

7-O-METHYLGARCINONE E FROM *GARCINIA COWA*KITTISAK LIKHITWITAYAWUID,\* THATREE PHADUNGCHAROEN, CHULABHORN MAHIDOL†‡  
and SOMSAK RUCHIRAWAT†‡

Department of Pharmacognosy, Faculty of Pharmaceutical Sciences, Chulalongkorn University, Bangkok 10330, Thailand; † Chulabhorn Research Institute, Bangkok 10210, Thailand; ‡ Department of Chemistry, Faculty of Science, Mahidol University, Bangkok 10400, Thailand

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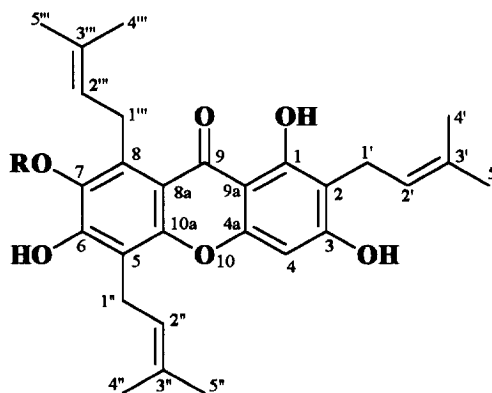
**Key Word Index**—*Garcinia cowa*; Guttiferae; xanthenes; 7-O-methylgarcinone E; NMR spectroscopy.**Abstract**—The stem bark of *Garcinia cowa* furnished a new xanthone which was characterized as 7-O-methylgarcinone E. © 1997 Elsevier Science Ltd. All rights reserved

## INTRODUCTION

The bark of *Garcinia cowa* Roxb. (Guttiferae) has been used in Thai folk medicine for its antipyretic property [1]. Previous investigations of this plant revealed the presence of five prenylated xanthenes, namely cowanin, cowanol, norcowanin, cowaxanthone and 1,3,6-trihydroxy-7-methyl-2,5-bis(prenyl)xanthone [1, 2]. As a continuation of our phytochemical work on Thai medicinal plants [3–8], we re-examined the constituents of the bark of *G. cowa*. During the course of the separation, 7-O-methylgarcinone E (**1**) was isolated as a new xanthone. This report describes the structure elucidation of the new xanthone (**1**).

## RESULTS AND DISCUSSION

Compound **1** exhibited a quasimolecular ion  $[M+H]^+$  at  $m/z$  479.2430, corresponding to the formula  $C_{29}H_{35}O_6$  (calcd. for 479.2434), and therefore establishing a molecular formula of  $C_{29}H_{34}O_6$ . The  $^1H$  NMR spectrum of **1** (Table 1) displayed signals which were suggestive of a polyhydroxylated polyprenylated xanthone structure [1, 2, 9]. It showed, in the down-field region, an aromatic proton resonance at  $\delta$  6.31 (*s*, H-4) and three OH signals at  $\delta$  6.15 (*br s*, 3-OH), 6.39 (*s*, 6-OH) and 13.82 (*s*, 1-OH). Three prenyl groups were present in the structure of **1**, as evident from the following resonances: (1) three olefinic protons at  $\delta$  5.25 (*m*, H-2'''), 5.27 (*m*, H-2''), and 5.28 (*m*, H-2'); (2) three pairs of methylene protons at  $\delta$  3.44 (*br d*,  $J = 7.37$  Hz, H<sub>2</sub>-1'), 3.55 (*br d*,  $J = 7.33$  Hz, H<sub>2</sub>-

**1** R = Me**2** R = H

1'') and 4.05 (*d*,  $J = 6.41$  Hz, H<sub>2</sub>-1'''); and (3) six methyl protons at  $\delta$  1.67 (*br s*, H<sub>3</sub>-5'''), 1.67 (*br s*, H<sub>3</sub>-5''), 1.75 (*br d*,  $J = 1.22$  Hz, H<sub>3</sub>-5'), 1.81 (*br d*,  $J = 0.92$  Hz, H<sub>3</sub>-4'''), 1.83 (*br d*,  $J = 0.91$  Hz, H<sub>3</sub>-4') and 1.85 (*br d*,  $J = 0.92$  Hz, H<sub>3</sub>-4''). The nature of the allylic and homoallylic coupling systems within each isoprene moiety was explicitly demonstrated in the homonuclear COSY spectrum. In fact, the  $^1H$  NMR spectral properties of **1** possessed very close resemblance to those of garcinone E (**2**) [9], except for the presence of a methoxy resonance at  $\delta$  3.79 (*s*, 7-OMe) in **1** instead of a hydroxyl group in **2**. From the mass difference (15 amu) between **1** and **2**, it could be inferred that **1** was an *O*-methyl derivative of **2**. Careful comparison of the  $^{13}C$  NMR data of **1** and **2** [9], particularly the shifts of C-6, C-7 and C-8, (Table 1) indicated that the methoxy substituent in **1** should be located at C-

\* Author to whom correspondence should be addressed.

Table 1.  $^1\text{H}$  and  $^{13}\text{C}$  NMR spectral data\*

Position	$^1\text{H}$ of 1	$^{13}\text{C}$ of 1	$^{13}\text{C}$ of 2†
1		160.5	160.5
2		108.3	108.2
3		161.5	161.5
4	6.31 (s)	93.2	93.2
4a		155.0	155.1
5		113.9	113.3
6		152.3	148.7
7		142.2	139.3
8		131.8	124.6
8a		111.9	111.3
9		182.4	183.1
9a		103.6	103.7
10a		153.5	151.3
1'	3.44 (br d, 7.37)	21.4	21.5
2'	5.28 (m)	121.5	121.5
3'		135.7	135.8
4'	1.83 (br d, 0.91)	17.9	17.9
5'	1.75 (br d, 1.22)	25.8	25.8
1''	3.55 (br d, 7.33)	22.6	22.6
2''	5.27 (m)	121.1	121.0
3''		132.6	133.7
4''	1.85 (br d, 0.92)	17.9	18.0
5''	1.67 (br s)	25.8	25.8
1'''	4.05 (br d, 6.41)	26.4	25.8
2'''	5.25 (m)	123.5	121.9
3'''		133.9	135.1
4'''	1.81 (br d, 0.92)	18.1	18.0
5'''	1.67 (br s)	25.8	25.9
1-OH	13.82 (s)		
3-OH	6.15 (br s)		
6-OH	6.39 (s)		
7-OMe	3.79 (s)	62.0	

\* In  $\text{CDCl}_3$  at 500 MHz for  $^1\text{H}$  and 125.7 MHz for  $^{13}\text{C}$ .

† From ref. [9].

7. Conclusive proof for the structure of **1** came from extensive analysis of the correlation peaks in the NOESY and HMBC spectra (Table 2). Of the most important observations in the HMBC spectra are the 3-bond connectivity between  $\text{H}_2\text{-1}'''$  and C-7, and between 7-OMe and C-7. The NOEs observed for  $\text{H}_2\text{-1}'''$  and 7-OMe, and 6-OH and 7-OMe further confirmed the placement of the methoxy group at C-7. The locations of the three 3-methyl-2-butene units at C-2, C-5 and C-8 were supported by the HMBC correlations of, for example,  $\text{H}_2\text{-1}'$  and C-1,  $\text{H}_2\text{-1}''$  and C-6, and  $\text{H}_2\text{-1}'''$  and C-8a, respectively. The presence of 3-OH was indicated by the 3-bond coupling between  $\text{H}_2\text{-1}'$  and C-3. Hence **1** was identified as 1,3,6-trihydroxy-7-methoxy-2,5,8-triprenylxanthone.

## EXPERIMENTAL

**Plant material.** The stem bark of *Gacinia cowa* Roxb. was collected from the botanical garden of Faculty of Pharmaceutical Sciences, Chulalongkorn University, Thailand in April 1994, where a voucher specimen is retained. Authentication through com-

Table 2. NOESY and HMBC correlation data for compound **1**

Proton	NOESY (proton)	HMBC (carbon)
4		2, 9a; (3), (4a)*
1'	2', 4'	1, 3, 3'; (2), (2')
2'	1', 5'	4', 5'
4'	1', 5'	2', 5'; (3')
5'	2', 4'	2', 4'; (3')
1''	2'', 4''	6, 10a, 3''; (5), (2'')
2''	1'', 5''	4'', 5''
4''	1'', 5''	2'', 5''; (3'')
5''	2'', 4''	2'', 4''; (3'')
1'''	2''', 4''', 7-OMe	7, 8a, 3'''; (8), (2''')
2'''	1''', 5''', 7-OMe	4''', 5'''
4'''	1''', 5''', 7-OMe	2''', 5'''; (3''')
5'''	2''', 4'''	2''', 4'''; (3''')
1-OH		2, 9a; (1)
6-OH	7-OMe	5, 7; (6)
7-OMe	1'', 2'', 4'', 6-OH	7

\* Number in parentheses indicates 2-bond coupling.

parison with herbarium specimens in the Botany Section, Department of Agriculture, Ministry of Agriculture.

**Isolation.** The dried stem bark of *G. cowa* (2 kg) was powdered and extracted with EtOH. The extract, after removal of the solvent, gave a brown viscous solid (50 g). This was sepd into 7 frs by quick CC on silica gel, eluting with hexane, toluene and EtOAc in a polarity-gradient manner. Fr. 2 (2 g) was further sepd by CC on silica gel, using  $\text{CHCl}_3$  as the solvent to give fr. 2.2 (145 mg). CC of this fr. with silica gel using a series of hexane–EtOAc mixts in a polarity-gradient fashion yielded a fr. (60 mg) which was further purified in a similar manner to afford **1** (3 mg) as a yellow powder.

**7-O-Methylgarcinone E (1).** HRFABMS: observed  $m/z$  479.2430  $[\text{M} + \text{H}]^+$ , calcd 479.2434 for  $\text{C}_{29}\text{H}_{35}\text{O}_6$ . EIMS  $m/z$  (rel. int.) 478 (89), 451 (29), 435 (99), 407 (100), 391 (25), 379 (35), 367 (20), 353 (31), 323 (45), 295 (26), 183 (33), 168 (41), 69 (61), UV  $\lambda_{\text{max}}^{\text{MeOH}}$  nm (log  $\epsilon$ ) 244 (4.44), 260 (4.37), 320 (4.32), 362 (3.90).

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