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ROSEADIONE, A DITERPENE KETONE FROM *HYPOESTES ROSEA*

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Key Word Index—*Hypoestes rosea*; Acanthaceae; X-ray analysis; new diterpene; roseadione.

Abstract—A tricyclic diterpene ketone, roseadione, has been isolated from *Hypoestes rosea* and its structure established as a dicyclopenta[*a*, *d*]cyclooctane derivative.

INTRODUCTION

Hypoestes rosea is a tropical shrub in the family Acanthaceae [1], several members of which are used in folk medicine in West Africa [1]. A previous phytochemical investigation [2] of the hexane extract of the leaves of *H. rosea* resulted in the isolation of lupeol, roseanolone (**1**) and three unidentified compounds. We now present the structure of roseadione (**2**) which was isolated from the aerial parts of *H. rosea*.

RESULTS AND DISCUSSION

The hexane extract of the leaves and stems of *H. rosea*, upon column chromatography, gave five colourless crystalline compounds, one of which was the known roseanolone (**1**) [1]. One of the remaining four compounds was assigned structure **2** and called roseadione. Roseadione, MW 318, exhibited a composition of $C_{20}H_{30}O_3$ by high resolution mass spectrometry and the mass spectrum also showed a prominent loss of water. It exhibited no appreciable UV absorption, thus indicating the absence of any conjugated chromophore. The IR spectrum (λ_{max}^{KBr} cm^{-1}) indicated the presence of a hydroxyl (3428), a five-membered ring ketone (1742) and another carbonyl group (1664). The low frequency carbonyl was thought to be hydrogen-bonded to the hydroxyl group since the UV spectrum had indicated lack of conjugation in the compound which could otherwise have explained the low frequency absorption. The hydroxyl group in roseadione was thought to be tertiary because it could not be acetylated with acetic anhydride and pyridine. The ^{1}H NMR spectrum of **2** indicated the presence of five methyl groups, three of which were secondary, one tertiary, while the last was attached to an olefinic carbon, and also showed the presence of a hydroxyl group whose proton was observed as a D_2O-exchangeable singlet at δ 4.05.

Additional structural information was obtained from the ^{13}C NMR spectrum of **2** which confirmed the presence of five methyl groups (*q* at δ 19.3, 20.6, 23.0, 24.3 and 24.4), a tertiary hydroxyl-bearing carbon (*s* at 82.1), a tetra-substituted double bond (*s* at 130.3 and 139.1) and two carbonyl groups (*s* at 215.9 and 216.3). In addition, there were absorptions due to five methylene groups (*t* at 25.5, 26.3, 37.0, 38.0 and 43.5), four tertiary carbons (*d* at 29.1, 49.2, 51.0 and 54.6) and one quaternary carbon (*s* at 55.3).

The spectral data alone did not allow unambiguous determination of the structure of roseadione, and so an X-ray crystallographic analysis was undertaken. A stereoscopic drawing of roseadione is shown in Fig. 1; the bond distances and angles are given separately.* The distance between the carbonyl oxygen O-3 and the hydroxyl oxygen O-2 was 2.615 Å and this confirmed the presence of an intramolecular hydrogen bond.

Roseadione thus has the uncommon dicyclopenta[*a*,*d*]cyclooctane skeleton; it and roseanolone represent the only two compounds isolated from higher plants having this skeleton. The other few related terpenes are the fusicoccins [3], ophiobolins [4], cotylenins [5] and ceroplastanes [6]. The fusicocins, ophiobolins and cotylenins were isolated from fungi, while the ceroplastanes were isolated from wax secreted by insects.

EXPERIMENTAL

The mp was determined on a Kofler hot-stage apparatus and is uncorr. Optical rotation was recorded on Perkin–Elmer 141

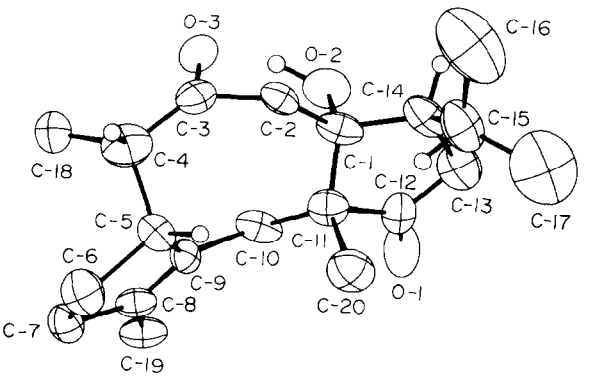

Fig. 1.

*They are deposited at the Cambridge Crystallographic Centre.

polarimeter. IR was determined on a Perkin–Elmer model 137 spectrophotometer. ^{1}H NMR and ^{13}C NMR were determined in $CDCl_3$ using TMS as an internal standard on a Bruker (25.15 MHz) W.M. 250 spectrometer. Chemical shifts are expressed as ppm (δ) and coupling constants (J) in Hz (s = singlet, d = doublet, t = triplet, q = quartet). The MS were recorded on a V.G. Micromass 7070H mass spectrometer using a direct inlet system; chemical ionization with isobutane as standard; m/z values are given with relative intensities in parentheses.

Isolation of roseadione. Hypoestes rosea was collected near Akure, Nigeria. The identity of the plant was confirmed at the Forest Research Institute of Nigeria, Ibadan where a voucher specimen was deposited. The leaves and twigs of the plant were macerated and extracted by percolation with hot hexane. Removal of solvent gave a gum (53.6 g) which was chromatographed (column) on silica gel (MPLC) and eluted (batch, 150 ml) with increasing concns of Et_2O in hexane. Elution with 20% Et_2O in hexane gave three crystalline compounds, the first of which was roseadione (**2**) (360 mg). Roseadione crystallized from EtOAc–hexane as small needles. Mp 156–157°; $[\alpha]_D^{20}$ + 122° (c 0.12 in $CHCl_3$); λ_{max}^{KBr} cm^{-1}: 3428 (OH), 1742 (C=O), 1664 (C=O); δ 0.96 (d, J = 7 Hz, 6H), 1.00 (s, 3H), 1.09 (d, J = 6 Hz, 3H), 1.69 (s, 3H), 3.66 (d, J = 12 Hz, 2H), 4.05 (s, 1H, D_2O exchangeable); m/z 319.2268, $[M+17]^+$ ($C_{20}H_{31}O_3$), 318.2198 $[M]^+$ (10, $C_{20}H_{30}O_3$), 301 $[M+1-H_2O]^+$ (100, $C_{20}H_{29}O_2$), 300 $[M-H_2O]^+$ (26, $C_{20}H_{28}O_2$), 282 (25), 258 (11), 247 (17), 245 (12), 209 (13), 187 (12), 149 (50), 121 (52) 110 (32), 93 (39) and 79 (26).

X-Ray crystallography. The crystallographic data for **2** were collected on an Enraf–Nonius CAD4 diffractometer. The space group was found to be $P2_12_12_1$ with cell constants a = 5.971 (2) Å, b = 13.979 (4) Å, and c = 21.290 (9) Å and four molecules in the unit cell. The intensities of 1839 reflections were measured using graphite monochromated Mo–K_α radiation of which 1075 unique reflections with $I > 2.3\sigma$ (I) were used in the structure determination. The structure was solved by the use of MULTAN 79 programme package and refined by least-squares methods to R = 0.073. (All non-hydrogen atoms were supplied in pre-calculated positions with isotropic Bs of 6.0 Å and were not refined.)

Fig. 1 is an ORTEP drawing of the molecule; the bond distances and angles are listed elsewhere. Listings of positional and thermal parameters, atomic coordinates, observed and calculated structure factors are submitted as supplementary material to be deposited in the Cambridge University Crystallographic Centre.

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