Pergamon

0031-9422(95)00051-8

Phytochemistry, Vol. 39, No. 5, pp. 1247–1248, 1995

0031-9422/95 $9.50 + 0.00

2,4-BIS(4-HYDROXYBENZYL) PHENOL FROM *GASTRODIA ELATA*

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(*Received* 15 *November* 1994)

Key Word Index—*Gastrodia elata*; Orchidaceae; tubers; 2,4-*bis*(4-hydroxybenzyl)-phenol.

Abstract—A new benzyl derivative, 2,5-*bis*(4-hydroxybenzyl) phenol, together with three known compounds, was isolated from tubers of *Gastrodia elata*. They were identified from spectroscopic data.

INTRODUCTION

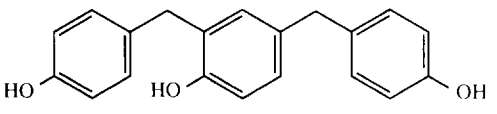
The steamed and dried tubers of *Gastrodia elata*, which are called "Tianma" in China, have been prescribed for rheumatism, paralysis and other neuralgic disease [1]. With regard to the constituents of these tubers, several hydroxybenzyl derivatives have been reported [2, 3]. In the course of our search for compounds having anti-epileptic activity from natural sources, we have re-examined the constituents of *G. elata* and have isolated a new phenolic compound, 2,4-*bis*(4-hydroxybenzyl) phenol, together with three known compounds.

RESULTS AND DISCUSSION

A methanolic extract of commercial tubers was partitioned between ethylacetate and water and the ethylacetate phase subjected to chromatography on silica gel to give four compounds **1**–**4**. Compounds **2**–**4** were identified as 4-hydroxybenzyl alcohol, 4,4′-dihydroxy diphenylmethane and *bis*(4-hydroxybenzyl)ether, respectively, by comparison of their physical and spectral data with those described in the literature [2].

Compound **1** exhibited a $[M]^+$ at *m/z* 306 (EI mass spectrum), together with the characteristic fragment ion peak of a monohydroxy benzyl group at *m/z* 107 [2]. The ^{1}H NMR spectrum showed signals ascribable to aromatic protons (two AA′BB′ and one ABC types), in addition to those due to two benzylic methylenes (δ3.68 and 3.78) and three phenolic hydroxyl groups (δ8.05). These observations revealed that **1** is a new assymmetric *bis*(hydroxybenzyl) phenolic compound. The assignment of all proton and carbon signals arising from **1** was performed by COSY, NOESY and HMBC spectroscopy. In the HMBC spectrum, the methylene carbon (C-7′, δ34.3) gave long-range correlations with three proton signals (H-3, H-2′ and H-6′), while the other (C-7″, *d* 39.7) showed cross-peaks with four proton signals (H-3, H-5, H-2″ and H-6″). Furthermore, there were pronounced correlation peaks between H-3 and two carbon signals, C-1 (δ152.7) and C-5 (δ126.8) [Fig. 1]. Other significant correlations demonstrated that the three hydroxyl groups are located at C-1, C-4′ and C-4″; the structure of **1** was thus elucidated.

The presence of *bis*(4-hydroxybenzyl) derivatives may be of chemotaxonomic interest, since many bibenzyl analogues appear in tubers of another orchid species, *Bletilla striata* [4, 5].



1

EXPERIMENTAL

^{1}H NMR: 600 MHz, ^{13}C NMR: 150 MHz, CD_3OD, TMS as int. standard. The NOESY spectrum was obtained using a mixing time of 500 msec and the HMBC spectrum was recorded with 64 scans ($^{2,3}J_{CH}$ = 7 Hz).

Isolation. Ground powder of dried tubers of *G. elata* Blume. (2 kg) was percolated with MeOH (8 l) at room temp. After removal of solvent, the extract was partitioned between EtOAc and H_2O. The EtOAc layer was evapd to give a brown syrup (11.2 g). This was subjected to CC on Bio Beads S-X2 (benzene–EtOAc, 1:1) to give 3 frs, 1 (3.9 g), 2 (5.8 g) and 3 (1.1 g). Fr. 2 was subjected to

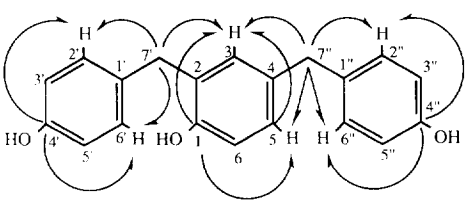


Fig. 1. HMBC correlations of **1**.

CC on silica gel ($CHCl_3$–MeOH, 9:1) to give **1** (18 mg), together with 4-hydroxybenzyl alcohol (1 g), 4,4′-dihydroxy diphenylmethane (100 mg) and *bis*(4-hydroxybenzyl)ether (32 mg).

2,4-bis(4-*Hydroxybenzl*)-*phenol* (**1**). Needles, mp 153–155°. IR ν_{max}^{KBr} cm^{-1}: 3300, 1610, 1600, 1520; EI-MS *m/z* (rel. int.): 306 $[M]^+$ (100), 199 $[M - CH_2C_6H_4OH]^+$ (69), 107 $[HOC_6H_4CH_2]^+$ (61). ^1H NMR (CD_3OD): δ6.99 (2H, *d*, J = 8.5 Hz, H-2′ and H-6′), 6.92 (2H, *d*, J = 8.5 Hz, H-2″ and H-6″), 6.79 (1H, *d*, J = 2.2 Hz, H-3), 6.77 (1H, *d*, J = 8.0, 2.0 Hz, H-5), 6.67 (1H, *d*, J = 8.0 Hz, H-6), 6.67 (2H, *d*, J = 8.5 Hz, H-3″ and H-5″), 6.65 (2H, *d*, J = 8.5 Hz, H-3′ and H-5′), 3.78 (2H, *s*, H_2-7′), 3.68 (2H, *s*, H_2-7″). ^{13}C NMR (CD_3OD): δ154.9 (C-3′), 154.7 (C-4′), 152.7 (C-1), 132.9 (C-4), 132.7 (C-1″), 132.2 (C-2), 130.4 (C-3), 129.3 (C-2′ and C-6′), 129.2 (C-2″ and C-6″), 128.0 (C-1′), 126.8 (C-5), 114.6 (C-3′ and C-5′), 114.5 (C-6, C-3″ and C-5″), 39.7 (C-7″), 34.3 (C-7′).

Acknowledgement—We are grateful to Mr Du Xiaoming of the Institute of Medical and Pharmaceutical Sciences Dalian, China, for identification of materials.

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