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A FARNESOL DERIVATIVE FROM *TANACETUM AUCHERANUM*

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Key Word Index—*Tanacetum aucheranum*; Compositae; flavonoids; farnesol derivative.

Abstract—*Tanacetum aucheranum* yielded a new farnesol derivative, 3,10-dihydroxy-5,8-diacetoxy-1(2),11(12)-dehydrojarnesol, and flavonoids. The structures of the compounds were determined by means of spectral methods. Copyright © 1996 Elsevier Science Ltd

INTRODUCTION

Tanacetum aucheranum L., which is an Ir.-Tur. element, grows in the eastern part of Turkey at an altitude of 1900–2950 m on limestone rocks [1]. The plant was studied for the first time chemically and yielded a new farnesol derivative (**1**) in addition to four known flavonoids (**2**–**5**).

RESULTS AND DISCUSSION

Tanacetum aucheranum afforded the known flavonoids, 6,7,3′,4′-tetramethoxyluteolin (**2**) [2], salvigenin (**3**) [3], pectolinarigenin (**4**) [4], 6-hydroxyluteolin 6-methyl ether (**5**) [5] and a new farnesol derivative (**1**).

The IR spectrum of **1** displayed ester groups at 1740, 1260, 1730 and 1250 cm^{-1}, hydroxyl groups at 3440 cm^{-1} and unsaturation at 1650 cm^{-1}. The HR mass spectrum of **1** gave a peak at *m/z* 295.19128 for $C_{17}H_{26}O_4 + 1$, indicating the loss of an acetyl group from the molecule. The Cl mass spectrum of the compound showed the molecular peak at *m/z* 253 $[M-1]^+$ corresponding to the molecular formula $C_{19}H_{30}O_6$. The ^1H NMR spectrum exhibited three double doublets at δ 5.88 (1H, *dd*, J = 17.5 and 11 Hz), 5.25 (1H, *dd*, J = 17.5 and 1.5 Hz) and 5.08 (1H, *dd*, J = 11 and 1.5 Hz), which indicated a terminal double bond of an aliphatic chain. The three-fold doublet at δ 5.61 (1H, *ddd*, J = 4.5, 8.5 and 9), the double doublet at δ 5.30 (1H, *dd*, J = 4.5 and 9) and the singlets at δ 2.09 and 2.02 indicated two acetoxy groups on the chain. The chemical shift of a tertiary methyl group (δ 1.28) showed the presence of a hydroxyl group at C-3. The signal at δ 4.00 (1H, *dd*, J = 4.5 and 9) showed the presence of another hydroxyl group in the molecule (Table 1). Acetylation of **1** afforded a triacetyl derivative (**1a**). In the ^1H NMR specturm of **1a**, H-10 was shifted from δ 4.00 to 5.10 and the third acetyl signal appeared at δ 2.04. All the signals were assigned by spin decoupling experiments. Irradiation of the double doublet at δ 5.88 (H-2) collapsed the double doublets at δ 5.25 ($H\text{-}1_{trans}$) and 5.08 ($H\text{-}1_{cis}$) into doublets (each J = 1.5 Hz). Irradiation of the three-fold doublet at δ 5.61 (H-5) collapsed the broadened doublet at δ 5.38 (H-6, J = 8.5 Hz) to a broadened singlet and simplified the multiplets at δ 2.00 and 1.70 (H-4 and H-4′) and vice versa. Irradiation of the double doublet at δ 4.00 (H-10) simplified the multiplet at δ 1.70 (H-9 and H-9′), while irradiation of the double doublet at δ 5.30 (H-8) simplified the multiplet at δ 1.70 and turned the doublet at δ 1.75 (H-14, J = 1.5 Hz) into a singlet. The ^{13}C NMR spectrum (APT technique) gave two saturated, two unsaturated methylene signals, two olefinic methine signals, three methine signals attached to an oxygen function and five methyl signals. The proton bearing carbons were assigned by HETCOR experiments. The main problem in this structure was the locations of the hydroxyl and acetyl groups at C-9 and C-10. The hydroxyl group could be at C-9 and the acetyl group at C-10 and vice versa. The fragments in the EI mass spectrum at *m/z* 71, 95, 97 and 149 indicated that the hydroxyl group was at C-10. In addition, the cross peaks between H-12, H-10, H-12′ and C-10 in the COLOC spectrum supported the proposed structure (Table 1).

EXPERIMENTAL

General. CC: Kieselgel 60 (0.063–0.200 mm, Merck) and Sephadex LH-20 (Pharmacia); TLC: precoated silica gel 60 F_{254}, 0.2 mm plates (Merck), spots were detected under UV and by spraying with acidified ceric sulphate followed by heating. ^1H NMR: 400 and 200 MHz, respectively; ^{13}C NMR, HETCOR, COLOC: 50.32 MHz, with $CDCl_3$ as solvent and TMS as int.

Table 1. ^{1}H NMR spectrum of compound **1** (^{a}400 MHz, ^{b}200 MHz, $CDCl_3$)

H	**1a**[a]	**1a**[b]		APT (**1**[b])	COLOC (**1**[b])
1t	5.34 *dd*	5.29 *dd*	C-1	112.16 (+)	
1c	5.08 *dd*	5.04 *dd*	C-2	114.17 (−)	H-15, H-2
2	5.88 *dd*	5.87 *dd*	C-3	72.39 (+)	H-1, H-1′, H-2, H-15
4	2.00 *dd*	1.90 *m*	C-4	39.01 (+)	
4′	1.78 *m*	1.90 *m*	C-5	68.71 (−)	
5	5.61 *ddd*	5.59 *ddd*	C-6	125.92 (−)	H-4
6	5.38 *br d*	5.36 *br d*	C-7	137.22 (+)	H-14
8	5.30 *dd*	5.10 *m*	C-8	75.31 (−)	H-9
9	1.70 *m*	1.90 *m*	C-9	46.29 (+)	H-13, H-14
9′	1.70 *m*	1.90 *m*	C-10	71.65 (−)	H-12, H-12′, H-9
10	4.00 *dd*	5.10 *m*	C-11	146.79 (+)	H-13
12	4.97 *br s*	4.96 *br s*	C-12	111.05 (+)	
12′	4.84 *br s*	4.89 *br s*	C-13	17.95 (+)	H-13
13	1.73 *br s*	1.71 *br s*	C-14	13.19 (+)	H-14
14	1.75 *d*	1.71 *br s*	C-15	28.41 (+)	H-15
15	1.28	1.28 *s*	OCO	170.80 (+)	
2′	2.02 *s*	2.01 *s*	–Me	21.19 (+)	
4′	2.09 *s*	2.06 *s*	OCO	170.10 (+)	
OAc	—	2.04 *s*	–Me	21.37 (+)	

J(Hz): 1t, 2 = 17; 1c, 2 = 11; 5, 4 = 8.5; 5, 4′ = 4.5; 4, 4′ = 15; 5, 6 = 9.5; 8, 9 = 4; 8, 9′ = 9, 10, 9 = 3.5; 10, 9′ = 9.

standard; HR and EI MS: VG ZabSpec Spectrometer (TUBITAK-Gebze).

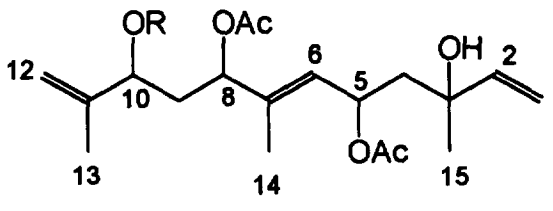
Plant material. T. aucheranum (DC.) Schultz Bip. was collected from Kop Mountain in Bayburt (northeast Turkey). A voucher specimen (ISTE 68080) is deposited in the Herbarium of the Faculty of Pharmacy, University of Istanbul, Turkey.

Extraction and isolation. Dried and powdered aerial parts (1.3 kg) were extracted successively with petrol (40–60°), EtOAc and MeOH. The EtOAc and MeOH extracts (60 g) were combined and treated with MeOH. The residue was applied to a Sephadex LH-20 (500 g) column and eluted with MeOH. The frs from CC were controlled by TLC and similar frs were combined and further sepd by silica gel CC and prep. TLC. Thus, 70.4 mg **1**, 500 mg **2**, 65 mg **3**, 750 mg **4**, 130 mg **5** and 170 mg **6** were obtained.

3,10-*Dihydroxy*-5,8-*diacetoxy*-(2),11(12)-*dehydrofarnesol* (**1**). IR $\nu_{max}^{CHCl_3}$ cm^{-1}: 3440 (OH), 1740, 1730, 1260, 1250 (ester groups), 1650 (unsatn), 1460, 1375, 1020; ^{1}H, ^{13}C NMR, COLOC: Table 1; HRMS *m/z*: 295.19128 [M − HOAc]$^+$; ($C_{19}H_{30}O_6$); EIMS *m/z* (rel. int.): 309.3 [M − 3 × Me]$^+$ (10), 295.3 [M − OAc]$^+$ (10), 283.3 [M − 71]$^{\cdot+}$ (10), 234.2 [M − 2 × HOAc]$^+$ (28), 224.1 [283 − 59] (76), 216.1 [234 − H_2O]$^+$ (100), 164.1 [224 − 69]$^+$ (33), 149.1 [164 − Me]$^+$ (71), 146.1 [164 − H_2O]$^+$ (32), 97 [CH_2=C(Me)CHOHCH=CH]$^{\cdot+}$ (45), 95.0 [CH_2=C(Me)CHOHCH=CH]$^{\cdot+}$ (85), 85.1 [CH_2=C(Me)CHOHCH$_2$]$^{\cdot+}$ (33), 77 [95 − H_2O] (85), 71 [CH_2=C(Me)CHOH]$^+$ (100).

Acetylation of **1**. Compound **1** (15 mg) was treated with pyridine (1.5 ml) and Ac_2O (1.5 ml) overnight. After evapn *in vacuo* the reaction mixt. was sepd by prep. TLC to give **1a** (9 mg).

3-*Hydroxy*-5,8,10-*triacetoxy*-1(2),11(12)-*dehydrofarnesol* (**1a**). IR $\nu_{max}^{CHCl_3}$ cm^{-1}: 3450 (OH), 1740, 1240 (ester), 1650 (C=C), 1440, 1375, 1020, 940; ^{1}H NMR: Table 1; EIMS *m/z* (rel. int.): 396 [M]$^+$ ($C_{21}H_{32}O_7$) (0.2), 337 [M − OAc]$^+$ (0.4), 277 [337 − HOAc]$^+$ (10), 217 [277 − HOAc]$^+$ (39), 216 (81), 201 (33), 190 (45), 164 (51), 149 (76), 137 (79), 109 (90), 95 (100), 82 (91), 69 (87).



1 R = H

1a R = OAc

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