	39.1 (CH_2)	3.57 (m) 3.47 (m)	H-5
5	72.8 (CH)	3.62 (m)	H-4, H-6
6	36.7 (CH_2)	1.90 (m)	
7–26	22.7–29.7 ($n \times \text{CH}_2$)	1.25 (br.s)	
27	14.1 (CH_3)	0.86 (t, $J = 6.5$)	
NH		6.33 (br.d, $J = 7.3$)	H-2
1'	174.5 (C)		
2'	36.7 (CH_2)	2.24 (t, $J = 6.5$)	H-3'
3'–15'	22.7–29.7 ($n' \times \text{CH}_2$)	1.25 (br.s)	
16'	14.1 (CH_3)	0.86 (t, $J = 6.5$)	

ACKNOWLEDGMENT

This study was supported by the Natural Science Foundation Project of CQ CSTC (No. CSTC, 2006BB5052) and the Southwest University Science Foundation for Doctoral Scientists (SWNUB2005013).

REFERENCES

1. T.-S. Jeong, J.-A. Ahn, Y.-K. Kim, S.-H. Bok, B.-M. Kwon, J. Shin, and Y. Seo, *Bioorg. Med. Chem. Lett.*, **7** (11), 1481 (1997).
2. K. Marotti, C. K. Castle, T. P. Boyle, A. H. Lin, R. W. Murray, and G. W. Melchior, *Nature*, **364** (6432), 73 (1993).
3. Y. Kaxhman and S. Hirsch, *Tetrahedron*, **45** (12), 3897 (1989).
4. W. Jin, K. L. Rinehart, and E. E. A. Jares, *J. Org. Chem.*, **59** (1), 144 (1994).
5. G. T. Carter and K. L. Rinehart, *J. Am. Chem. Soc.*, **100** (23), 7411 (1978).
6. J. Y. Su, Y. Li, and X. Q. Yu, *Acta Sci. Nat. Univ. Sunyatseni*, **28** (2), 33 (1989).
7. J. Adams and Q. Ann, *Mass Spectrom. Rev.*, **12**, 51 (1993).
8. J. Shin and Y. Seo, *J. Nat. Prod.*, **58** (6), 948 (1995).