2, 2-DIMETHYLCROMENES FROM EUPATORIUM ASCHEMBORNIANUM*

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Key Word Index—Eupatorium aschembornianum; Compositae; Eupatorieae; chromenes; benzofuran derivative.

Abstract—Two new chromenes, eupatoriochromene B and C, and a new benzofuran derivative were isolated from the petrol-soluble fractions of the leaves and flowers of Eupatorium aschembornianum.

INTRODUCTION

Several chromenes have been isolated from plants of the genera Eupatorium and Ageratum. Two of them (demethoxy-ageratochromene and ageratochromene) possess insect antijuvenile hormone activity in several orders [1]. As part of our chemical systematic study of plants of the tribe Eupatorieae, we previously investigated Stevia monardae and isolated an isomer of ageratochromene (1) and demethoxy-ageratochromene (2) [2].

We now wish to report the isolation and structure elucidation of two new chromenes, which we have named eupatoriochromene B (1) and eupatoriochromene C (2), and a new benzofuran derivative (8a) from Eupatorium aschembornianum Schauer, besides the known demethoxy-ageratochromene (7-methoxy-2,2-dimethylchromene) (3) [3], 5-hydroxy-6-acetyl-8-methoxy-2,2-dimethylchromene (4) [4], 5,8-dimethoxy-6-acetyl-2,2-dimethylchromene (5) [5] and 2-isopropenyl 6-methoxy-2,3-dihydrobenzofuran (7) [6].

RESULTS AND DISCUSSION

Eupatoriochromene B (1) is a colourless oil, C_{13}H_{18}O_{3} (M' at m/z 220). Its IR spectrum demonstrated the presence of a gem-dimethyl group (1378 and 1362 cm\(^{-1}\)) and a benzene ring (1610 and 1580 cm\(^{-1}\)). Its \(^1\)H NMR spectrum was in accord with structure 1, showing sharp singlets at \(\delta 3.42\) (3H), 3.32 and 3.85 (2H) corresponding to the 2,2-dimethyl grouping of the chromene ring and two methoxy groups. The protons at C-3 and C-4 appeared as a symmetrical AB pattern of doublets at \(\delta 5.49\) (1H, d, J = 10 Hz) and 6.26 (1H, d, J = 10 Hz), which were absent in the \(^1\)H NMR spectrum of the dehydro derivative (9). The aromatic protons appeared as two doublets at \(\delta 6.66\) (1H, d, J = 8 Hz) and 6.39 (1H, d, J = 8 Hz) showing that the unoccupied positions on the ring were ortho to each other. Since the chemical shifts of H-3 and H-4 correspond to an unsubstituted chromene at C-5 [7], the methoxy groups must be at C-7 and C-8. This assumption was confirmed by ozonolysis of 1 to afford the dialdehyde 10 whose \(^1\)H NMR spectrum (Table 1) exhibited one doublet at \(\delta 7.6\), assigned to H-5, which shifted downfield due to the deshielding effect of the carbonyl group. Therefore H-5 must be ortho to the aromatic aldehyde.

Eupatoriochromene C (2) is an oil, C_{13}H_{18}O_{4} (M' at m/z 264), which gave bands in the IR spectrum at
3410, 1380 and 1370 cm⁻¹ corresponding to a hydroxyl group and a gem-dimethyl group. Its ¹H NMR spectrum displayed sharp singlets at δ 1.46 (6H), 3.72 (3H), 3.84 (3H) assigned to the gem-dimethyl group due to a 1-hydroxy-ethyl group. In the aromatic and two methoxyl groups. It also gave rise to signals in the proton region only a singlet was found at δ 6.85, suggesting that the aromatic ring was trisubstituted.

The third new compound isolated was the benzofuran derivative 8a. It was obtained as an oil, C₁₉H₁₄O₄ (M⁺ at m/z 252), which had IR absorptions at 3400, 1150 and 1050 cm⁻¹ indicating the presence of tertiary and primary hydroxyl groups. This was confirmed by acetylation with Ac₂O-pyridine to give the monoacetate 8b. The ¹H NMR spectrum (CDCl₃) was in accord with structure 8a. A one-proton singlet at δ 6.58 corresponded to H-3, as in methoxyeuparin [8]. Furthermore, the ¹H NMR spectrum exhibited signals at δ 7.34 (1H, d, J = 8 Hz), 6.80 (1H, dd, J = 8, 2 Hz) and 6.95 (d, J = 2 Hz) corresponding to H-4, H-5 and H-7, respectively. The resonance at δ 3.8 (2H, AB, J = 11 Hz) was assigned to the -CH₂-OH group and a singlet at δ 1.58 (3H) to the tertiary methyl group. Based on all these facts we propose 8a as the most likely structure for the benzofuran derivative.

**EXPERIMENTAL.**

Mps are uncorr. Known compounds were identified by comparison of the IR and ¹H NMR spectra. Elementary analyses were determined by Dr. F. Pascher, Germany.

_E. aschberbournianum_ Sch. was collected 5 km west of Topilejo D.F. on the México-Cuernavaca road in October 1978. A voucher specimen (Calderon-31) has been deposited at Herbario Nacional, UNAM (MEXU). Dried leaves and flowers (1.53 kg) of the plant were extracted first with petrol (1.35 kg) using petrol-C₆H₆ and C₆H₆-EtOAc. From the fractions eluted with petrol-C₆H₆ (1:2) (3 g), after purification by prep. TLC, afforded 171 mg 1, mp 81-82° (lit. 88° [4]) and 203 mg 2. Compound 1 was obtained as an oil; UV λmax nm (E): 222 (16260), 273 sh (6080), 280 sh (5990); IR νmax cm⁻¹: 1610, 1500, 1377, 1365; EIMS (probe) 70 eV, m/z (rel. int.): 222 [M⁺] (45), 215 [M-Me⁺] (100). (Found: C, 71.08; H, 7.55; O, 21.30. C₁₉H₁₄O₄ requires: C, 70.89; H, 7.62; O, 21.79%.)

_Eupatoriochromene C (6-[1-hydroxyethyl]-5, 8-dimethoxy-2, 2-dimethylchromene) (2)._ Chromatographic fractions eluted with petrol-C₆H₆ (1:2) (10 g) and with C₆H₆-EtOAc (3:1) (3 g), after purification by prep. TLC, afforded 123 mg 4, mp 81-82° (lit. 88° [4]) and 203 mg 2. Compound 1 was obtained as an oil; UV λmax nm (E): 222 (16260), 273 sh (6080), 280 sh (5990); IR νmax cm⁻¹: 1610, 1500, 1377, 1365; EIMS (probe) 70 eV, m/z (rel. int.): 222 [M⁺] (45), 215 [M-Me⁺] (100). (Found: C, 71.08; H, 7.55; O, 21.30. C₁₉H₁₄O₄ requires: C, 71.08; H, 7.55; O, 21.30%).

**Table 1.** ¹H NMR data of compounds 1, 2, 6, 8a, 8b, 9 and 10 (100 MHz, CDCl₃, TMS as int. standard)

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>6</th>
<th>8a</th>
<th>8b</th>
<th>9</th>
<th>10</th>
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<tbody>
<tr>
<td>H-3</td>
<td>5.49 d (10)*</td>
<td>5.64 d (10)</td>
<td>5.63 d (10)</td>
<td>6.58 s</td>
<td>6.57 s</td>
<td>1.78 t (7)</td>
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<td>H-4</td>
<td>6.26 d (10)</td>
<td>6.52 d (10)</td>
<td>6.53 d (10)</td>
<td>7.34 d (8)</td>
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<td>2.72 t (7)</td>
<td>10.26</td>
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<tr>
<td>H-5</td>
<td>6.66 d (8)</td>
<td>6.80 dd (8, 2)</td>
<td>6.82 dd (8, 2)</td>
<td>6.71 d (8)</td>
<td>7.6 d (8)</td>
<td>6.41 d (8)</td>
<td>6.76 d (8)</td>
</tr>
<tr>
<td>H-6</td>
<td>6.39 d (8)</td>
<td>6.85 s</td>
<td>6.76 s</td>
<td>6.95 d (2)</td>
<td>6.97 d (2)</td>
<td>1.37 s</td>
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<tr>
<td>H-7</td>
<td>5.14 q (6)</td>
<td>5.14 q (6)</td>
<td>5.14 q (6)</td>
<td>5.98 d (11)</td>
<td>4.48 d (12)</td>
<td>1.36 t (7)</td>
<td>2.19</td>
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<tr>
<td>H-12</td>
<td>1.47 d (6)</td>
<td>1.51 d (6)</td>
<td>1.58 s</td>
<td>1.61 s</td>
<td>1.61 s</td>
<td>1.51 s</td>
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<td>Gem-di Me</td>
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<td>1.46 s</td>
<td>1.37 s</td>
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<tr>
<td>Ac</td>
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*Values in parentheses are coupling constants in Hz.*
Acetylation of 2. Acetylation of 2 (50 mg) with Ac₂O-pyridine gave after prep. TLC the oily monoacetate 6. UV λ max nm (ε): 227 (31180), 274 (7010), 283 sh (5930), 320 (1720); IR ν max cm⁻¹: 1735, 1650, 1600, 1500; EIMS (probe) 70 eV, m/z (rel. int.): 306 [M]+ (13), 291 [M – Me]+ (40), 43 (100).

6 - Methoxy - 2 - [1 - acetoxy - 2 - hydroxy - 2 - propyl]benzofuran (8b). A 30 mg sample of 8a acetylated with Ac₂O-pyridine as usual, gave the acetate 8b (28 mg). Oil, UV λ max nm (ε): 218 (7410), 246 (5950), 286 (3570); IR ν max cm⁻¹: 3370, 1730, 1640, 1500, 1150; EIMS (probe) 70 eV m/z (rel. int.): 264 [M]+ (96), 191 [M – 73]+ (92), 43 (100).

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REFERENCES