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A CARDENOLIDE GLYCOSIDE FROM *GOMPHOCARPUS SINAICUS*

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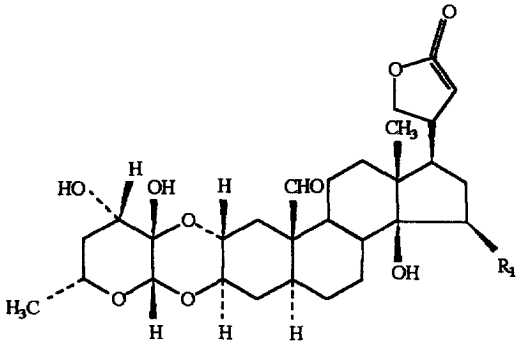
Key Word Index—*Gomphocarpus sinaicus*; Asclepiadaceae; aerial parts; Δ^7-cardenolides.

Abstract—A cardenolide glycoside was isolated from the aerial parts of *Gomphocarpus sinaicus* Boiss. along with the previously known cardenolide glycoside 15β-hydroxycalotropin. The structure of the new glycoside was elucidated on the basis of spectroscopic data and comparison of NMR data with those of the congeners. It was identified as 15β-hydroxy-7,8-dehydrocalotropin. © 1998 Elsevier Science Ltd. All rights reserved

INTRODUCTION

Gomphocarpus sinaicus Boiss. (syn. *Asclepias sinaica* Muschl.), indigenous to the sandy mountainous region in South Sinai province of Egypt, is rich in a number of cardenolides, in particular cardenolide glycosides with unusual doubly linked sugars [1–3]. In a previous study on *G. sinaicus* [3], the structure of the compounds thought to be 5,6-dehydrocalotropin and 5,6-dehydrocalotropagenin were revised to 7,8-dehydrocalotropin and 7,8-dehydrocalotropagenin, respectively. In the course of further investigations, a new cardenolide glycoside was isolated and its structure is described in this paper.



1 R_1 = OH, Δ^7

15-hydroxycalotropin R_1 = OH

7,8-dehydrocalotropin R_1 = H, Δ^7

RESULTS AND DISCUSSION

Compound **1** had the molecular formula $C_{29}H_{38}O_{10}$ deduced from its FAB-mass spectrum and the presence of 29 carbons observed in the ^{13}C NMR spectrum. In the ^1H NMR spectrum one formyl proton was observed at δ 9.86 as a singlet signal, suggesting compound **1** to be a 9-oxocardenolide. An anomeric proton signal appeared as a singlet at δ 5.08, so that compound **1** was considered to be a doubly linked glycoside. A proton signal assignable to H-3′ was observed at δ 4.12 (*dd*, J = 12, 4.5 Hz) and its coupling mode to the C-4′ methylene protons showed that H-3′ retained β (axial)-orientation. In the ^1H and ^{13}C NMR spectra, this compound exhibited the presence of one secondary hydroxyl group along with a 14β-hydroxyl in the aglycone moiety.

Comparing the ^1H and ^{13}C NMR data of compound **1** with those reported for 7,8-dehydrocalotropin [3], signals due to rings A, B and C of the steroidal framework and the sugar moiety were in good agreement. In the ^1H NMR spectrum, an extra multiplet signal was observed at δ 4.75. In the ^{13}C NMR spectrum, the carbon signal for C-15 was shifted from δ 39.6 in 7,8-dehydrocalotropin to δ 74.3 in compound **1**. The signals due to C-16 was also downshifted (= 10.2 ppm). Since these shifts were similar to those reported fro 15-hydroxycardenolides [3–5], compound **1** should be a 15-hydroxy-7,8-dehydrocalotropin. The orientation of the hydroxyl group was determined to be β by the similarity of the chemical shifts to those for 3′-epiafroside isolated from the same plant [3] and not to those reported for 15α-hydroxycardenolides (15α-

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Table 1. ^{1}H NMR spectral data for compound **1**, 7,8-dehydrocalotropin and 15β-hydroxycalotropin

H	**1**	7,8-dehydrocalotropin	15β-hydroxycalotropin
1α	1.18 *t*(12)	1.15 *t*(12)	1.12 *t*(12)
1β	2.50 *dd*(12, 4.5)	2.50 *dd*(12, 4.5)	2.48 *dd*(12, 4.5)
2β	hidden	4.85 hidden	hidden
3α	4.15 *td*(12, 4.5)	4.30 *ddd*(12, 10, 4.5)	4.30 *td*(10, 4.5)
7	6.25	6.36	
15	4.75 *m*	1.85, 2.36	4.73
17	2.76 *dd*(10.5, 6)	2.85	2.77
18	0.85	0.85	0.88
19	9.86 *s*	9.86 *d*(1.5)	10.02
21	5.24 *dd*(18, 1.5)	5.25 *dd*(18, 1.5)	5.26 *dd*(18, 1.5)
	4.98 *dd*(18, 1.5)	5.05 *dd*(18, 1.5)	5.04 *dd*(18, 1.5)
22	6.12	6.11 *br. s*	6.08 *br. s*
1′	5.08 *s*	5.08 *s*	hidden
3′	4.12 *dd*(12, 4.5)	4.12 *dd*(12, 4.5)	4.12 *dd*(12, 4.5)
4′	2.02, 2.12 *q*(12)	2.02 *td*(12, 4.5)	2.01, 2.10
		2.12 *q*(12)	
5′	3.77 *m*	3.76 *m*	3.74 *m*
6′	1.34 *d*(6)	1.35 *d*(6)	1.34 *d*(6)

Spectra were measured in pyridine-d_5.

Table 2. ^{13}C NMR spectral data for compound **1** and related compounds

C	1	7,8-dehydrocalotropin	15β hydroxycalotropin	3′-epiafroside	15α-hydroxy-cardenolide
1	35.6	35.5	36.5	42.8	36.9
2	68.8	68.9	69.3	69.1	26.9
3	72.0	72.0	72.3	73.1	73.8
4	33.6	33.7	33.9	32.9	34.3
5	38.5	38.8	43.5	45.0	44.1
6	29.6	29.6	28.1	28.3	29.4
7	122.3	120.9	27.1	26.8	27.7
8	138.2	140.7	42.5	40.9	42.5
9	44.8	44.9	48.7	49.4	50.2
10	52.2	52.3	53.0	37.9	36.0
11	23.7	23.7	22.1	21.6	21.3
12	38.1	38.8	38.1	38.5	39.6
13	48.4	50.8	49.2	49.0	49.2
14	83.2	84.4	81.5	81.8	85.1
15	74.3	39.6	72.2	72.9	79.5
16	38.1	27.9	37.8	37.9	39.6
17	48.8	50.7	48.2	49.4	48.4
18	16.6	16.1	16.5	16.8	17.7
19	206.6	206.7	208.0	13.8	11.2
20	175.3	175.3	174.9	175.1	175.8
21	73.6	73.6	73.7	73.7	73.8
22	118.1	117.9	118.1	118.1	117.1
23	174.5	174.3	174.3	174.8	175.0
1′	97.3	97.3	97.3	97.4	
2′	92.7	92.7	92.7	92.7	
3′	73.9	73.9	73.8	73.9	
4′	39.9	39.9	39.9	39.9	
5′	68.5	68.5	86.5	68.5	
6′	21.5	21.5	21.5	21.5	

Spectra were measured in pyridine-d_5.

hydorxyuzarigenin acetate) [6]. Thus, compound **1** was identified to be the new compound 15β-hydroxy-7,8-dehydrocalotropin. Since from a previous publication [3], the structures of the compounds thought to be 5,6-dehydrocalotropin and 5,6-dehydrocalotropagenin were revised to 7,8-dehydrocalotropin and 7,8-dehydrocalotropagenin, respectively, and as the NMR data of compound **1** are very similar to those reported for a compound which has previously been isolated from *G. sinaicus* and identified as 15β-hydroxy-5,6-dehydrocalotropin [1], this compound should also be revised to 15β-hydroxy-7,8-dehydrocalotropin. The identity of the known cardenolide glycoside 15β-hydroxycalotropin was established by comparing its spectral data with literature data [1].

EXPERIMENTAL

Generally for instrumental, plant material, extraction, fractionation and isolation see reference [3], where the purified chloroform extract was fractionated by CC on silica gel 60 and eluted with $CHCl_3$–MeOH (17:3). The eluted fractions were classified according to TLC into three groups. Group II was again subjected to CC on silica gel 60 and eluted with $CHCl_3$-MeOH (4:1) (10 ml fractions). Fractions 80–115 were further purified using FC RP-18 with 60% MeOH in H_2O. The concentrated eluate was separated on MPLC using MeOH–CH_3CN–H_2O (1:1:1.7) to give 15β-hydroxycalotropin (8.1 mg) (m/z 547; $[M-H]^-$), and compound **1** (3.1 mg) (m/z 545; $[M-H]^-$). ^1H and ^{13}C NMR data: see Tables 1 and 2.

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