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FOLIOSATE, A BIS-DITERPENE AND 9-*EPI-ENT*-7,15-ISOPIMARADIENE DERIVATIVES FROM *CALCEOLARIA FOLIOSA**

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Key Word Index—*Calceolaria foliosa*; Scrophulariaceae; bis-diterpene; 9-epimeric pimarane diterpenes.

Abstract—In addition to four new 9-*epi*-pimarane diterpenes, the aerial part of *Calceolaria foliosa* yielded a new bis-diterpene, foliosate, derived from the esterification of malonic acid by two 17-hydroxy-9-*ent*-7,15-isopimaradiene units. The structures of the new compounds were elucidated by spectroscopic methods and chemical transformations.

INTRODUCTION

In continuation of our work on the diterpenoids occurring in plants of the genus *Calceolaria* [1, 2], we have now studied *C. foliosa*, another uncommon taxon distributed in the coastal hills of Central Chile [3]. This paper describes the structure elucidation of a new bis-diterpene, which has been given the trivial name foliosate (**2**), and four new 9-epimeric pimarane diterpenes (**1**, **3**, **5** and **6**) isolated from the aerial parts of the plant.

RESULTS AND DISCUSSION

The petrol extract of the fresh aerial parts of *C. foliosa* afforded 17-acetoxy-9-*epi-ent*-7,15-isopimaradiene (**1**), bis- (9-*epi-ent*-17,15-isopimaradiene-17-yl) malonate (**2**), 17-hydroxy-9-*epi*-7,15-isopimaradiene (**3**), 9-*epi-ent*-7,15-isopimaradiene (**4**), 9-*epi-ent*-7,15-isopimaradiene-17-oic acid (**5**) and 17-malonyloxy-9-*epi-ent*-7,15-isopimaradiene (**6**).

Compound **1**, $C_{22}H_{34}O_2$ ([M]$^+$ at *m/z* 330), showed bands for acetoxy and olefinic groups in the IR spectrum. Its ^{1}H NMR spectrum exhibited three methyl groups as singlets at δ0.82, 0.85 and 0.88, and a broad two-proton singlet at δ3.80 was assigned to the methylene protons of a primary acetoxy group (δ1.99, *s*, acetyl).

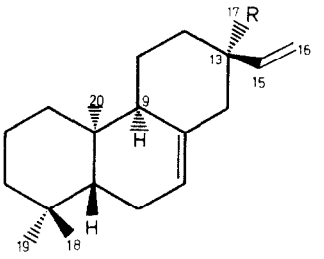
The spectrum also showed the characteristic signals of a vinyl group (δ5.62, *dd*, H-15; 5.08 *dd*, H-16c; 4.99 *dd* H-16t) and a methine signal (δ5.28, *br d*, H-7) indicated a trisubstituted double bond. The ^{13}C NMR spectrum of **1** (Table 1) confirmed the presence of these features and suggested that the compound possessed a 7,15-isopimaradiene-type structure. Thus, the diterpenoid moiety of **1** was presumed to be related with that of 18-malonyloxy-9-*epi-ent*-isopimarol previously isolated from *C. glandulosa* [1]. This presumption was proved to be correct because the ^{13}C NMR chemical shifts of **1** closely corresponded to those of 9-*epi-ent*-7,15-isopimaradiene [1], except for the C-ring carbon atoms. The differences observed in chemical shift can be rationalized by considering the effects of the primary acetoxyl group. Therefore, placing the acetoxyl group at C-17, **1** is shown to be 17-acetoxy-9-*epi-ent*-7,15-isopimaradiene.

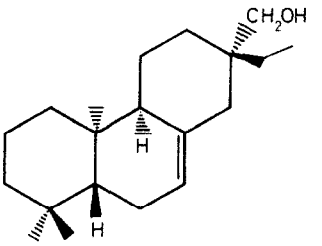
Compound **3** was a crystalline product with molecular formula $C_{20}H_{32}O$. Its structure was readily deduced by comparing its spectral data with that of **1**. In fact, the ^{1}H NMR spectrum of **3** was very similar to that of 17-acetoxy-9-*epi-ent*-7,15-isopimaradiene (**1**), but the acetate methyl singlet was missing and the methylene-17 signal, appearing as a collapsed AB system in **1**, was shifted upfield from δ3.80 to 3.34 (H, *d*, J = 10.6, H-17) and 3.29 (H, *d*, J = 10.6, H-17′). These differences between the ^{1}H NMR spectra of **1** and **3** indicated that the new compound (**3**) must be the deacetyl derivative of **1**. The ^{13}C NMR spectrum of **3** (Table 1) confirmed all the above results and defined the proposed structure as 17-hydroxy-9-*epi-ent*-7,15-isopimaradiene. By catalytic reduction of **3** the vinyl at C-13 was selectively reduced to give 15,16-dihydro-17-hydroxy-9-*epi-ent*-7-isopimaraene (**4**), the spectra of which (see Experimental and Table 1) are in full accordance with the assigned structure.

That compound **5** was the carboxylic derivative of **3** was shown by the MS, the ^{1}H and ^{13}C NMR spectra and because, by reaction with ethereal diazomethane, the methyl ester **5a** was easily obtained. (see Experimental and Table 1). In fact, the ^{1}H NMR spectrum showed that **5** lacked resonances for the methylene protons at C-17 and its ^{13}C NMR spectrum clearly exhibited the characteristics signal of a carboxylic group (δ182.2 *s*), which produced the expected deshielding effect on C-13. The other carbon resonances are almost unshifted compared with those of **3**, leading to the assignment of the structure of **5** as 9-*epi-ent*-7,15-isopimaradiene-17-oic acid. On the other hand, the presence of a carbomethoxyl group in the ^{1}H NMR spectrum of **5a** was evident by a three proton singlet at δ3.66.

The mass spectrum of **6** revealed a molecular ion at *m/z* 374 [M]$^+$ corresponding to $C_{23}H_{34}O_4$. The ^{1}H NMR spectrum of **6** was in part very close to that of **1**. However, the acetoxy singlet was replaced by a two-proton singlet centred at δ 3.40 which led to the proposal that a malonate moiety may be present [1, 2]. The ^{13}C NMR spectrum of **6** (Table 1) confirmed this point by the presence of signals at δ166.4, 40.8 and 170.3 which corresponded to

*Part 3 in the series 'Diterpenoids from *Calceolaria* species'. For part 2 see ref. [1].





4

R

1 CH_2OAc

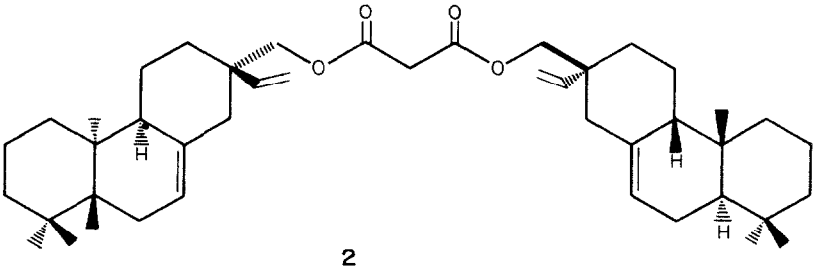
3 CH_2OH

5 COOH

5a COOMe

6 CH_2OCOCH_2COOH

6a CH_2OCOCH_2COOMe



2

the malonate carbons [1, 2]. In agreement with this, alkaline hydrolysis of **6** yielded 17-hydroxy-9-*epi-ent*-7,15-isopimaradiene (**3**). In addition, by reaction with ethereal diazomethane, compound **6** was easily transformed to its methyl ester derivative **6a** (see Experimental and Table 1). Therefore on the basis of these data, **6** is shown to be 17-malonyloxy-9-*epi-ent*-7,15-isopimaradiene.

Finally, foliosate (**2**) isolated as a gum, had molecular formula $C_{43}H_{64}O_4$ ([M]$^+$ at *m/z* 644) and its IR spectrum revealed absorptions attributable to ester (1720 cm^{-1}) and olefinic (3060, 1640, 920 cm^{-1}) groups. The ^1H NMR spectrum of **2** was superimposable to that of **1**, i.e. the spectrum exhibited the characteristics of a 7,15-isopimaradiene nucleus and a malonate unit (δ 3.37). However, the integral due to the terpene moiety was twice that of the malonate residue, which suggested that two diterpene units must be linked by malonic acid. Lithium aluminium hydride reduction of **2** yielded an alcohol identical in all respects to the natural product **3**. The ^{13}C NMR spectrum of **2** (Table 1) exhibited 22 signals, which were unambiguously assigned by comparison with the corresponding carbon atoms of the above substances. Therefore, foliosate (**2**) corresponded to bis-(9-*epi-ent*-7,15-isopimaradiene-17-yl) malonate.

To the best of our knoweldge, only three bis-diterpenes in which two diterpene units combined via malonic acid, have been found in nature prior to the present work. They are diisopimaryl malonate from *Nepeta tuberosa* subsp. *reticulata* [4], and corymbivillosol and corybivillosol-3-*O*-acetate from *Corymbium villosum* [5].

The occurrence of 9-epimeric diterpenoids has been reported for another species of the genus *Calceolaria* [1]; therefore, these findings confirmed that a modification of the normal diterpenoid cyclization of geranylgeranyl pyrophosphate must operate in some members of the genus.

EXPERIMENTAL

Mps: uncorr; ^1H NMR: 60, 400 and 500 MHz in $CDCl_3$ with TMS; ^{13}C NMR: 100 and 125 MHz, $CDCl_3$ with TMS. Assignments of ^{13}C NMR chemical shifts were made with the aid of APT and SFORD. IR: film on NaCl or KBr pellets; MS: direct inlet, 70 eV.

Calceolaria foliosa Phil, collected in parque Nacional La Campana, V-región, Chile in Nov. 1986, was identified by Dr Otto Zoellner (Universidad Católica de Valparaíso). A voucher specimen is deposited at Universidad Federico Santa María.

The fresh aerial parts of *C. foliosa* (1.2 kg) were extracted at room temp. with petrol for 6 hr, affording 45 g of a syrup. This crude material (20 g) was chromatographed on a silica gel column (600 g, HF_{254} for TLC) and eluted with mixts of petrol and EtOAc of increasing polarity. Fractions of 125 ml were

Table 1. ^{13}C NMr spectral data of compounds **1–5**, **5a**, **6** and **6a** ($CDCl_3$, TMS)

C	1*	2	3	4	5	5a	6	6a
1	36.9	36.8	36.8	37.0	36.8	36.9	36.7	36.7
2	19.0	18.8	18.8	19.0	18.8	18.9	18.7	18.7
3	43.0	43.0	43.1	43.3	43.0	43.2	43.0	42.9
4	33.0	32.9	32.9	32.5	32.9	33.0	32.7	32.7
5	43.5	43.5	43.5	43.5	43.5	43.7	43.5	43.4
6	23.9	23.8	23.8	24.0	23.9	24.0	23.7	23.6
7	120.3	120.8	120.2	120.2	121.9	121.8	120.6	120.5
8	135.1	135.3	135.9	136.8	134.7	135.0	135.1	135.1
9	53.2	53.1	53.5	53.8	52.8	53.0	53.1	53.1
10	35.3	35.2	35.3	35.3	35.2	35.4	35.1	35.1
11	24.7	24.5	24.8	24.6	24.4	24.6	24.4	24.4
12	33.7	33.4	33.5	33.0	33.5	33.9	33.4	33.4
13	42.6	42.5	45.0	40.1	49.8	50.1	42.5	42.5
14	44.1	44.0	44.1	43.8	44.1	44.4	43.8	43.8
15	141.0	141.1	142.4	23.2	138.9	139.5	140.9	141.0
16	114.7	115.3	115.6	7.5	116.6	116.0	115.0	114.8
17	72.1	72.9	71.5	70.5	182.2	178.0	73.0	72.7
18	33.6	33.5	33.5	33.6	33.5	33.6	33.3	33.3
19	22.3	22.2	22.2	22.3	22.2	22.2	22.0	22.0
20	22.9	22.8	22.7	22.9	22.7	22.8	22.5	22.5
$COCH_2CO$		166.4					166.4	165.9
$COCH_2CO$		41.7					40.8	41.1
$COCH_2CO$		166.4					170.3	166.4
MeO						51.9		51.9

*Acetate carbons at 170.4 and 21.1 ppm.

taken and combined based upon TLC and ^{1}H NMR (60 MHz) monitoring to give in order of elution: a mixture of 17-acetoxy-9-*epi-ent*-7,15-isopimaradiene (**1**) and bis-(9-*epi-ent*-7,15-isopimaradiene-17-yl) malonate (**2**), 17-hydroxy-9-*epi-ent*-7,15-isopimaradiene (**3**, 360 mg), a mixture containing 9-*epi-ent*-7,15-isopimaradiene-17-oic acid (**4**) and a mixture containing 17-malonyloxy-9-*epi*-ent-7,15-isopimaradiene (**5**).

The mixture containing **1** and **2** was subjected to silica gel CC (100 g., HF_{254} for TLC) impregnated with $AgNO_3$ (10%), using petrol–EtOAc (9:1, 2 l; 8:2, 2 l). Fractions 7-12, containing a single compound, were mixed and afforded **1** (210 mg). Fractions 18–28, containing another pure compound, were mixed affording **2** (480 mg). The mixtures containing **4** and **5** were purified separately by repeated chromatography on silica gel CC

17-*Acetoxy*-9-epi-ent-7,15-*isopimaradiene* (**1**). Viscous colour less oil, $[\alpha]_D^{25} - 120.6°$ ($CHCl_3$; *c* 1.02). IR $\nu_{max}^{CHCl_3}$ cm^{-1}: 3060, 2980–2840, 1735, 1630, 1450, 1380, 1360, 1250, 1035, 915, 845, 820; ^{1}H NMR (400 MHz): δ5.62 (1H, *dd*, *J* = 11.0, 17.8 Hz, H-15), 5.28 (1H, *br d*, *J* = 4.9 Hz, H-7), 5.08 (1H, *dd*, *J* = 11.0, 1.0 Hz, H-16 c), 4.99 (1H, *dd*, *J* = 17.8, 1.0 Hz, H-16t), 3.80 (2H, *br s*, H_2-17), 1.99 (3H, *s*, acetyl), 0.88 (3H, *s*, Me-18), 0.85 (3H, *s*, Me-20), 0.82 (3H, *s*, Me-19); ^{13}C NMR: see Table 1; MS *m/z* (rel. int.): 330 $[C_{22}H_{34}O_2]^+$ (78), 315 $[M - Me]^+$ (68), 270 $[M - HOAc]^+$ (67), 255 $[M - Me - HOAc]^+$ (75), 131 (87), 91 (100), 81 (89), 69 (99), 43 (63), 41 (60).

Bis-(9-epi-ent-7,15-*isopimaradiene*-17-*yl*) *malonate* (foliosate, **2**). viscous colourless oil, $[\alpha]_D^{25} - 133.7°$ ($CHCl_3$; *c* 1.07). IR $\nu_{max}^{CHCl_3}$ cm^{-1}: 3060, 2980–2840, 1720, 1640, 1460, 1415, 1390, 1380, 1370, 1330, 1270, 1150, 1020, 920, 850, 820; ^{1}H NMR (500 MHz): δ 5.65 (2H, *dd*, *J* = 11.1, 17.9 Hz, H-15 and H-15'), 5.32 (2H, *br d*, *J* = 4.7 Hz, H-7 and H-7'), 5.13 (2H, *dd*, *J* = 11.1, 1.0 Hz, H.16c and H-16'c), 5.04 (2H, *dd*, *J* = 17.9, 1.0 Hz, H-16t and H-16't), 3.92 (4H, *br s*, H_2-17 and H_2-17'), 3.37 (2H, *s*, H_2-malonyl), 0.93 (6H, *s*, Me-18 and Me-18'), 0.90 (6H, *s*, Me-20 and Me-20'), 0.86 (6H, *s*, Me-19 and Me-19'); ^{13}C NMR: see Table 1; MS *m/z* (rel. int.): 644 $[C_{43}H_{64}O_4]^+$ (60), 629 $[M - Me]^+$ (30), 373 (10), 288 $[C_{20}H_{32}O]^+$ (15), 270 $[C_{20}H_{30}]^+$ (100), 255 (30), 229 (26), 133 (16), 109 (29), 83 (22), 69 (18), 55 (12).

Reduction of foliosate. **2** (100 mg) was treated with $LiALH_4$ in dry Et_2O. After usual work-up and crystallization from MeOH–H_2O, **3** was obtained as white crystals (75 mg).

17-*Hydroxy*-9-epi-ent-7,15-*isopimaradiene* (**3**). Mp 75–76° $[\alpha]_D^{25} - 160.6°$ ($CHCl_3$; *c* 1.0). IR ν_{max}^{KBr} cm^{-1}: 3420, 3070, 2980–2840, 1640, 1460, 1380, 1050, 990, 920, 845, 820; ^{1}H NMR (400 MHz): δ5.62 (1H, *dd J* = 11.0, 17.8 Hz, H-15), 5.32 (1H, *br d*, *J* = 5.0 Hz, H-7), 5.23 (1H, *dd*, *J* = 11.0, 1.0 Hz, H-16c), 5.07 (1H, *dd*, *J* = 17.8, 1.0 Hz, H-16t), 3.34 (1H, *d*, *J* = 10.6 Hz, H-17), 3.29 (1H, *d*, *J* = 10.6 Hz, H-17'), 0.93 (3H, *s*, Me-18), 0.89 (3H, *s*, Me-20), 0.86 (3H, *s*, Me-19); ^{13}C NMR: see Table 1; MS *m/z* (rel. int.): 288 $[C_{20}H_{32}O]^+$ (13), 273 $[M - Me]^+$ (79), 133 (69), 109 (89), 105 (78), 91 (76), 69 (92), 55 (100), 43 (71), 41 (79).

15,16-*Dihydro*-17-*hydroxy*-9-epi-ent-7,15-*isopimaradiene* (**4**). **3** (160 mg) was dissolved in 50 ml of MeOH. PtO_2 (40 mg) was added and the mixt. hydrogenated in a Parr apparatus at an initial pressure of 50 psi. After 4 hr, the mixt was filtered, concd and chromatographed on a silica gel column (20 g) and eluted with petrol–EtOAc (9:1) yielding pure **4** (80 mg). Mp 93–94° (MeOH–H_2O), $[\alpha]_D^{25} - 180.2$ ($CHCl_3$; *c* 0.7). IR ν_{max}^{KBr} cm^{-1}: 3300, 2980–2840, 1460, 1380, 1050, 850, 825, 780; ^{1}H NMR (60 MHz): δ 5.30 (1H, *m*, H-7), 3.33 (2H, *br s*, H_2-17), 0.93 (3H, *s*, Me-18), 0.87 (6H, *s*, Me-20 and Me-19); ^{13}C NMR: see Table 1; MS *m/z* (rel. int.): 290 $[C_{20}H_{34}O]^+$ (100), 275 $[M - Me]^+$ (86), 259 (61), 257 (55), 135 (88), 121 (79), 119 (84), 109 (98), 81 (71), 67 (73), 43 (67), 41 (56).

9-epi-ent-7,15-*Isopimaradiene*-17-*oic acid* (**5**). Mp 160–161°, $[\alpha]_D^{25} - 174.2$ ($CHCl_3$; *c* 1.0). IR ν_{max}^{KBr} cm^{-1}: 3200, 3060, 2980–2840, 1710, 1640, 1450, 1410, 1380, 1275, 930, 850, 780; ^{1}H NMR (400 MHz): δ10.80 (1H, *s*, COOH), 5.82 (1H, *dd*, *J* = 10.8, 17.6 Hz, H-15), 5.45 (1H, *br d*, *J* = 5.0 Hz, H-7), 5.32 (1H,

dd, $J = 10.8$, 1.0 Hz, H-16c) 5.25 (1H, *dd*, $J = 17.6$, 1.0 Hz, H-16t), 0.94 (3H, *s*, Me-18), 0.93 (3H, *s*, Me-20), 0.92 (3H, *s*, Me-19); ^{13}C NMR: see Table 1; MS *m/z* (rel. int.): 302 $[C_{20}H_{30}O_2]^+$ (11.3), 287 $[M-Me]^+$ (68), 255 (54), 213 (62), 133 (65), 121 (73), 119 (78), 107 (76), 85 (75), 81 (86), 55 (100), 43 (62), 41 (67).

Methyl 9-epi-ent-7,15-*isopimaradiene*-17-*oate* (**5a**). After addition of CH_2N_2–Et_2O, **5** (100 mg) was transformed to **5a**. Mp 44–45° $[\alpha]_D^{25}$ −136.6 ($CHCl_3$; *c* 1.12). IR ν_{max}^{KBr} cm^{-1}: 3060, 2980–2840, 1730, 1640, 1455, 1430, 1390, 1380, 1370, 1250, 930, 850, 830; ^{1}H NMR (400 MHz: δ 5.80 (1H, *dd*, $J = 10.8$, 17.6 Hz, H-15), 5.39 (1H, *br d*, $J = 4.8$ Hz, H-7), 5.19 (1H, *dd*, $J = 10.8$ 1.0 Hz, H-16c), 5.11 (1H, *dd*, $J = 17.6$, 1.0 Hz, H-16t), 3.66 (3H, *s*, COOMe), 0.93 (3H, *s*, Me-18), 0.90 (3H, *s*, Me-20), 0.87 (3H, *s*, Me-19); ^{13}C NMR: see Table 1; MS *m/z* (rel. int.): 316 $[C_{21}H_{32}O_2]^+$ (79), 301 $[M-Me]^+$ (55), 257 (67), 241 (100), 231 (75), 205 (74), 159 (68), 133 (64), 119 (74), 107 (73), 81 (82), 67 (77), 55 (64), 43 (58), 41 (60).

17-*Malonyloxy*-9-epi-ent-7,15-*isopimaradiene* (**6**). Viscous colourless oil, $[\alpha]_D^{25}$ −127.5 ($CHCl_3$; *c* 1.0). IR ν_{max}^{film} cm^{-1}: 3500–3300, 3080, 2980–2840, 1740, 1715, 1640, 1450, 1410, 1380, 1310, 1160, 1010, 920, 845, 820; ^{1}H NMR (400 MHz): δ 7.60 (1H, *sa* COOH), 5.62 (1H, *dd*, $J = 11.0$, 17.8 Hz, H-15), 5.30 (1H, *br d*, $J = 5.0$ Hz, H-7), 5.13 (1H, *dd*, $J = 11.0$, 1.0 Hz, H-16c), 5.02 (1H, *dd*, $J = 17.8$, 1.0 Hz, H-16t), 3.93 (2H, *br s*, H_2-17), 3.40 (2H, *s*, H_2-malonyl), 0.90 (3H, *s*, Me-18), 0.87 (3H, *s*, Me.20), 0.84 (3H, *s*, Me-19); ^{13}C NMR see Table 1; MS *m/z* (rel. int.): 374 $[C_{23}H_{34}O_4, M]^+$ (1), 359 $[M-Me]^+$ (8), 330 $[M-CO_2]^+$ (2), 270 (100), 255 (45), 231 (60), 133 (75), 109 (85), 55 (80), 43 (68), 41 (55).

Methyl 17-*malonyloxy*-9-epi-ent-7,15-*isopimaradiene* (**6a**). After addition of CH_2N_2–Et_2O, **6** (50 mg) was transformed to **6a**. Mp 59–60° (petrol–EtOAc), $[\alpha]_D^{25}$ −125.3 ($CHCl_3$; *c* 1.74). IR ν_{max}^{KBr} cm^{-1}: 3080, 2980–2840, 1740–1730, 1640, 1450, 1435, 1410, 1380, 1345, 1280, 1210, 1150, 1015, 915 845, 820; ^{1}H NMR (400 MHz): δ 5.65 (1H, *dd*, $J = 11.0$, 17.8 Hz, H-15), 5.33 (1H, *br d*, $J = 5.0$ Hz, H-7), 5.14 (1H, *dd*, $J = 11.0$, 1.0 Hz, H-16c), 5.04 (1H, *dd*, $J = 17.8$, 1.0 Hz, H-16t), 3.92 (2H, *br s*, H_2-17), 3.73 (3H, *s*, COOMe), 3.38 (2H, *s*, H_2-malonyl), 0.93 (3H, *s*, Me-18), 0.89 (3H, *s*, Me-20), 0.86 (3H, *s*, Me-19); ^{13}C NMR: see Table 1; MS *m/z* (rel. int.): 388 $[C_{24}H_{36}O_4, M]^+$ (7), 373 $[M-Me]^+$ (11), 270 (84), 255 (100), 229 (80), 146 (91), 133 (73), 131 (84), 109 (83), 105 (98), 81 (99), 69 (82), 55 (86), 43 (64), 41 (75).

Hydrolysis of **6**. **6** (100 mg) was treated with K_2CO_3 in MeOH at room temp. under N_2. After 6 hr the mixt. was filtered, concd and crystallized from MeOH–H_2O. The spectral and physical properties (TLC, IR, ^{1}H, NMR and MS) of this compound were in full agreement with those of the natural product **3**.

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REFERENCES

1. Piovano, M., Gambaro, V., Chamy, M. C., Garbarino, J. A., Nicoletti, M., Guilhem, J. and Pascard, C. (1988) *Phytochemistry* **27** (in press).
2. Chamy, M. C., Piovano, M., Gambaro, V., Garbarino, J. A. and Nicoletti, M. (1987) *Phytochemistry* **26**, 1763.
3. Marticorena, C. and Quezada, M. (1988). *Gayana* (*Botánica*) **42**, 1.
4. Pascual, Teresa, J. de, Urones, J. G., Sanches Maras, F., Fernández Ferreras, J., Lilhgow Bertelloni, A. M. and Basabe Barcela, P. (1987) *Phytochemistry* **26**, 1481.
5. Zdero, C. and Bohlmann, F. (1988) *Phytochemistry* **27**, 227.