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A BENZOXEPINE DERIVATIVE FROM *DELPHINIUM FORMOSUM*

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Key Word Index—*Delphinium formosum*; Ranunculaceae; benzoxepine derivative; oxformasine.

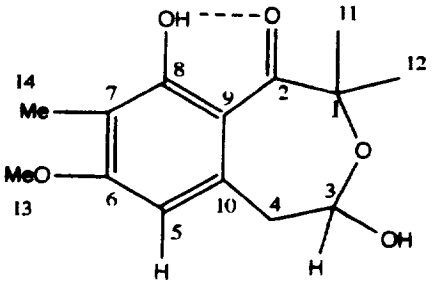
Abstract—From an ethanolic extract of *Delphinium formosum*, in addition to a group of C_{19} alkaloids, a new benzoxepine derivative was isolated, whose structure was elucidated by spectral data, including 1D and 2D NMR techniques, as 1,1′,7-trimethyl-2-oxo-3,8-dihydroxy-6-methoxy-benztetrahydrooxepine.

INTRODUCTION

In a previous study on *Delphinium formosum* Boiss. et Huet., we isolated one new and six known norditerpenoid alkaloids [1]. From the same plant extract, we have now obtained a new benzoxepine derivative oxformasine (**1**). The structure of the new compound was elucidated from spectral analysis, including 1D and 2D NMR techniques.

RESULTS AND DISCUSSION

The HREI-mass spectrum of oxformasine (**1**) indicated the molecular formula $C_{14}H_{18}O_5$ (*m/z* 266.1148; calcd 266.1154). ^{1}H NMR and ^{13}C NMR spectra provided the most information about the structure of **1**. Signals at δ 13.82 (1H, *s*) (hydrogen bond between the hydroxyl at C-8 and an oxo group at C-2), 6.09 (1H, *s*, H-5), 4.61 (1H, *t*, $J = 9$ Hz, H-3), 3.93 (3H, *s*, C-6 OMe), 3.20 (2H, *d*, $J = 9$ Hz, CH_2-4), 2.58 (3H, *s*, C-7 Me), 1.34 and 1.23 (each, 3H, *s*) C-1 methyl groups, were observed. ^{13}C NMR (DEPT) experiment indicated the presence of four methyl quartets, one methylene triplet, two methine doublets and seven quaternary C singlets for 14C atoms. The ^{1}H–^{1}H COSY spectrum showed relationships between the C-3 and C-4 protons, as well as between the two methyl groups at C-1. A ^{1}H–^{13}C correlation spectrum (HETCOR) showed the corresponding protons and carbons (see Experimental). A HMBC experiment made the unambiguous assignment of carbons and protons possible, long-range correlations being observed between H-12 at δ 1.34 and C-2 (δ 202.8), as well as between H-11 (δ 1.23) and C-2, between H-5 (δ 6.09) and C-4 (δ 28.9) and C-14 (δ 32.3) (three and four bonds away, respectively) and between H-3 (δ 4.61) and C-4 (two bonds away); thus, the placements of the functional groups were decided. The two methyl groups (Me-11 and Me-12) should be situated at C-1 (δ 71.60). The hydroxyl group observed at δ 90.64, should be at C-3 between the two oxygen functions. The structure of compound **1** was therefore established as 1,1′,7-trimethyl-2-oxo-3,8-dihydroxy-6-methoxy-benztetrahydrooxepine. The UV and IR spectral data are in agreement with the suggested structure. This is the first time that a benzoxepine derivative has been isolated from a *Delphinium* species.



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EXPERIMENTAL

General. ^{1}H and ^{13}C NMR were recorded using a Bruker AM 400, 2D expts on a 500 MHz Bruker ORX. Silica gel (Merck) prep. plates were used for final purification.

Plant material. The plant was collected from the Santa highlands, 1500 m altitude in the eastern Black sea area. A voucher specimen is deposited in the Herbarium of Faculty of Pharmacy, University of Marmara (Istanbul) under MARE 4157.

Extraction and isolation. Dried and powdered plant material was extracted with EtOH by percolation and the extract evapd under vacuum at 35°. The residue was

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treated with 0.5 N H_2SO_4 and extracted with $CHCl_3$. The acidic aq. part was basified with NaOH to pH 10. The soln was then extracted with $CHCl_3$, evapd to dryness and 1.5 g of crude alkaloidal mixt. obtained. This was chromatographed over basic Al_2O_3. When the column was eluted with petrol–EtOAc (4:1), the first compound obtained was benzoxepine (15 mg); later frs contained the alkaloids previously isolated [1].

Oxformasine (**1**). UV λ_{max}^{MeOH} nm (log ε): 290 (3.8), 221 (3.5). IR $\nu_{max}^{CHCl_3}$ 3: 3450, 2980, 2880, 1690, 1623, 1595, 1470, 1420, 1370, 1310, 1280, 1250, 1180, 1140, 1100, 1070, 1000. ^{1}H NMR ($CDCl_3$): δ 1.23 (3H, *s*), 1.34 (3H, *s*) (Me-11 and Me-12), 2.58 (3H, Me-14), 3.20 (2H, *d*, $J = 9$ Hz, H_2-4), 3.93 (3H, *s*, OMe at C-6), 6.09 (1H, *s*, H-5), 13.82 (1H, *s*, hydrogen bond). ^{13}C NMR ($CDCl_3$): δ C-1 71.6, C-2 202.8, C-3 90.6, C-4 28.9, C-5 93.8, C-6 158.8, C-7 128.3, C-8 167.0, C-9 108.3*, C-10 107.1*, C-11 24.4, C-12 26.1, C-13 59.1, C-14 32.3 (* interchangeable). HREI-MS *m/z* (rel. int.): 266.1148 $[M]^+$ (100), 251 $[M\text{-}Me]^+$ (18), 233 $[M - Me - H_2O]^+$ (36), 208 (25), 194 (42), 166 (10), 150 (7), 69 (5), 59 (15).

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