6-C-formyl and 6-C-hydroxymethyl flavanones from Petiveria alliacea

Article *in* Phytochemistry · July 1992

DOI: 10.1016/0031-9422(92)83304-H

Phytochemistry, Vol. 31, No. 7, pp. 2481–2482, 1992
Printed in Great Britain.

0031–9422/92 $5.00+0.00

6-*C*-FORMYL AND 6-*C*-HYDROXYMETHYL FLAVANONES FROM *PETIVERIA ALLIACEA*

FRANCO DELLE MONACHE* and LUIS ENRIQUE CUCA SUAREZ†

Centro Chimica dei Recettori del C.N.R., Università Cattolica, Largo F. Vito 1, 00168 Rome, Italy; †Departamento de Quimica, Universidad Nacional de Colombia, Bogotà, Colombia

(*Received* 7 *October* 1991)

Key Word Index—*Petiveria alliacea*; Phytolaccaceae; *C*-formyl flavanone; *C*-hydroxymethyl flavanones; flavonoid rhamnosides.

Abstract—Three new flavonoids have been isolated from the leaves of *Petiveria alliacea* and assigned the structures 6-formyl-8-methyl-7-*O*-methylpinocembrin, 6-hydroxymethyl-8-methyl-7-*O*-methylpinocembrin and 6-hydroxymethyl-8-methyl-5,7-di-*O*-methylpinocembrin, respectively. The 3-*O*-rhamnosides of dihydrokampferol, dihydroquercetin and myricetin have also been isolated.

INTRODUCTION

Petiveria alliacea is a shrub used in the traditional medicine of South America [1]. The plant has a garlic-like odour, which is transferred to the milk of cows [2, 3]. Previous work on this species led to the characterization of sulphides from the roots [4–6] and waxes from the petrol extract of the whole plant [6]. In this paper we report the isolation from the ethanol extract of the leaves three known flavonoid rhamnosides and three new C-alkylated derivatives of pinocembrin.

RESULTS AND DISCUSSION

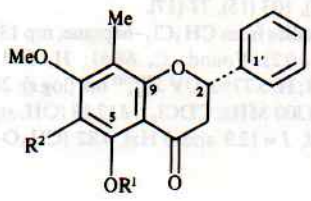
The ethanol extract from the leaves of *Petiveria alliacea* was fractionated by successive extraction in *n*-hexane, chloroform and ethyl acetate. The chloroform-soluble portion afforded three compounds by chromatography over silica gel, all of which showed in the ^{1}H NMR spectra the characteristic signals for C-2 and C-3 protons of flavanones and a broad singlet (5H) for an unsubstituted B ring. The remaining signals of the first compound ($C_{18}H_{16}O_5$), named leridal, were sharp singlets which were attributed to chelated hydroxyl (δ12.98), formyl (δ10.22), methoxyl (δ3.90) and methyl (δ2.07) substituents of the A ring. In agreement with the above findings, the mass spectrum disclosed fragments at *m/z* 104 and 77 (ring B), at *m/z* 235 [M−C_6H_5] and *m/z* 208 (ring A). Furthermore, a phloroglucinol-type oxygenation of ring A was inferred by the low field signals of the oxygenated aromatic carbons in the ^{13}C NMR spectrum (Table 1).

Finally, the relative position of the methyl and formyl substituents was established by NOE experiments. Irradiation of the resonance at δ10.22 caused the enhancement of both signals at δ3.90 (7-OMe) and 12.98 (5-OH), while irradiation of the resonance at δ12.98 increased the intensity of the formyl signal. Therefore, this compound is 6-formyl-8-methyl-7-*O*-methylpinocembrin (**1**).

Table 1. ^{13}C NMR data (75 MHz, $CDCl_3$) of the flavanones **1–3**

	1	2	3
2	79.9	79.2	79.2
3	44.9	43.5	45.5
4	187.4	197.0	189.6
5	167.8	158.2	163.8[a]
6	106.5[a]	113.1	119.3
7	166.2[b]	165.7	160.0[a]
8	113.9[a]	111.9	118.4
9	165.1[b]	161.5	159.9[a]
10	107.5[a]	105.0	112.1
1′	137.6	138.2	138.5
2′,6′	125.9	126.0	125.9
3′,5′	128.9	128.9	128.9
4′	129.0	129.0	128.8
5-OR	—	—	61.3
6-R[1]	192.6	54.8	55.1
7-OMe	61.7	61.8	61.8
8-Me	7.0	8.0	8.6

[a,b]Interchangeable.



	R¹	R²
1	H	CHO
2	H	CH_2OH
3	Me	CH_2OH

*Author to whom correspondence should be addressed.

The second compound (**2**), $C_{18}H_{18}O_5$, showed a very similar ^{1}H NMR spectrum, only the formyl signal being substituted by a 2H broad quartet at δ4.82, which was attributed to a hydroxymethyl group. In agreement, the APT ^{13}C NMR spectrum showed a methylene signal at δ54.8 (Table 1), while in the mass spectrum the A ring fragments were shifted at *m/z* 237 and 210 with respect to **1**. In an NOE experiment, the resonance at δ4.82 enhanced both signals for 5-OH and 7-OMe; thus the compound is 6-hydroxymethyl-7-*O*-methylpinocembrin (**2**) and is named leridol.

A comparison of the spectral data (see Experimental and Table 1) of the third compound ($C_{19}H_{20}O_5$) with those of **2** indicated that it was the 5-*O*-methyl ether (**3**) of leridol. The ethyl acetate-soluble portion of the extract afforded two flavanonol rhamnosides and one flavonol rhamnoside. They were identified as engeletin, astilbin and myricitrin on the basis of the ^{1}H and ^{13}C NMR data (see Experimental) and the first two also by co-TLC with authentic specimens. Acid hydrolyses yielded dihydrokempleferol, dihydroquercetin and myricetin, respectively.

EXPERIMENTAL

Plant material. Leaves of *Petiveria alliacea* L. (Phytolaccaceae) were collected in Lerida, Dept. of Tolima (Colombia) and identified by Prof. R. Jaramillo of the Instituto de Ciencias Naturales, Universidad Nacional de Colombia (Bogotà), where voucher specimens are deposited.

Extraction and purification. Powdered air-dried leaves (1.3 kg) were extracted with cold EtOH and part (33 g) of the residue (70 g) partitioned between hexane and MeOH–H_2O (9:1). The aqueous alcoholic portion was concd and extracted with $CHCl_3$, EtOAc and BuOH, successively. Part (4.2 g) of the $CHCl_3$ extract (13.5 g) was chromatographed on silica gel with C_6H_6–EtOAc (9:1) to afford leridal (**1**; 120 mg), leridol (**2**; 60 mg) and leridol 5-methyl ether (**3**; 50 mg).

Part (3.7 g) of the EtOAc extract (6.9 g) by chromatography on silica gel afforded engeletin (120 mg; eluted with $CHCl_3$–MeOH, 9:1), astilbin (78 mg; eluted with $CHCl_3$–MeOH, 4:1) and myricitrin (50 mg; eluted with $CHCl_3$–MeOH, 7:3).

Leridol (**1**). Needles from MeOH, mp 168–170°; $[\alpha]$ +33° ($CHCl_3$; *c* 0.2). Found: C, 69.12; H, 5.20. $C_{18}H_{16}O_5$ requires: C, 69.22; H, 5.16%. UV λ_{max}^{MeOH} nm (log ε): 258 (4.47), 345 (3.53). ^{1}H NMR (300 MHz, $CDCl_3$): δ12.98 (OH, *s*), 10.22 (CHO, *s*), 7.45 (C_6H_5, *m*), 5.55 (H-2, *dd*, *J* = 13 and 3 Hz), 3.90 (OMe, *s*), 3.06 (H-3a, *dd*, *J* = 17 and 13 Hz), 2.87 (H-3b, *dd*, *J* = 17 and 3 Hz), 2.07 (8-Me, *s*). ^{13}C NMR: see Table 1; the assignment of the C-5 signal was based on the deuterium isotope effect ($\Delta\delta$ −17 Hz) in partially deuterated **1**. EIMS (probe) 70 eV, *m/z* (rel. int.): 312 $[M]^+$ (52), 297 (11), 284 (22), 235 (11), 208 (14), 207 (11), 180 (100), 152 (52), 104 (22), 103 (15), 77 (17).

Leridol (**2**). Needles from CH_2Cl_2–heptane, mp 139–140°; $[\alpha]_D$ +21° ($CHCl_3$; *c* 0.2). Found: C, 68.61; H, 5.91. $C_{18}H_{18}O_5$ requires: C, 68.78; H, 5.77%. UV λ_{max}^{MeOH} nm (log ε): 282 (4.18), 350 (3.52). ^{1}H NMR (300 MHz, $CDCl_3$): δ12.19 (OH, *s*), 7.45 (C_6H_5, *m*), 5.46 (H-2, *dd*, *J* = 12.9 and 3 Hz), 4.82 (CH_2O–, *br q*), 3.86 (OMe, *s*), 3.12 (H-3a, *dd*, *J* = 17.2 and 12.9 Hz), 2.87 (H-3b, *dd*, *J* = 17.2 and 3 Hz), 2.15 (OH, *br s*), 2.09 (8-Me, *s*). ^{13}C NMR: see Table 1; the assignment of the quaternary carbons followed from the data of a long-range HETCOR experiment. EIMS (probe) 70 eV, *m/z* (rel. int.): 314 $[M]^+$ (100), 296 (36), 281 (12), 263 (7), 253 (8), 237 (7), 219 (52), 209 (20), 205 (13), 182 (41), 181 (23), 104 (33), 103 (26), 77 (22).

5-O-*Methylleridol* (**3**). Plates from CH_2Cl_2–heptane, mp 157–158°; $[\alpha]_D$ +18° ($CHCl_3$; *c* 0.15). Found: C, 69.45; H, 6.21. $C_{19}H_{20}O_5$ requires: C, 69.50; H, 6.14%. UV λ_{max}^{MeOH} nm (log ε): 270 (4.15), 328 (3.58). ^{1}H NMR (300 MHz, $CDCl_3$): δ7.45 (C_6H_5, *m*), 5.47 (H-2, *dd*, *J* = 13 and 3 Hz), 4.74 (CH_2O, *q*, *J* = 12 Hz), 3.85 (OMe, *s*), 3.84 (OMe, *s*), 3.05 (H-3a, *dd*, *J* = 16.7 and 13 Hz), 2.86 (H-3b, *dd*, *J* = 16.7 and 3 Hz), 2.30 (OH, *br s*), 2.17 (8-Me, *s*). ^{13}C NMR: see Table 1. EIMS (probe) 70 eV, *m/z* (rel. int.): 328 $[M]^+$ (100), 313 (5), 310 (10), 297 (13), 295 (8), 267 (8), 251 (15), 224 (40), 223 (28), 219 (30), 181 (85), 150 (25), 104 (18), 103 (18), 77 (20).

Dihydrokampferol-3-O-α-rhamnoside (*engeletin*). ^{1}H NMR (300 MHz, acetone-d_6): δ11.91 (5-OH, *s*), 7.42 (H-2′, H-6′, *d*, *J* = 8.6 Hz), 6.93 (H-3′, H-5′, *d*, *J* = 8.6 Hz), 6.01, 5.98 (H-6, H-8, *d* × 2, *J* = 2 Hz), 5.22 (H-2, *d*, *J* = 11 Hz), 4.70 (H-3, *d*, *J* = 11 Hz), 4.24 (H-5″, *m*), 4.07 (H-1″, *br s*), 3.74 (H-3″, *dd*, *J* = 3.2 and 9.5 Hz), 3.61 (H-2″, *br s*), 3.41 (H-4″, *t*, *J* = 9.5 Hz), 1.18 (Me-6″, *d*, *J* = 6.3 Hz). ^{13}C NMR (75 MHz, acetone-d_6): δ195.8 (C-4), 167.9, 165.1, 163.6, (C-7, C-5, C-9), 158.9 (C-4′), 129.8 (C-2′, C-6′), 128.2 (C-1′), 116.3 (C-3′, C-5′), 102.3, 101.4 (C-1″, C-10), 97.3, 96.1 (C-6, C-8), 83.1 (C-2), 77.6 (C-3), 73.4, 72.1, 71.3, 69.9 (C-3″, C-5″, C-2″, C-4″), 18.0 (Me).

Dihydroquercetin 3-O-α-rhamnoside (*astilbin*). ^{1}H NMR (300 MHz, acetone-d_6): δ11.92 (5-OH, *s*), 7.09 (H-2′, *d*, *J* = 2 Hz), 6.90 (H-5′, H-6′, *m*), 6.0, 5.97 (H-8, H-6, *d* × 2, *J* = 2.2 Hz), 5.17 (H-2, *d*, *J* = 10.7 Hz), 4.68 (H-3, *d*, *J* = 10.7 Hz), 4.25 (H-5″, *m*), 4.12 (H-1″, *br s*), 3.70 (H-3″, *dd*, *J* = 3.2 and 9.5 Hz), 3.62 (H-2″, *br s*), 3.38 (H-4″; *t*, *J* = 9.5 Hz), 1.17 (Me-6″, *d*, *J* = 6.5 Hz). ^{13}C NMR (75 Hz, acetone-d_6): δ195.8 (C-4), 167.7, 165.1, 163.5 (C-7, C-5, C-9), 146.7, 145.9 (C-3′, C-4′), 128.8 (C-1′), 120.3 (C-2′), 116.0, 115.3 (C-5′, C-6′), 102.1, 101.2 (C-10, C-1″), 97.0, 95.9 (C-6, C-8), 83.2 (C-2), 77.3 (C-3), 73.3, 72.1, 71.2, 69.7 (C-3″, C-5″, C-2″, C-4″), 17.9 (Me).

Myricetin 3-O-α-rhamnoside (*myricitrin*). ^{1}H and ^{13}C NMR data identical to literature values.

Acknowledgement—This work was supported by a grant from the Commission of the European Communities.

REFERENCES

1. Penso, G. (1983) in *Index Plantarum Medicinalium Totius Mundi euromque synonymorum*. O.E.M.F., Milan.
2. Perez-Abelaez, E. (1978) in *Plàntas utiles de Colombia*. Litografia Arco, Bogotà.
3. Garcia Barriga, H. (1974) in *Flora medicinal de Colombia*. Imprenta Nacional, Bogotà.
4. Von Szczepanski, Ch., Zgorzelak, P. and Hoyer, G. A. (1972) *Arzneim-Forsch.* **22**, 1975.
5. Adesogan, E. K. (1974) *J. Chem. Soc. Chem. Commun.* 906.
6. De Sousa, J. R., Demuner, A. J., Pinheiro, J. A., Breitmaier, E. and Cassels, B. K. (1990) *Phytochemistry* **29**, 3653.