Pergamon

PII: S0031-9422(97)00251-3

Phytochemistry, Vol. 45, No. 8, pp. 1663–1668, 1997

0031-9422/97 $17.00+0.00

MODIFIED ABIETANE DITERPENOIDS AND A METHOXYLUPANE DERIVATIVE FROM *SALVIA PALAESTINA*

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(*Received* 30 *January* 1997)

Key Word Index—*Salvia palaestina*; Labiatae; 19(4 → 3)-*abeo*-abietane, 2,3-seco-abietane and methoxylupane derivatives; 2-oxocandesalvone A; salvipalestinoic acid; 2α-methoxylup-20(29)-en-3β-ol.

Abstract—Two new abietane diterpenoids, 2-oxocandesalvone A and salvipalestinoic acid, and a new methoxylupane derivative have been isolated from the aerial parts of *Salvia palaestina*. Several previously known triterpenes and abietane diterpenes have also been found in the same plant, together with sitosterol, 5-hydroxy-7,4′-dimethoxyflavone and a mixture of fatty acid esters of tyrosol. The structures of the new compounds [11,12,14-trihydroxy-19(4 → 3)-*abeo*-3,8,11,13-abietatetraen-2,7-dione (2-oxocandesalvone A), 12,14-dihydroxy-7-oxo-2,3-seco-8,11,13-abietatrien-2,11-olide-3-oic acid (salvipalestinoic acid) and 2α-methoxylup-20(29)-en-3β-ol] were established by spectroscopic means.

INTRODUCTION

Several flavonoids and terpenoids have been reported [1, 2] as constituents of *Salvia palaestina* growing in Turkey. Now, an investigation of this plant collected in Egypt allowed the isolation of eight triterpenes and six abietane diterpenoids, together with sitosterol, 5-hydroxy-7,4′-dimethoxyflavone and a mixture of fatty esters of 2-(*p*-hydroxyphenyl)-ethanol (tyrosol). Among these compounds, three are new substances [the diterpenes 2-oxocandesalvone A (**1a**) and salvipalestinoic acid (**2a**) and the triterpene 2α-methoxylup-20(29)-en-3β-ol (**7**)] and only two (ursolic acid and 5-hydroxy-7,4′-dimethoxyflavone) have previously been found in the first studies on this species [1, 2]. Thus, some differences in chemical contents seem to occur between *S. palaestina* growing in Egypt or Turkey; they could be attributed to botanical varieties or to diversities of climate, humidity, soil, etc. We report here the isolation, identification and structural elucidation of the constituents of *S. palaestina* collected in Egypt.

RESULTS AND DISCUSSION

From an acetone extract of the roots of *S. palaestina* we have isolated the triterpenes lupeol (**4**) [3], lup-20(29)-ene-2α,3β-diol (**5**) [3–5], lup-20(29)-ene-3β,23-diol (**6**) [6]‡, 3β-acetoxyolean-12-en-28-al [7, 8] and 3β-acetoxyolean-12-en-28-ol [9], and the diterpenes horminone (7α,12-dihydroxy-8,12-abietadiene-11,14-dione) [10, 11] and 12-*O*-methylpisiferic acid (12-methoxy-8,11,13-abietatrien-20-oic acid) [12, 13], as well as sitosterol and a mixture of fatty esters of tyrosol [14].

The triterpenes **4**, **5** and **6** were also found in an acetone extract of the aerial parts of *S. palaestina*, together with a mixture of ursolic [2] and oleanolic acids and the already known diterpenoids candelabrone (**3a**, 11,12,14-trihydroxy-8,11,13-abietatriene-3,7-dione) [13, 15] and candesalvone B (11,12,14-trihydroxy-7-oxo-3,4-seco-4(18),8,11,13-abietatetraen-3-oic acid] [13], as well as 5-hydroxy-7,4′-dimethoxyflavone [1]. In addition, three new natural substances, 2-oxocandesalvone A (**1a**), salvipalestinoic acid (**2a**) and 2α-methoxylup-20(29)-en-3β-ol (**7**), were also isolated from the acetone extract of the aerial parts of the plant.

Since diterpenoids **1a**, **2a** and **3a** proved to be very unstable under chromatographic conditions, as well as in chloroform or methanol solution, the structural determination of 2-oxocandesalvone A (**1a**) and salvipalestinoic acid (**2a**) and the identification of candelabrone (**3a**) were established from their *O*-methyl derivatives **1b**, **2b** and **3b** [13]. Therefore, we carried out the treatment of the impure fractions containing **1a**, **2a** and **3a** with ethereal diazomethane, now that

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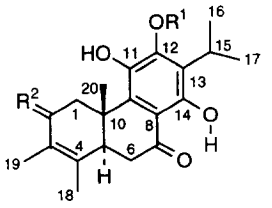
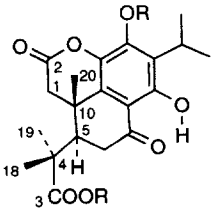
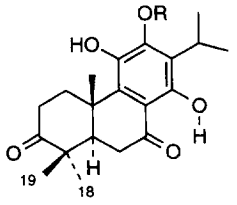
‡ Some unreported [6] physical data of **6** are included in the Experimental part.



	R^1	R^2
1a	H	O
1b	Me	O
8	Me	H_2



2a R=H
2b R=Me



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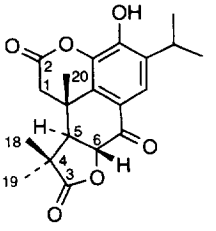
3b R=Me



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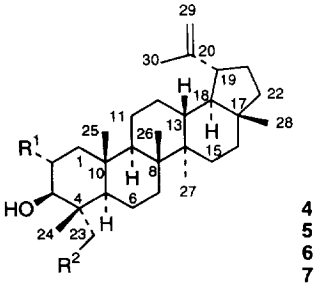

	R^1	R^2
4	H	H
5	OH	H
6	H	OH
7	OMe	H

the ^{1}H NMR spectra of these fractions were devoid of arylmethyl ether or carbomethoxyl signals.

2-Oxocandesalvone A 12-methyl ether (**1b**) had the molecular formula $C_{21}H_{26}O_5$ and its ^{1}H and ^{13}C NMR spectra (Tables 1 and 2, respectively) were very similar to those of 12-*O*-methylcandesalvone A (**8**, $C_{21}H_{28}O_4$) [13]. The observed differences were consistent with the existence in **1b** of a ketone at the C-2 position instead of the C-2 methylene group of **8**. The presence in **1b** of this α,β-unsaturated ketone grouping was supported by the following data: (i) IR absorption of **1b** at 1600 cm^{-1}, which was lacking in **8**, and strong UV absorption for **1b** at 239 nm (log ε 4.22) as compared with that of **8** (λ_{max} 239, log ε 3.92) [13] (see also Experimental); (ii) downfield shift of the C-1–C-4 carbons in **1b** (Table 2) with respect to those of **8** [13] [$\Delta\delta$ +13.1 (C-1), +163.7 (C-2), +5.5 (C-3) and +28.0 (C-4)]; (iii) the C-1 methylene protons of **1b** appeared as an AB system at δ 2.46 *dd* (H-1α, with an additional long-range coupling with the Me-20 protons, ^4J = 0.7 Hz) and 4.24 *d* (H-1β), J_{gem} = 17.1 Hz (Table 1), instead of the pattern displayed by the two contiguous methylene groups (C-1 and C-2) of **8** [13]; (iv) the HMBC spectrum of **1b** (Table 3) showed, among others, connectivities between the C-1 methylene protons and the C-2, C-3, C-5, C-10 and C-20 carbons, whereas the C-2 carbonyl carbon correlated with the H-1α, H-1β and Me-19 protons. Moreover, the other correlations observed in the HMBC spectrum of **1b** (Table 3) were only compatible with the proposed structure for 12-*O*-methyl-2-oxocandesalvone A and allowed the unequivocal assignment of all the carbons. On the basis of these data, the previous assignments for the C-9 and C-11 aromatic carbons of 12-*O*-methylcandesalvone A (**8**) [13] must be reversed.

From all the above data, it was evident that 2-oxocandesalvone A possessed structure **1a**. The absolute configuration of the diterpenoid must be *normal* (the one depicted in the formula), since its derivative **1b** showed specific rotations of positive sign and increasing values between 589 and 436 nm (see Experimental) as shown by candelabrone (**3a**) and other diterpenoids possessing an aryl ketone chromophore at C-7 [13, 15]. This conclusion was also supported on biogenetic grounds, because the other abietane derivatives co-occurring in *S. palaestina* [horminone, candelabrone (**3a**) and 12-*O*-methylpisiferic acid] belong to the *normal* series [10–13, 15].

The IR spectrum of 12-*O*-methylsalvipalestinoic acid methyl ester (**2b**, $C_{22}H_{28}O_7$) showed, among others, aryl δ-lactone (1780 cm^{-1}) [16], chelated aryl ketone (1630 cm^{-1}) [13] and ester (1735 cm^{-1}) absorptions. The ^{1}H NMR and ^{13}C NMR spectra of **2b** (Tables 1 and 2, respectively) firmly supported its structure. The ^{1}H NMR and ^{13}C NMR data corresponding to the aryl ketone moieties of **1b** and **2b** were almost identical (Tables 1 and 2), thus establishing the same partial structure in both compounds. The C-1–C-4 and C-18–C-20 carbons of **2b** (Table 2) resonated approximately at the same field as those corresponding to the 2,3-seco-abietane pygmaeocin A (**9**) [16] [$\Delta\delta$ = δ(**2b**)-δ(**9**) −0.9 (C-1), −1.9 (C-2), −2.4 (C-3), −0.2 (C-4), +1.1 (C-18), +3.3 (C-19) and +0.7 (C-20) ppm], thus supporting the 2,11-δ-lactone and the C-5 side-chain structural parts of **2b**. The pattern showed by the H-5α and C-6 methylene protons in the ^{1}H NMR spectrum of **2b** (an ABC system, $J_{5\alpha,6\beta}$ = 10.5 Hz, $J_{5\alpha,6\alpha}$ = 6.7 Hz and $J_{6\alpha,6\beta}$ = 17.7 Hz; Table 1 spectrum in C_6D_6 solution) established the remaining structural part of this compound. However, the ^{1}H NMR spectrum of **2b** recorded in $CDCl_3$ (Table 1) showed the H-5α and C-6 methylene protons at δ 2.76 as a 3H singlet signal, a detail not previously observed in this kind of compound [10–13, 15, 16].

Finally, the HMBC spectrum of **2b** (Table 3) was only consistent with the proposed structure and, together with the HMQC spectrum, allowed the complete assignment of all the carbons and protons of this compound (Tables 1 and 2). In particular, the assignment of both C-1 methylene protons was in agreement with the W-type coupling observed between the axial H-1α (δ 2.58 *dd*, J_{gem} = 17.1 Hz,

Table 1. ^{1}H NMR spectral data for compounds **1b** and **2b***

H	**1b**†	**2b**†	**2b**‡	*J* (Hz)	**1b**†	**2b**†	**2b**‡
1α	2.46 *dd*	2.58 *dd*	2.08 *dd*	1α,1β	17.1	15.0	14.9
1β	4.24 *d*	2.80 *d*	2.69 *d*	1α,20	0.7	1.0	1.0
5α	3.17 *ddq*	2.76 *s*	2.12 *dd*	5α,6α	3.4	0	6.7
6α	2.99 *dd*	2.76 *s*	2.12 *dd*	5α,6β	14.7	0	10.5
6β	2.70 *dd*	2.76 *s*	2.32 *dd*	5α,19	1.2	0	0
15	3.33 *sept*	3.52 *sept*	3.79 *sept*	6α,6β	17.1	0	17.7
Me-16§	1.39 *d*	1.32 *d*	1.51 *d*	15,16(17)	7.0	7.0	7.1
Me-17§	1.38 *d*	1.31 *d*	1.50 *d*	18,19	1.1	0	0
Me-18	1.97 *br s*‖	1.34 *s*¶	0.80 *s*¶				
Me-19	1.87 *br quint*	1.26 *s*¶	0.76 *s*¶				
Me-20	1.29 *d*	1.30 *d*	0.79 *d*				
PhOMe	3.80 *s*	3.93 *s*	3.18 *s*				
COOMe	—	3.73 *s*	3.68 *s*				
11-OH**	6.16 *s*	—	—				
14-OH**	13.16 *s*	12.83 *s*	13.55 *s*				

* At 500 MHz. Chemical shifts (δ values) are relative to residual $CHCl_3$ (δ 7.25) or C_6H_6 (δ 7.15). Spectral parameters were obtained by first order approximation and the assignments were in agreement with HMQC spectra.

† In $CDCl_3$ solution.

‡ In C_6D_6 solution.

§ Interchangeable numbering system.

‖ $W_{1/2}$ = 2.5 Hz.

¶ These assignments may be reversed.

** Disappeared after addition of D_2O.

Table 2. ^{13}C NMR spectral data for compounds **1b** and **2b***

C	**1b**	**2b**	C	**1b**	**2b**
1	49.4 *t*	40.8 *t*	12	152.9 *s*	153.8 *s*
2	198.2 *s*	166.1 *s*	13	127.3 *s*	129.1 *s*
3	132.4 *s*	177.9 *s*	14	158.7 *s*	159.9 *s*
4	151.9 *s*	44.5 *s*	15	26.0 *d*	24.8 *d*
5	44.9 *d*	48.8 *d*	16†	20.3 *q*	20.5 *q*
6	37.5 *t*	35.7 *t*	17†	20.2 *q*	20.4 *q*
7	202.9 *s*	202.1 *s*	18	17.9 *q*	21.3 *q*‡
8	112.0 *s*	108.8 *s*	19	11.2 *q*	28.5 *q*‡
9	131.0 *s*	131.9 *s*	20	16.7 *q*	20.2 *q*
10	40.7 *s*	38.6 *s*	PhOMe	62.1 *q*	61.9 *q*
11	139.3 *s*	134.8 *s*	COOMe	—	52.4 *q*

* Spectra were recorded at 125.7 MHz, in $CDCl_3$. Chemical shifts (δ values) are relative to solvent signals (δ_{CDCl_3} 77.00). Multiplicities were determined by HMQC spectra. All the assignments were in agreement with HMQC and HMBC spectra.

† Interchangeable numbering system.

‡ For compound **2b**, these assignments may be reversed.

$J_{\text{long-range}}$ = 1.0 Hz; Table 1 spectrum in $CDCl_3$ solution) and the Me-20 protons (δ 1.30 *d*), and with the correlation showed between the H-1β equatorial proton (δ 2.80 *d*, J_{gem} = 17.1 Hz) and the C-9 carbon (δ 131.9 *s*) [H(1β)-C(1)-C(10)-C(9) dihedral angle ~ 180°].

In agreement with all the above data, salvipalestinoic acid possessed structure **2a**. In this case, the absolute configuration of the diterpenoid was uncertain from the variation of the optical rotation values of **2b** (see above and Experimental). However, we suppose that **2a** possesses a *normal* abietane absolute stereochemistry, like the other abietanes found in the plant (see above). Moreover, **2a** could arise biogenetically from the *normal* abietane candelabrone (**3a**, co-occurring in the plant) [13, 15] by a rupture of the C-2–C-3 bond [16].

From a biogenetic point of view, it is of interest to indicate that several ring A-seco-abietanes of types 1,10- [17], 2,3- (such as **2a** and **9**) [16], 3-4- (candesalvone **B**, this work and ref. [13]) and 4,5-seco [18, 19] have been found as natural substances and, to our knowledge, 1,2-seco-abietanes have not been isolated so far.

The ^{1}H NMR and ^{13}C NMR spectra (Table 4) of the methoxytriterpene found in *S. palaestina* (**7**, $C_{31}H_{52}O_2$) were consistent with a lup-20(29)-ene structure [C-29 terminal methylene protons at δ 4.56 *sext*, 1H, and 4.68 *br d*, 1H, J_{gem} = 2.5 Hz, $J_{29A,30}$ = 1.4 Hz, $J_{29B,30}$ < 0.3 Hz, and δ 1.67 *br s*, 3H (Me-30); δ_C 150.9 *s* (C-20), 109.4 *t* (C-29) and 19.3 *q* (C-30)] [20] possessing a secondary hydroxyl group and a methoxyl substituent at the C-2α and C-3β positions [$\delta_{H\text{-}2\beta}$ 3.20 *ddd* and $\delta_{H\text{-}3\alpha}$ 3.02 *d*, $J_{2\beta,3\alpha}$ = 9.3 Hz, $J_{2\beta,1\alpha}$ = 11.8 Hz, $J_{2\beta,1\beta}$ = 4.4 Hz; δ_{OMe} 3.34 *s*, 3H; δ_C 78.9 *d* (C-2), 81.6 *d* (C-3) and 56.2 *q* (OCH_3)]. The location of the methoxyl group at the C-2α position was supported by the HMBC spectrum of **7**, which showed connectivities between the methoxyl protons (δ 3.34 *s*) and the C-2 carbon (δ 78.9 *d*) and also between the methoxyl carbon (δ 56.2 *q*) and the H-2β proton (δ 3.20 *ddd*).

Triterpenoid natural products containing methoxyl

Table 3. Significant data from the HMBC spectra of compounds **1b** and **2b**

C	Correlated with protons **1b**	**2b**
1	Me-20	Me-20
2	1α, 1β, Me-19	1α, 1β
3	1α, 1β, Me-18, Me-19	5α, Me-18, Me-19, COOMe
4	Me-18, Me-19	Me-18, Me-19
5	1α, 1β, 6α, 6β, Me-18, Me-20	6α, 6β
6	5α	5α
7	6α, 6β	5α, 6α, 6β
8	14-OH	6α, 14-OH
9	Me-20, 11-OH	1β
10	1α, 1β, 6α, 6β, Me-20	1α, 1β, 5α, 6α, 6β
11	11-OH	*
12	15, 11-OH, PhOMe	15, PhOMe
13	15, Me-16, Me-17, 14-OH	15, Me-16, Me-17, 14-OH
14	15, 14-OH	15, 14-OH
15	Me-16, Me-17	Me-16, Me-17
16	15	15
17	15	15
20	1α, 1β	1α, 1β

* No C(11)-proton connectivities were observed.

groups are somewhat rare [21]. In our opinion, compound **7** is not an artefact, because it was present in the initial acetone extract of the plant (TLC analysis) and its chemical precursor (**5**, also found in *S. palaestina*, see above) was recovered unchanged when it was treated with the same solvents and in the same way as the plant material and the extract.

EXPERIMENTAL

General. Mps: uncorr. Plant materials were collected in April 1996 near St Catherine's Monastery, Sinai, Egypt, and voucher specimens were deposited in the Herbarium of the Department of Pharmaceutical Sciences, National Research Centre, Cairo, Egypt.

Extraction and isolation of the constituents from the aerial parts. Dried and powdered aerial parts of *Salvia palaestina* Benth. (2.65 kg) were extracted with Me_2CO (2 × 10 l) at room temp. for 1 week. A portion (30 g) of the total extract (265 g) was subjected to CC (silica gel, Merck no. 7734, deactivated with 10% H_2O, w/v, 700 g) eluting with petrol and petrol–EtOAc mixts, yielding the following compounds in order of increasing chromatographic polarity: lupeol (**4**, 175 mg) [3], 2α-methoxylup-20(29)-en-3β-ol (**7**, 50 mg), a mixt. (4:1) of oleanolic and ursolic acids, respectively (26 mg), lup-20(29)-ene-2α,3β-diol (**5**, 85 mg) [3–5], lup-20(29)-ene-3β,23-diol (**6**, 46 mg) [6], impure 2-oxocandesalvone A (**1a**, 285 mg), 5-hydroxy-7,4′-dimethoxyflavone (14 mg) [1], impure candelabrone (**3a**, 65 mg) [13, 15], candesalvone B (650 mg) [13] and impure salvipalestinoic acid (**2a**, 23 mg). Compounds **1a**, **2a** and **3a** were purified as their *O*-methyl derivatives (**1b**, **2b** and **3b**, respectively) after treatment of the impure samples with ethereal CH_2N_2.

Extraction and isolation of the constituents from the roots. Dried and powdered roots of *S. palaestina* (950 g) were extracted (× 3) with Me_2CO (4 l) as above. The extract (19 g) was chromatographed (CC, silica gel 400 g, as above) giving the following compounds in order of increasing chromatographic polarity: 3β-acetoxyolean-12-en-28-al (10 mg) [7, 8], horminone (21 mg) [10, 11], lupeol (**4**, 53 mg) [3], a mixture of fatty esters of tyrosol (15 mg) [14], 3β-acetoxyolean-12-en-28-ol (9 mg) [9], sitosterol (250 mg), 12-*O*-methylpisiferic acid (8 mg) [12, 13], lup-20(29)-ene-2α,3β-diol (**5**, 11 mg) [3–5] and lup-20(29)-ene-3β,23-diol (**6**, 15 mg) [6].

The previously known compounds were identified by their physical (mp, $[\alpha]_D$) and spectroscopic (IR, ^1H NMR, MS) data and, in some cases, by comparison (mmp, TLC) with authentic samples.

12-O-Methyl-2-oxocandesalvone A (**1b**). Mp 253–255° (MeOH); $[\alpha]_D^{24}$ +105.3°, $[\alpha]_{578}$ +113.5°, $[\alpha]_{546}$ +134.0°, $[\alpha]_{436}$ +151.8° ($CHCl_3$; *c* 0.282). IR ν_{max}^{KBr} cm^{-1}: 3300 (OH), 3200–2500 br (chelated OH at C-14), 1660 (α,β-unsaturated ketone at C-2), 1620 (chelated aryl ketone at C-7), 2950, 1420, 1340, 1315, 1260, 1235, 1110, 1090, 1050, 1015, 955, 885, 820, 640; UV λ_{max}^{MeOH} nm (log ε): 239 (4.22), 279 (3.90), 372 (3.67); ^1H NMR: Table 1; ^{13}C NMR: Table 2; EIMS (70 eV, direct inlet) *m/z* (rel. int.): 358 $[M]^+$ (44), 343 $[M-Me]^+$ (100), 327 $[M-OMe]^+$ (4), 325 $[M-Me-H_2O]^-$ (60), 313 (8), 311 (9), 301 (6), 283 (9), 273 (7), 241 (10), 215 (4), 199 (5), 91 (4), 83 (6), 77 (4), 55 (6), 53 (3). (Found: C, 70.46; H, 7.55. $C_{21}H_{26}O_5$ requires: C, 70.37; H, 7.31%).

Methyl 12-O-methylsalvipalestinoate (**2b**). Mp 172–174° (MeOH); $[\alpha]_D^{21}$ −5.3°, $[\alpha]_{578}$ −5.0°, $[\alpha]_{546}$ −3.5°, $[\alpha]_{436}$ +4.5°, $[\alpha]_{365}$ −27.0° ($CHCl_3$; *c* 0.206). IR ν_{max}^{KBr}

Table 4. ^1H and ^{13}C NMR spectral data for compound **7***

H	7	$J_{H,H}$ (Hz)	7	C	7
1α	0.66 *dd*	1α, 1β	12.4	1	42.1 *t*
1β	2.14 *dd*	1α, 2β	11.8	2	78.9 *d*
2β	3.20 *ddd*	1β, 2β	4.4	3	81.6 *d*
3α	3.02 *d*	2β, 3α	9.3	4	38.9 *s*
5α	0.77‡	11α, 12α	4.5	5	55.3 *d*
6A†	1.39‡	11β, 12α	12.6	6	18.2 *t*
6B†	1.53‡	12α, 12β	12.6	7	34.2 *t*
7A†	1.39‡	12α, 13β	12.6	8	41.0 *s*
7B†	1.39‡	18α, 19β	5.8	9	50.5 *d*
9α	1.33‡	19β, 21α	5.8	10	38.3 *s*
11A†	1.26‡	19β, 21β	5.8	11	21.1 *t*
11B†	1.47‡	29A, 29B	2.5	12	25.1 *t*
12α	1.08 *qd*	29A, 30	1.4	13	38.0 *d*
12β	1.70‡	29B, 30	<0.3	14	42.9 *s*
13β	1.66‡			15	27.4 *t*
15A†	1.00‡			16	35.6 *t*
15B†	1.68‡			17	43.0 *s*
16A†	1.36‡			18	48.3 *d*
16B†	1.48‡			19	48.0 *d*
18α	1.36‡			20	150.9 *s*
19β	2.37 *td*			21	29.8 *t*
21A†	1.33‡			22	40.0 *t*
21B†	1.91 *m*			23	28.6 *q*
22A†	1.18‡			24	16.7 *q*
22B†	1.38‡			25	17.3 *q*
Me-23	1.03 *s*			26	16.0 *q*
Me-24	0.81 *s*			27	14.5 *q*
Me-25	0.89 *s*			28	18.0 *q*
Me-26	1.03 *s*			29	109.4 *t*
Me-27	0.94 *s*			30	19.3 *q*
Me-28	0.78 *s*			OMe	56.2 *q*
29A	4.56 *sext*				
29B	4.68 *br d*				
Me-30	1.67 *br s*				
OMe	3.34 *s*				

* At 500 MHz (^1H) and 125.7 MHz (^{13}C), in $CDCl_3$. Chemical shifts are relative to residual $CHCl_3$ for ^1H (δ 7.25) and to the solvent for ^{13}C (δ 77.00). The multiplicity of the carbons was assigned from the HMQC and DEPT spectra. All these assignments were in agreement with HMQC and HMBC spectra.

† The configuration of these protons was not assigned.

‡ The multiplicities of these signals are unclear due to overlapping and their chemical shifts were measured from the HMQC spectrum.

cm^{-1}: 3150–2650 br (chelated OH at C-14), 1780 (aryl δ-lactone), 1735 (ester), 1630 (chelated aryl ketone at C-7), 1550 (aromatic), 2930, 2860, 1470, 1420, 1380, 1340, 1260, 1130, 1090, 1020, 980, 960, 915, 800; UV λ_{max}^{MeOH} nm (log ε): 237 (4.23), 276 (4.09), 347 (3.77); ^1H NMR: Table 1; ^{13}C NMR: Table 2; EIMS (70 eV, direct inlet) *m/z* (rel. int.): 404 $[M]^+$ (100), 389 $[M-Me]^+$ (92), 375 (7), 345 (8), 303 (15), 287 (34), 275 (10), 261 (45), 246 (24), 233 (52), 125 (11), 123 (10), 111 (28), 109 (17), 99 (15), 97 (42), 95 (29), 85 (34), 83 (49), 71 (43), 69 (44), 67 (24), 57 (59), 55 (57). (Found: C, 65.20; H, 7.08. $C_{22}H_{28}O_7$ requires: C, 65.33; H, 6.98%).

2α-Methoxylup-20(29)-en-3β-ol (**7**). Mp 225–227° (MeOH); $[\alpha]_D^{21}$ −20.8° ($CHCl_3$; *c* 0.446). IR ν_{max}^{KBr} cm^{-1}: 3600 sharp, 3450 br (OH), 3060, 1640, 890 (exocyclic methylene), 2940, 2860, 1455, 1395, 1380, 1190, 1145, 1100, 1055, 1010, 950, 645; ^1H and ^{13}C NMR: Table 4; EIMS (70 eV, direct inlet) *m/z* (rel. int.): 456 $[M]^+$ (59), 441 $[M-Me]^+$ (22), 424 $[M-MeOH]^+$ (9), 423 $[M-H_2O-Me]^+$ (13), 409 (11), 346 (12), 345 (11), 264 (14), 257 (12), 237 (38), 229 (15), 219 (34), 218 (45), 205 (88), 203 (62), 189 (72), 177 (39), 175 (44), 161 (43), 149 (45), 147 (53), 135 (59), 133 (62), 123 (64), 121 (100), 109 (83), 95 (80), 81 (88), 67 (34), 55 (20). (Found: C, 81.32; H, 11.26. $C_{31}H_{52}O_2$ requires: C, 81.52; H, 11.48%).

Lup-20(29)-ene-3β,23-diol (**6**). Mp 232–233° (MeOH); $[\alpha]_D^{23}$ +25.9° ($CHCl_3$; *c* 0.216). IR, ^1H and ^{13}C NMR and MS identical to those previously described [6], except for the chemical shift of the C-1 carbon, which appears at δ 38.3 *t* in our spectrum and it is reported at δ 35.55 *t* in [6], probably by mistake. The δ_{C-1} of 38.3 agrees with the value reported for several lupane derivatives closely related with **6** [20].

Acknowledgements—We thank Prof. K. H. Batanouny, Department of Botany, Cairo University, Egypt, for the identification of plant materials. This work was supported by the Spanish 'Dirección General de Investigación Científica y Técnica' (grants PB93-0154 and PB94-0104). One of us (A. A. H.) thanks the 'Agencia Española de Cooperación Internacional' for a studentship.

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