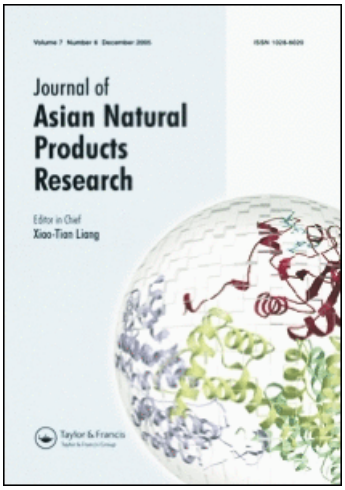

Journal of Asian Natural Products Research
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t713454007

Artemisterol, a new steryl ester from the whole plant of *Artemisia apiacea*

Sung-Jin Lee[a]; Hye Min Kim[b]; Jeong Min Lee[b]; Hee Seung Park[b]; Sanghyun Lee[b]
[a] Department of Animal Life Resources Science, Kangwon National University, Chuncheon, South Korea [b] Department of Applied Plant Science, College of Industrial Science, Chung-Ang University, Anseong, South Korea

To cite this Article Lee, Sung-Jin , Kim, Hye Min , Lee, Jeong Min , Park, Hee Seung and Lee, Sanghyun(2008) 'Artemisterol, a new steryl ester from the whole plant of *Artemisia apiacea*', Journal of Asian Natural Products Research, 10: 4, 281 — 283
To link to this Article: DOI: 10.1080/10286020701782486
URL: http://dx.doi.org/10.1080/10286020701782486

Journal of Asian Natural Products Research
Vol. 10, No. 4, April 2008, 281–283

Artemisterol, a new steryl ester from the whole plant of *Artemisia apiacea*

Sung-Jin Lee[a] Hye Min Kim[b], Jeong Min Lee[b], Hee Seung Park[b] and Sanghyun Lee[b]*

[a]*Department of Animal Life Resources Science, Kangwon National University, Chuncheon 200-701, South Korea;* [b]*Department of Applied Plant Science, College of Industrial Science, Chung-Ang University, Anseong 456-756, South Korea*

(*Received 14 March 2007; final version received 17 October 2007*)

A new steryl ester, artemisterol (**1**), together with known compounds α-amyrin (**2**), β-amyrin (**3**), β-sitosterol (**4**), 5,6,7-trimethoxycoumarin (**5**), and 6-methoxy-7,8-methylenedioxycoumarin (**6**), were isolated from the methanolic extracts of *Artemisia apiacea* by repeated column chromatography. The structure of **1** was elucidated as stigmast-5-en-3β,29-diol 29-*p*-hydroxycinnamate by spectral data analyses.

Keywords: *Artemisia apiacea*; Compositae; artemisterol; steryl ester

1. Introduction

Genus *Artemisia* (Compositae) is widespread in nature, consisting of more than 350 species. *A. apiacea* is distributed on wasteland and river beaches of Korea, Japan and China, and has been used as traditional medicine to treat eczema and jaundice.[1] Previous investigations on *A. apiacea* have revealed the presence of coumarins, caffeates, terpenoids and sterols.[2–7] During the course of our continued studies on the compounds from *A. apiacea*, a new steryl ester (**1**), together with known compounds, α-amyrin (**2**), β-amyrin (**3**), β-sitosterol (**4**), 5,6,7-trimethoxycoumarin (**5**), and 6-methoxy-7,8-methylenedioxycoumarin (**6**), were isolated and identified. Compound **1** is described here for the first time as a naturally occurring compound.

2. Results and discussion

Compound **1** was obtained as white crystals. It responded positively to the Liebermann–Burchard test, indicating the sterol nature of the molecule. The IR spectrum of **1** showed absorption bands for the presence of a hydroxyl group at 3420 cm^{-1}, and an ester linkage at 1732 cm^{-1}. As shown in Table 1, the ^{1}H NMR and ^{13}C NMR spectra of **1** were similar to those of β-sitosterol[8–10] and *p*-hydroxycinnamic acid.[11,12] In the ^{1}H NMR spectrum of **1**, two angular methyl singlets of 18- and 19-Me at δ 0.69 and 1.00, the doublets of 21-, 26- and 27-Me at δ 0.91, 0.84 and 0.79, and the broad doublet of H-6 (an olefinic proton) at δ 5.34 were observed, respectively, indicating the β-sitosterol moiety of **1**. The doublet signals at δ 7.41 and 6.83 indicated A_2B_2 pattern of 1,4-substituted aromatic protons, and a pair of doublets at δ 7.61 and 6.28 with $J = 15.9$ Hz showed the presence of *trans*-allylic moiety indicating the *p*-hydroxycinnamic acid moiety of **1**. Its ^{13}C NMR spectrum showed the presence of a carboxylic acid group at δ 167.7 and an oxymethylene carbon (C-29) at δ 64.7. The key HMBC correlations on **1** are shown in Figure 1. Accordingly, compound **1** was assigned as a new steryl ester and named artemisterol (stigmast-5-en-3β,29-diol 29-*p*-hydroxycinnamate).

Chemical investigations of the genus *Artemisia* have afforded a diverse range of secondary metabolites,[13] but no steryl esters. Stigmastane- and ergostane-type steryl esters were isolated from *Lepidium sativum* and *Tricholomopsis rutilans*, respectively,[14,15] but this is the first report on the occurrence of a steryl ester (**1**) in the genus *Artemisia*. To the best of our knowledge, artemisterol (**1**) from *A. apiacea* is the first example of a naturally occurring steryl ester in which a β-sitosterol moiety is coupled with a *p*-hydroxycinnamic acid moiety.

3. Experimental

3.1 General experimental procedures

MS spectrum was measured with a Jeol JMS-AX505WA mass spectrometer. IR spectrum was recorded with a Jasco FT/IR-300E instrument on KBr disc. ^{1}H NMR and ^{13}C NMR spectra were recorded with a Bruker AVANCE 400 NMR spectrometer using TMS as an internal standard. TLC analysis was performed on Kieselgel 60 F_{254} (Merck) plates (silica gel, 0.25 mm layer thickness), with compounds visualised by spraying with 20% H_2SO_4 followed by charring at 100°C. Silica gel (Merck, 200–400 mesh

*Corresponding author. Email: slee@cau.ac.kr.

ISSN 1028-6020 print/ISSN 1477-2213 online

DOI: 10.1080/10286020701782486
http://www.informaworld.com

Table 1. ^{1}H and ^{13}C NMR spectral data for compound **1** in $CDCl_3$ (δ ppm).

No.	**1**		β-Sitosterol		*p*-Hydroxycinnamic acid[a]	
	δ_H	δ_C	δ_H	δ_C	δ_H	δ_C
1		37.2		37.8		
2		29.7		32.2		
3	3.53 m	71.9	3.55 tt, 5.1, 11.7	71.2		
4		39.6		43.2		
5		140.6		141.9		
6	5.34 br d, 5.0	121.8	5.37 br d, 5.1	121.1		
7		31.9		32.2		
8		31.6		32.2		
9		50.1		50.5		
10		36.5		36.8		
11		21.2		21.4		
12		40.5		40.1		
13		42.2		42.5		
14		56.8		56.9		
15		24.3		24.5		
16		28.2		28.5		
17		55.9		56.3		
18	0.69 s	12.0	0.70 s	12.1		
19	1.00 s	19.0	1.03 s	19.3		
20		36.1		36.4		
21	0.91 d, 6.6	18.8	0.95 d, 6.6	19.0		
22		34.4		34.2		
23		26.5		26.4		
24		45.8		46.1		
25		29.3		29.4		
26	0.84 d, 6.8	19.4	0.84 d, 7.3	19.6		
27	0.79 d, 6.8	19.8	0.82 d, 6.8	20.0		
28		23.0		23.4		
29	4.18 t, 6.7	64.7	0.88 t, 7.6	12.1		
1′		115.5				115.5
2′	7.41 d, 8.6	115.9			7.58 d, 8.6	115.8
3′	6.83 d, 8.6	129.9			6.86 d, 8.6	130.1
4′		158.0				159.7
5′	6.83 d, 8.6	129.9			6.86 d, 8.6	130.1
6′	7.41 d, 8.6	115.9			7.58 d, 8.6	115.8
7′	7.61 d, 15.9	127.0			7.57 d, 15.8	125.4
8′	6.28 d, 15.9	144.4			6.36 d, 15.8	144.2
9′		167.7				168.0

Chemical shifts were reported in parts per million (δ), and coupling constants (J) were expressed in hertz. All signals were assigned using 1D and 2D NMR.
[a]NMR solvent for *p*-hydroxycinnamic acid was DMSO-d_6.

ASTM) was used for column chromatography. All other chemicals and reagents were analytical grade.

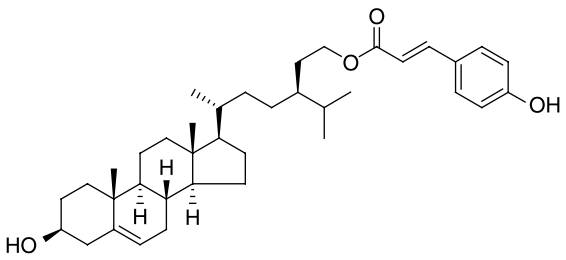

Figure 1. Structure of artemisterol (**1**).

3.2 Plant material

The whole plant of *Artemisia apiacea* Hance was purchased from the Kyungdong market in 2005, Korea. A voucher specimen (Lee 2006-01) of this plant has been deposited at the Natural Products Research Lab., Department of Applied Plant Science, Chung-Ang University, Korea.

3.3 Extraction and isolation

The air-dried powders of *A. apiacea* (5 kg) were extracted with MeOH (10 liters × 3) under reflux. The resultant extracts were combined and concentrated under

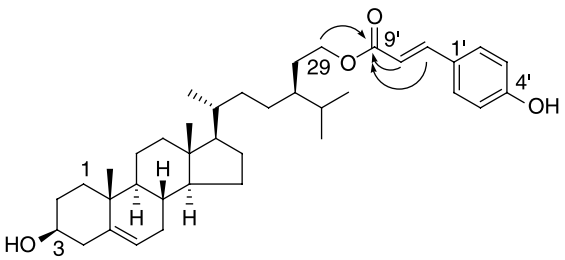

Figure 2. Key HMBC correlations of artemisterol (**1**).

reduced pressure to afford 255 g of the residue. The MeOH extract (255 g) was suspended in water and then fractionated successively with equal volumes of *n*-hexane (38 g), CH_2Cl_2 (32 g), EtOAc (47 g) and *n*-BuOH (25 g). A portion of the *n*-hexane fraction (10 g) was chromatographed on a silica gel (600 g) column eluting with a gradient of *n*-hexane/EtOAc to afford compound **1** (5 mg), α-amyrin (**2**, 8 mg), β-amyrin (**3**, 4 mg), β-sitosterol (**4**, 6 mg), 5,6,7-trimethoxycoumarin (**5**, 10 mg), and 6-methoxy-7,8-methylenedioxycoumarin (**6**, 12 mg).

3.3.1 Artemisterol (1)

IR ν_{max} (KBr): 3420, 2920, 1732 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) and ^{13}C NMR (100 MHz, $CDCl_3$) spectral data: see table 1; EI-MS (70 eV, rel. int.): *m/z* 414 $[M - C_9H_8O_3]^+$, 396, 329, 303, 273, 255, 213, 199, 159, 145.

Acknowledgements

This work was supported by a grant from the "GRRC" Project of Gyeonggi Provincial Government, Republic of Korea.

References

[1] C.S. Yook, *Colored Medicinal Plants of Korea*, (Academy Publishing Co., Seoul, 1989), p. 522.
[2] H. Shimomura, Y. Sashida and Y. Ohshima, *Phytochemistry* **18**, 1761 (1979).
[3] H. Shimomura, Y. Sashida and Y. Ohshima, *Chem. Pharm. Bull.* **28**, 347 (1980).
[4] H. Shimomura, Y. Sashida, Y. Oshima, T. Azuma and M. Saitoh, *Yakugaku Zasshi* **100**, 1164 (1980).
[5] K. Yano, *Flavour Ind.* **1**, 328 (1970).
[6] O.C. Kim and H.J. Jang, *Hanguk Nonghwa Hakhoechi* **37**, 37 (1994).
[7] S. Lee, K.S. Kim, J.M. Jang, Y. Park, Y.B. Kim and B.K. Kim, *Arch. Pharm. Res.* **25**, 285 (2002).
[8] I. Rubinstein, L.J. Goad, A.D.H. Clague and L.J. Mulheirn, *Phytochemistry* **15**, 95 (1976).
[9] R.M. Ma and P.S. Schaffer, *Arch. Biochem. Biophys.* **47**, 419 (1953).
[10] I.M. Chang, H.S. Yun-Choi and K. Yamasaki, *Kor. J. Pharmacogn.* **12**, 12 (1981).
[11] H. Friedrich, *Lloydia*, **39**, 1 (1976).
[12] Y.S. Kwon, E.Y. Kim, W.J. Kim, W.K. Kim and C.M. Kim, *Arch. Pharm. Res.* **25**, 300 (2002).
[13] R.X. Tan, W.F. Zheng and H.Q. Tang, *Planta Med.* **64**, 295 (1998).
[14] M.H. Mughal, M. Ali, M. Iqbal and P.S. Srivastava, *Phytochemistry* **50**, 1375 (1999).
[15] F. Wang and J.K. Liu, *Steroids* **70**, 127 (2005).