Herpetol, a New Dimeric Lignoid. from *Herpetospermum caudigerum* Wall

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Herpetospermum caudigerum, Cucurbitaceae, Lignoids, Herpetol, $\Delta^{7,7'(E)}$4,9,9′-Trihydroxy-5,5′-dimethoxy-7.0.4′,8.3′-lignoid

The title compound, a new dimer of coniferyl alcohol is the second benzofuran derivative isolated from *Herpetospermum caudigerum* seeds. Its structure has been elucidated by spectroscopic means as $\Delta^{7,7'(E)}$4,9,9′-trihydroxy-5,5′-dimethoxy-7.0.4′,8.3′-lignoid.

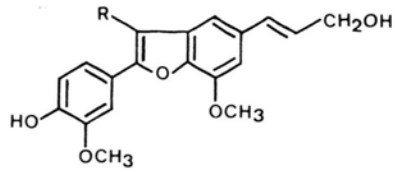
Introduction

Herpetospermum caudigerum Wall. seeds (Cucurbitaceae) accumulate lignoids of different polymerisation stages. Up to day, one dimer [1], three trimers [2–4] and one tetramer [3] have been identified. All those compounds, presently specific to *Herpetospermum*, are coniferyl alcohol derivatives generated by 8.3′ and 8.8′ oxidative coupling leading to benzofuran, dihydrobenzofuran, tetrahydrofuran, dioxabicyclo[3.3.0]octane and diphenylpropanone skeletons. Keeping on our investigation, we have isolated from the methanolic seeds extract a second dimer with a benzofuran ring, a new minor compound named herpetol (**2**).

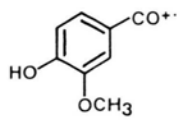
Results and Discussion

The mass spectrum of the natural product **2** shows the molecular ion at *m/z* 356 corresponding to $C_{20}H_{20}O_6$. This molecular formula is deduced from the exact mass determination of the TMSi-derivative at *m/z* 572 indicating furthermore three free –OH groups.

In addition to three sharp singlets corresponding to one $-CH_2OH$ (δ 4.78 ppm) and two $-OCH_3$ (δ 4.02 and 3.94 ppm), the ^{1}H-NMR spectrum (250 MHz; MeOH-D_4) exhibites five aromatic and four aliphatic protons. A 1,2,5-trisubstituted aromatic ring is bearing three protons located at δ 7.45 ppm – d – J 2 Hz, δ 7.33 ppm – dd – J 8.5 and 2 Hz, δ 6.92 ppm – d – J 8.5 Hz. The next two *meta* coupled ones at δ 7.30 ppm – broad d – J 2 Hz and δ 6.97 ppm – broad d – J 2 Hz, are belonging to a 1,2,3,5-tetrasubstituted ring. The four aliphatic protons occur in the form of an ABX_2 system corresponding to a *trans*-propenol chain at δ 6.68 ppm – broad d – J 16 Hz, δ 6.36 ppm – dt – J 16 and 6 Hz, δ 4.24 ppm – dd – J 6 and 1 Hz, responsible of the IR absorption at 970 cm^{-1}.



1 R = –CHO
2 R = $-CH_2OH$



m/z 151

Each of the two aromatic rings is linked to a double bond. This is jointly indicated by deshielding of the two groups of *meta* related H and the broadened signals relative to those attached to the tetrasubstituted ring which must therefore carry the *trans*-propenol chain. According to the molecular formula, the next double bond is constituted by the remaining two C-atoms obligatory quaternary. Connecting the aromatic rings, this insaturation has not to be *para*-conjugated to the C_3 chain, on the basis of the UV band at 305 nm for the natural product **2**. This is also supported by the bathochromic shift of 27 nm in alkaline medium, due to a phenolic hydroxyl on the trisubstituted ring, in the *para* position to the tetrasubstituted double bond.

Thus, there are five positions for the three substituents previously definited (one $-CH_2OH$ and two $-OCH_3$). The missing O-atom has to be included in a cycle which agrees with a 2-phenyl-

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benzofuran skeleton. The methylene hydroxy takes place on the furanic insaturation consequently to the absence of any coupling between this group and the aromatic H. Each of the two $-OCH_3$ has to be attached to an aromatic ring as strongly suggested by the fragment ion at *m/z* 151 which jointly confirms that distribution and the substitution in position 2 of the benzofuran. Herpetol (**2**) is considered 5-*trans*-(2-propen-1-ol)-7-methoxy-3-methylene hydroxy-2-(4-hydroxy-3-methoxy)phenylbenzofuran or $\Delta^{7,7'(E)}$4,9,9′-trihydroxy-5,5′-dimethoxy-7.0.4′,8.3′-lignoid, according to nomenclature recently proposed for this kind of compounds [5]. This analysis agrees with data relative to herpetal (**1**) which magnetic characteristics are similar to those reported here for herpetol (**2**).

In addition to *Herpetospermum caudigerum* Wall., phytochemical investigations of the various higher plants revealed the presence of dimeric lignoids with the benzofuran ring in three families: Eupomatiaceae [6–8], Krameriaceae [9] and Myristicaceae [10, 11] producing compounds generated by the biosynthetic coupling of propenylphenols-plus propenylphenols or propenylphenols-plus allylphenols.

Experimental

The general methods are the same as reported in ref. [1]. Extraction of herpetol (**2**) is effected as previously described for herpetal (**1**). Purification was carried out first on a silica column eluted with benzene-MeOH (95:5) and then through a Sephadex LH 20 coulmn eluted with AcOEt-MeOH (8:2).

Herpetol (**2**): UV λ_{max}^{MeOH} nm: 210, 230 sh., 270 and 305 sh.; $\lambda_{max}^{MeOH+NaOMe}$ nm: 210, 240, 285 and 332. IR ν_{max}^{KBr} cm^{-1}: 3420, 1620, 1610, 1515, 1480, 1430, 1410, 1375, 1320, 1280, 1265, 1220, 1145, 1115, 1035, 970, 880, 820 and 710. SM (70 eV) *m/z* (%): 356 ($M^{+\cdot}$; 100), 338 (18), 326 (17), 324 (18), 313 (30), 312 (24), 298 (13), 297 (11), 257 (78), 256 (52), 239 (50), 229 (36), 216 (44), 212 (36), 207 (47), 185 (56), 183 (28), 181 (31), 171 (52), 157 (39), 152 (34), 151 (46), 145 (39), 143 (54), 135 (67), 129 (100) and 123 (67). ^{1}H-NMR (see text).

TMSi-derivative: SM (70 eV) *m/z* (%): 572 ($M^{+\cdot}$; 100; 572.2447; $C_{29}H_{44}O_6Si_3$ = 572.2446), 500 (70), 482 (13), 442 (6), 428 (13), 411 (13), 410 (14), 393 (7), 381 (9), 379 (8), 362 (5), 320 (5), 309 (5), 289 (7), 277 (6), 223 (8), 204 (5), 151 (8), 147 (11) and 129 (7).

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