Phytochemistry, Vol. 29, No. 2, pp. 645–648, 1990.
Printed in Great Britain.

0031–9422/90 \$3.00 + 0.00

BISABOLANE RELATED GLYCOSIDES FROM *CARTHAMUS LANATUS*

ARTURO SAN FELICIANO,* MANUEL MEDARDE, BENEDICTO DEL REY, JOSE M. MIGUEL DEL CORRAL and ALEJANDRO F. BARRERO†

Departamento de Química Orgánica, Facultad de Farmacia, 37007 Salamanca, Spain; †Departamento de Química Orgánica, Facultad de Ciencias, Granada, Spain

(*Received in revised form* 10 *July* 1989)

Key Word Index—*Carthamus lanatus*; Compositae; sesquiterpene glycosides; bisabolane; tri-*nor*-bisabolane.

Abstract—Two new sesquiterpene glycosides were isolated from the more polar fraction of the hexane extract of *Carthamus lanatus*. They were identified as bisabolane and tri-*nor*-bisabolane fucosides and their structures were confirmed by synthesis from (−)-α-bisabolol-β-D-fucopiranoside.

INTRODUCTION

In previous work [1] we reported on the structural determination of the major component of the hexane extract of *Carthamus lanatus* (family Compositae, tribe Cynareae), that was identified as the β-D-fucopyranoside of α-bisabolol (**1**). In the present work we describe two minor glycosides with terpene structures of bisabolane and tri-*nor*-bisabolane that were isolated, providing that no acetyl groups were present, after acetylation of the more polar part of the extract.

RESULTS AND DISCUSSION

The less polar substance (**2a**) was an oily product whose IR spectrum exhibited absorptions of acetate groups, of a trisubstituted double bond and of a ketone conjugated with an α-substituted vinyl group, the latter grouping displaying an absorption at 215 nm in the UV spectrum [2].

Apart from signals of the three acetate groups and of the above mentioned groupings, the ^{13}C BB and DEPT-NMR spectra showed the existence of four methyls, five methylenes, six methines (1 acetalic and 4 oxygenated) and an oxygenated non-protonated carbon atom. The ^{1}H NMR also showed three methyl signals of the acetates, that of the olefinic proton of a trisubstituted double bond and those of a methylidene in the β-position of a carbonyl, apart from those of a methyl geminal to oxygen and those of two methyls on sp^2 carbons. The EI mass spectrum, showed a $[M-60]^+$ peak at *m/z* 448, and the comparison of NMR data with those of **1** and **1a** readily suggest the structure **2** for the natural compound. This structure was confimed by synthesis from **1a**, as described below.

The most polar substance (**3a**) was an oil whose IR, apart from absorptions of acetates and olefinic grouping, showed bands for an aldehyde, which was also observed in the ^{1}H and ^{13}C DEPT-NMR spectra. The main differences with respect to **1a** lay in the absence of the spectral signals corresponding to the C_{11}–C_{13} moiety, and the presence of the aldehyde group, that should be located at C_{10}. Thus, structures **3** and **3a** were deduced for this glycoside and its triacetate that were also confirmed by semisynthesis from **1a**.

Photochemical oxidation of the triacetate **1a** by singlet oxygen [3] (Scheme 1) afforded the hydroperoxides **4a**, **4′a** and **5a**, which by reduction with dimethyl sulphide yielded the alcohols **6a**, **6′a** and **7a**. PDC oxidation of the mixture **6a** + **6′a** afforded **2a** identical to the triacetate of the natural glycoside **2**. On treating the mixture of the three hydroperoxides with acetic anhydride in pyridine [4] the only reaction products obtained were the triacetates **2a** and **3a** identical to those prepared from the natural glycosides **2** and **3**.

Both **2** and **3** are new natural products hitherto undescribed either as glycosides or as free terpenoids. The glycoside β-D-fucopyranoside of 7-hydroxy-11,12,13-tri-*nor*-bisabol-3-en-10-al (**3**) is the first case of a bisabolane tri-*nor*-sesquiterpenoid.

EXPERIMENTAL

Carthamus lanatus L. was collected in July near Cabrerizos (Salamanca, Spain). Dried aerial parts (2.4 kg) were extracted with *n*-hexane. The extract was defatted with MeOH and a satd soln of urea in MeOH, and it was fractionated with aq. NaOH (4%). By CC of the neutral fr. (63.9 g) a polar fraction (680 mg) was collected, that was acetylated and chromatographed affording **2a** (390 mg) and **3a** (300 mg).

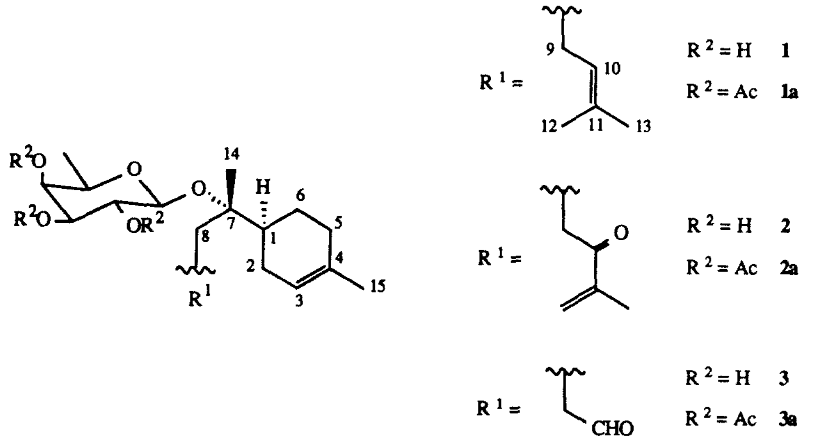
Compound **2a**. Oil. $[\alpha]_D^{22} = -16.2°$ (CHCl$_3$; *c* 0.90). IR ν_{max}^{film} cm^{-1}: 3080, 3020, 1740, 1685, 1640, 1230, 1070, 910, 840. UV λ_{max}^{EtOH} nm (ε): 215 (6100). EIMS 70 eV, *m/z* (rel. int.): 448 (0.4), 388 (1), 289 (1), 273 (10), 235 (1), 219 (10), 218 (6), 213 (4), 201 (4), 171 (7), 153 (29), 145 (7), 134 (21), 132 (47), 119 (16), 111 (26), 93 (17), 59 (33), 43 (100). NMR spectra see Tables 1 and 2.

Compound **3a**. Oil. $[\alpha]_D^{22} = -16.8°$ (CHCl$_3$; *c* 0.87). IR $\nu_{max}^{CHCl_3}$, cm^{-1}: 3040, 2730, 1750, 1730, 1250, 1170, 1130, 1070, 925, 910, 840. EIMS 70 eV, *m/z* (rel. int.) 315 (2), 289 (1), 273 (52), 256 (2), 237 (2), 213 (13), 195 (11), 179 (8), 171 (24), 153 (99), 111 (100), 83 (53). NMR spectra see Tables 1 and 2.

Table 1. ^{13}C NMR spectral data for compounds **1**, **1a**, **2**, **2a**, **3a**, **6a**, **6′a** and 7 (50.3 MHz)

C	**1**	**1a**	**6a + 6′a**		**7a**	**2**	**2a**	**3a**
1	41.24 *d*	40.56 *d*	40.68 *d*	40.49 *d*	41.44 *d*	41.44 *d*	40.62 *d*	40.74 *d*
2	26.94 *t*	26.50 *t*	28.36 *t*		26.14 *t*	26.94 *t*	26.67 *t*	26.49 *t*
3	120.60 *d*	120.11 *d*	120.16 *d*		120.27 *d*	120.32 *d*	119.91 *d*	119.73 *d*
4	134.32 *s*	134.15 *s*	134.39 *s*		134.14 *s*	134.35 *s*	134.62 *s*	134.44 *s*
5	31.10 *t*	30.82 *t*	30.95 *t*		30.85 *s*	31.52 *t**	30.91 *t**	30.83 *t*
6	23.54 *t*	22.76 *t*	26.64 *t*		22.86 *t*	23.55 *t*	22.75 *t*	22.80 *t*
7	81.75 *s*	81.82 *s*	82.14 *s*	81.99 *s*	81.66 *s*	81.41 *s*	81.80 *s*	81.20 *s*
8	37.95 *t*	37.90 *t*	33.88 *t*	33.91 *t*	41.28 *t*	31.52 *t**	31.35 *t**	29.42 *t*
9	21.87 *t*	21.50 *t*	22.90 *t*		122.61 *d*	31.03 *t**	30.91 *t**	38.20 *t*
10	124.98 *d*	124.67 *d*	76.17 *d*	75.78 *d*	140.97 *d*	202.58 *s*	202.46 *s*	202.24 *d*
11	131.04 *s*	130.86 *s*	147.86 *s*	147.78 *s*	70.63 *s*	144.58 *s*	144.55 *s*	—
12	17.81 *q*	17.60 *q*	110.76 *t*	110.07 *t*	29.79 *q*	124.33 *t*	124.29 *t*	—
13	25.66 *q*	25.46 *q*	17.51 *q*	18.30 *q*	29.79 *q*	17.61 *q*	17.66 *q*	—
14	20.19 *q*	19.56 *q*	19.62 *q*		19.78 *q*	19.84 *q*	19.55 *q*	19.24 *q*
15	23.34 *q*	23.14 *q*	23.34 *q*		23.30 *q*	23.26 *q*	23.33 *q*	23.14 *q*
1′	97.22 *d*	95.23 *d*	95.45 *d*		95.61 *d*	96.99 *d*	95.18 *d*	95.23 *d*
2′	71.45 *d*	69.29 *d*	69.38 *d*		69.36 *d*	71.77 *d*	69.22 *d*	69.22 *d*
3′	71.87 *d*	70.41 *d*	70.49 *d*		70.49 *d*	71.77 *d*	70.49 *d*	70.40 *d*
4′	74.42 *d*	71.60 *d*	71.64 *d*		71.65 *d*	74.37 *d*	71.60 *d*	71.50 *d*
5′	70.39 *d*	68.72 *d*	68.99 *d*		68.84 *d*	70.36 *d*	69.03 *d*	68.90 *d*
6′	16.55 *q*	16.06 *q*	16.20 *q*	16.34 *q*	16.26 *q*	16.40 *q*	16.05 *q*	16.05 *q*
Acetate		20.57 *q*	20.81 *q*		20.80 *q*		20.83 *q*	20.46 *q*
		20.57 *q*	20.70 *q*		20.71 *q*		20.63 *q*	20.46 *q*
		20.42 *q*	19.64 *q*		20.62 *q*		20.63 *q*	20.46 *q*
		170.50 *s*	170.77 *s*		170.77 *s*		170.64 *s*	170.53 *s*
		169.94 *s*	170.25 *s*		170.25 *s*		170.14 *s*	169.99 *s*
		168.99 *s*	169.30 *s*		169.31 *s*		169.32 *s*	169.13 *s*

Solvent $CDCl_3$. δ values in ppm from internal TMS.
*Interchangeable assignments.



Compound **2**. **2a** (390 mg) was saponified at room temp with a soln of Na_2CO_3 in MeOH–H_2O (1:1). After usual work-up, **2** (104 mg) was obtained. Oil. $[\alpha]_D^{22} = -20.9°$ ($CHCl_3$; *c* 0.52). IR $\nu_{max}^{CHCl_3}$ cm^{-1}: 3450, 3080, 3020, 1685, 1640, 1080, 910, 840. UV λ_{max}^{EtOH} nm (ε): 217 (6500). NMR spectra see Tables 1 and 2.

Photooxidation of **1a**. To **1a** (1.3 g) in *iso*-PrOH (25 ml), Rose Bengal (10 mg) was added and the soln exposed to sunshine for 4 hr to yield a mixt of hydroperoxides **4a**, **4′a** and **5** (1.2 g). This mixt (850 mg) was reduced with dimethyl sulphide (15 ml) and chromatographed to afford alcohols **6a** + **6′a** (370 mg) and **7a** (70 mg).

Compounds **6a** + **6b**. Oil. $[\alpha]_D^{22} = -14.8°$ ($CHCl_3$; *c* 2.0). IR $\nu_{max}^{CHCl_3}$ cm^{-1}: 3600, 3080, 3020, 1740, 1650, 1230, 1070, 970, 905, 840. NMR spectra see Tables 1 and 2.

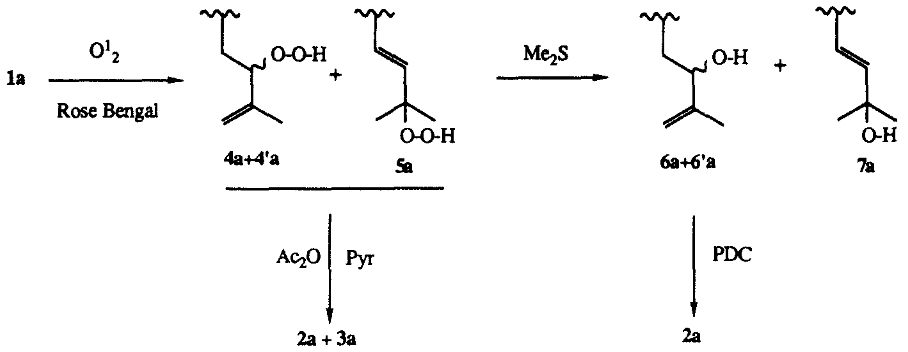
Compound **7a**. Oil. $[\alpha]_D^{22} = -10.9°$ ($CHCl_3$; *c* 2.25). IR $\nu_{max}^{CHCl_3}$ cm^{-1}: 3600, 3030, 1740, 1665, 1240, 1175, 1075, 975, 910, 830. NMR spectra see Tables 1 and 2.

Oxidation of **6a** + **6′a**. To a mixt of **6a** + **6′a** (300 mg) in CH_2Cl_2

Table 2. ^{1}H NMR spectral data for compounds **1**–**3a**, **6**, **6a** and **7** (200.13 MHz)

H	**1**	**1a**	**2**	**2a**	**3a**	**6a + 6′a**		**7a**
3	5.36 *m*	5.34 *m*	5.35 *m*	5.32 *m*	5.30 *m*	5.33 *m*		5.31 *m*
8a								2.22 *dd* (6.4, 14.6)
8b								2.40 *dd* (5.4, 14.6)
9a			2.71 *ddd* (5.4, 11.2, 16.8)	2.59 *ddd* (5.4, 11.1, 17.4)				5.73 *ddd* (5.4, 6.4, 15.8)
9b			3.11 *ddd* (3.5, 11.2, 16.8)	3.19 *ddd* (3.3, 11.1, 17.4)				
10	5.04 *br t* (6.5)	5.04 *br t* (6.5)			9.76 *s*	3.92–4.05 *m*		5.64 *d* (15.8)
12a	1.59 *s*	1.60 *s*	5.73 *br s*	5.73 *br s*		4.81 *br s*		1.30 *s*
12b			6.02 *br s*	6.02 *br s*		4.91 *br s*	4.94 *br s*	
13	1.66 *s*	1.67 *s*	1.85 *s*	1.85 *br s*		1.72 *br s*		1.30 *s*
14	1.12 *s*	1.08 *s*	1.14 *s*	1.10 *s*	1.10 *s*	1.10 *s*		1.12 *s*
15	1.63 *s*	1.64 *s*	1.65 *s*	1.63 *br s*	1.61 *s*	1.63 *br s*		1.62 *br s*
1′	4.36 *d* (7.6)	4.63 *d* (7.6)	4.36 *d* (6.1)	4.60 *d* (7.7)	4.61 *d* (7.7)	4.67 *d* (8)		4.65 *d* (7.8)
2′	—	5.20 *dd* (7.6, 10)	—	5.21 *dd* (7.7, 10.4)	5.15 *d* (7.7, 10.4)	5.20 *dd* (8, 10.5)		5.20 *dd* (7.8, 10.5)
3′	3.50–3.75 *m*	5.03 *dd* (3.3, 10)	3.50–3.75 *m*	5.01 *dd* (3.4, 10.4)	5.01 *d* (3.2, 10.4)	5.03 *dd* (3.5, 10.5)		5.02 *dd* (3.4, 10.5)
4′		5.21 *d* (3.3)		5.19 *d* (3.4)	5.17 *d* (3.2)	5.21 *d* (3.5)		5.21 *d* (3.4)
5′	—	3.78 *q* (6.5)	—	3.72 *q* (6.5)	3.76 *q* (6.2)	3.81 *q* (6.5)		3.77 *q* (6.5)
6′	1.25 *d* (6.5)	1.18 *d* (6.5)	1.16 *d* (6.5)	1.02 *d* (6.5)	1.09 *d* (6.2)	1.19 *d* (6.5)	1.21 *d* (6.5)	1.19 *d* (6.5)
		2.17 *s*		2.15 *s*	2.10 *s*	2.17 *s*		2.18 *s*
Acetate		2.03 *s*		2.03 *s*	1.96 *s*	2.03 *s*		2.03 *s*
		1.98 *s*		1.97 *s*	1.90 *s*	1.98 *s*		1.98 *s*

$CDCl_3$. δ values in ppm from internal TMS, followed by *multiplicity* and J values (in Hz) are stated.



Scheme 1

(13 ml), PDC (466 mg) was added and the reaction stirred at room temp. for 5 hr. By CC of the reaction product **2a** (136 mg) was isolated.

Treatment of **4a**, **4'a** *and* **5** *with* Ac_2O. A mixt. of **4a**, **4'a** and **5** (342 mg) in pyridine (6 ml) and Ac_2O (6 ml) was stirred at room temp. for 12 hr. By CC of the reaction product **2a** (210 mg) and **3a** (100 mg) were obtained.

Acknowledgements—We thank Dr A. G. Ravelo (Universidad de La Laguna, Spain) for MS measurement and the CAICYT for financial support (*n*°1857/82).

REFERENCES

1. San Feliciano, A., Barrero, A. F., Miguel del Corral, J. M., Gacimartín, M. V. and Medarde, M. (1982) *Phytochemistry* **21**, 2115.
2. Scott, A. I. (1964) *Interpretation of the Ultraviolet Spectra of Natural Products*, p. 61. Pergamon Press, Oxford.
3. Ikekawa, N., Ohta, A., Seki, M. and Takahashi, A. (1972) *Phytochemistry* **11**, 3037.
4. González, A., Galindo, A. and Mansilla, H. (1987) *Tetrahedron Letters* 4203.