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A New Stigmasterol and a New Eremophilenolide from *Ligularia dolichobotrys*

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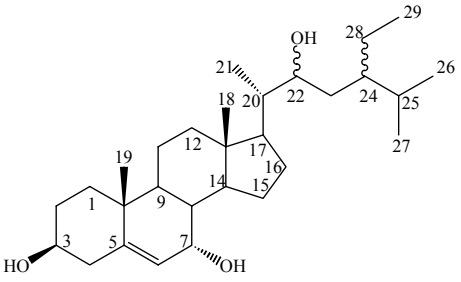
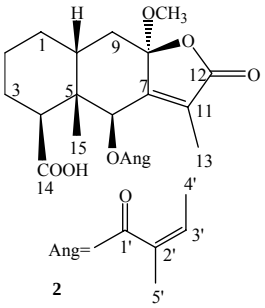
Abstract: A new stigmasterol 3β, 7α, 22-trihydoxystigmast-5-ene (**1**) and a new eremophilenolide 8α-methoxy-6β-angeloyloxyeremophil-7(11)-en-8β, 12-olide-14-oic acid (**2**) were isolated from *Ligularia dolichobotrys* Diels. Their structures were deduced on the basis of spectral data.

Keywords: *Ligularia dolichobotrys* Diels, Compositae, stigmasterol, eremophilanolide.

The genus *Ligularia* for its medicinal value, has been studied by our group for several years, but the chemical constituents for *Ligularia dolichobotrys* Diels have not been reported yet. In this paper, we report the structural elucidation of new compound **1** and **2** from this plant.



1



2

Compound **1** was obtained as colorless crystal from acetone, mp 122-124℃, $[\alpha]_D^{23}$ -54 (*c* 1.1, $CHCl_3$). Its EI-MS spectrum gave a molecular ion peak at *m/z* 446 and fragment ion peaks at *m/z* 428 $[M\text{-}H_2O]^+$, 410 $[M\text{-}2H_2O]^+$ and 395 $[M\text{-}2H_2O\text{-}Me]^+$, corresponding to a molecular formula $C_{29}H_{50}O_3$, which was supported by HRESI-MS at *m/z* 429.3742 $[M\text{-}H_2O+H]^+$ (calcd. 429.3757) and 411.3618 $[M\text{-}2H_2O+H]^+$ (calcd. 411.3621). The ^{1}H-NMR, ^{13}C-NMR and DEPT spectra of **1** (**Table 1**) exhibited signals for 6×CH_3, 9×CH_2, 11×CH, 3×C, which indicated that the structure of **1** was similar to a stigmastane skeleton with one double bond and three hydroxy groups. Compared with the related compound 7α-hydroxysitosterol[1], the side-chains of both were a little different.

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Compound **1** had a hydroxyl at C-22 ($\delta_{C\text{-}22}$ 71.26, $\delta_{H\text{-}22}$ 3.74 in $CDCl_3$) which can be confirmed by the cross signals between δ_H 1.25 (H-21) and δ_C 70.25 (C-22), δ_C 43.38 (C-20), δ_C 53.67 (C-17) in the HMBC spectrum (in pyridine-d_5). The configuration of the C-22 can not be determined only by comparing with the spectral data of similar compounds, although the absolute configurations of similar compounds were 22S[2]. Thus compound **1** was deduced as 3β, 7α, 22-trihydoxystigmast-5-ene.

It needs to be said that the NMR spectra of **1** were firstly measured in $CDCl_3$, then in pyridine-d_5 in order to compare with the data of the literature[1] (in $CDCl_3$) and the literature[2] (in pyridine-d_5).

Table 1 ^{1}H-NMR (400 MHz), ^{13}C-NMR (100 MHz) and DEPT data of compound **1**

H	δ_H[a]	δ_H[b]	C	δ_C[a]	δ_C[b]	DEPT
			1	37.00	38.47	CH_2
			2	31.35	32.46	CH_2
3	3.59 (m)	3.76 (m)	3	71.30	71.01	CH
4α		2.66 (s)	4	41.99	43.71	CH_2
4β		2.64 (d, J=4.44 Hz)				
			5	146.34	145.00	C
6	5.61 (d, J=4.92Hz)	5.87 (d, J=5.13 z)	6	123.79	125.42	CH
7	3.86 (m)	4.08 (dd, J=4.28, 4.35 Hz)	7	65.31	64.79	CH
			8	37.39	37.57	CH
			9	42.27	42.75	CH
			10	37.39	37.77	C
			11	20.69	21.22	CH_2
			12	39.16	39.88	CH_2
			13	42.48	42.75	C
			14	49.08	49.81	CH
			15	24.39	24.90	CH_2
			16	27.49	28.12	CH_2
			17	52.80	53.67	CH
18	1.00 (s)	0.76 (s)	18	18.22	18.48	CH_3
19	0.72 (s)	1.05 (s)	19	11.62	11.99	CH_3
			20	41.38	43.38	CH
21	0.79 (d, J=6.68 Hz)	1.25 (d, J=6.83 Hz)	21	12.28	13.09	CH_3
22	3.74 (brd, J=10.3 Hz)	4.03 (brdd, J=10.2, 2.02 Hz)	22	71.26	70.25	CH
			23	29.87	30.31	CH_2
			24	42.48	41.70	CH
			25	28.73	29.40	CH
26	0.94 (d, J=6.64 Hz)	0.98 (d, J=6.80 Hz)	26	20.53	20.78	CH_3
27	0.90 (d, J=6.64 Hz)	0.87 (d, J=6.84 Hz)	27	17.53	18.17	CH_3
			28	23.58	23.90	CH_2
29	0.89 (t, J=7.04 Hz)	0.90 (t, J=7.39 Hz)	29	11.88	12.17	CH_3

[a] measured in $CDCl_3$, [b] measured in pyridine-d_5, TMS, δ ppm.

Compound **2**, colorless gum, $[\alpha]_D^{23}$ -86 (*c* 0.5, $CHCl_3$), HRESI-MS showed $[M+NH_4]^+$ at *m/z* 410.2164 (calcd. 410.2173), and EI-MS showed a molecular ion peak at *m/z* 392 in accordance with the molecular formula $C_{21}H_{28}O_7$ and the presence of 21 carbons was confirmed by its ^{13}C-NMR and DEPT spectra data (**Table 2**). Its IR bands (1643.1, 1701.7, 1769.9 cm^{-1}) and UV absorption (225 nm) displayed a typical α,β -unsaturated γ-lactone. In the ^{1}H-NMR spectrum data, there was an angeloyl group and a methoxyl group signals. Except for the –OAng and the $-OCH_3$, the ^{13}C-NMR and

DEPT spectra showed 15 signals for 2×CH_3 (one of which was tertiary methyl), 4×CH_2, 3×CH (one of which was oxygenated), 6×C. Furthermore the signals of C-7 (δ 154.2, s), C-8 (δ 106.8, s), C-11 (δ 126.3, s), C-12 (δ 170.9, s) and C-13 (δ 8.1, q) showed compound **2** was an eremophilane derivative with an α, β-unsaturated γ-lactone, a COOH-14 group (δ 178.6, s, C-14)[3] , a –OAng and a –OCH_3. The –OAng should be located at C-6 (δ_{C-6} 70.3, d), for δ_{C-6} must be about 80 ppm if the –OCH_3 was located at C-6[4-6], thus the –OCH_3 located at C-8. Stereochemically, Me-14 and Me-15 are biogenetically β-orientations[7], so COOH-14 group should be in β-orientation. Besides, the presence of a homoallylic spin-coupling (J=1.2 Hz) between H-6 and H-13 showed that the –OAng at C-6 was in β-orientation and the –OCH_3 at C-8 was in α-orientation[7-8]. Therefore, the structure of compound **2** was determined as 8α-methoxy-6β-angeloyl-oxyeremophil-7(11)-en-8β, 12-olide-14-oic acid.

Table 2 ^{1}H-NMR (400 MHz), ^{13}C-NMR (100 MHz) and DEPT data of **2** ($CDCl_3$,δppm)

H	δ_H*	C	δ_C*	DEPT
		1	20.9	CH_2
		2	24.5	CH_2
		3	27.8	CH_2
4α	2.46 (dd, J=12.8, 4.2 Hz)	4	44.6	CH
		5	42.7	C
6	5.90 (q, J=1.2 Hz)	6	70.3	CH
		7	154.2	C
		8	106.8	C
		9	38.4	CH_2
10β	2.85 (m)	10	36.0	CH
		11	126.3	C
		12	170.9	C
13	1.84 (d, J=1.2 Hz)	13	8.1	CH_3
		14	178.6	C
15	1.09 (s)	15	16.1	CH_3
OMe	3.29 (s)	OMe	50.5	CH_3

*OAng: δ_H 6.33 ($H_{3'}$, qq, J=7.2, 1.4Hz), 2.10 ($H_{4'}$, dq, J=7.2, 1.3Hz), 2.01 ($H_{5'}$, dq, J=1.4, 1.3). δ_C 166.5 ($C_{1'}$, s), 126.7 ($C_{2'}$, s), 142.2 ($C_{3'}$, d), 20.6 ($C_{4'}$, q), 19.1 ($C_{5'}$, q).

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References

1. M. D. Greca, P. Monaco, L. Previtera, *J. Nat. Prod.*, **1990**, *53* (6), 1430.
2. S. Kubo, Y. Mimaki, Y. Sashida, T. Nikaido, T. Ohmoto, *Chem. Pharm. Bull.*, **1992**, *40* (9), 2469.
3. Y. Zhao, Z. J. Jia, H. R. Peng, *J. Nat. Prod.*, **1995**, *58* (9), 1358.
4. X. Q. Li, K. Gao, Z. J. Jia, *Chin. Chem. Lett.*, **2002**, *13* (10), 963.
5. M. J. Mao, Z. J. Jia, *Chin. Chem. Lett.*, **2001**, *12* (7), 601.
6. S. M. Zhang, G. L. Zhao, R. Li, G. Q. Lin, *Phytochenistry*, **1998**, *48* (3), 519.
7. Y. Moriyama, T. Takahashi, *Bull. Chem. Soc. Jpn.*, **1976**, *49* (11), 3196.
8. Naya, R. Kanazawa, M. Sawada, *Bull. Chem. Soc. Jpn.*, **1975**, *48* (11), 3220.

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