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FLAVESCIN: A NEW 1-KETOPOLYHYDROXYPREGNENE FROM *MARSDENIA FLAVESCENS*

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Key Word Index—*Marsdenia flavescens*; Asclepiadaceae; flavescin; steroids; polyhydroxypregnenone.

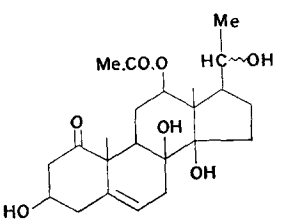
Abstract—A new polyhydroxy-1-ketosteroid, flavescin, was isolated from *Marsdenia flavescens* A. Cunn. Its structure was elucidated as 12-*O*-acetyl-3β,8β,12β,14β-20-pentahydroxy-Δ^5-pregnene-1-one.

INTRODUCTION

Marsdenia, one of over 300 genera in the Asclepiadaceae,[1] has a cosmopolitan distribution. All Australian species are endemic and the *Flora Australiensis*[2] lists 15 species. Two of these, *M. rostrata* and *M. flavescens*, are native to the Illawarra region of New South Wales. The constituents of *M. rostrata*[3,4] were reported earlier. This paper describes the isolation and structure elucidation of flavescin from *M. flavescens* A. Cunn.

RESULTS AND DISCUSSION

Marsdenia flavescens was collected by the authors from the Illawarra escarpment near Wollongong. Although this species grows among numerous other vines, it is easy to distinguish it from the others.[5] Because of the known alkaloidal content of *M. rostrata* we have searched for alkaloids in *M. flavescens* but found none. However, we isolated a new steroid, flavescin (I).



(I)

The molecular formula of flavescin was established as $C_{23}H_{34}O_7$. The presence of four hydroxyl groups and an acetate ester group in the molecule was established by IR and NMR spectroscopic evidence and confirmed by the ready loss of water and acetic acid

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[3] SUMMONS, R. E., ELLIS, J. and GELLERT, E. (1972) *Phytochemistry* **11**, 3335.
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molecules in the MS, viz. *m/e* 404 = M^+-H_2O (422 → 404, *m** 386·8), 386 = M^+-2H_2O (404 → 386, *m** 368·8), 344 = M^+-H_2O–AcOH (404 → 344, *m** 292·9), 326 = M^+-2H_2O–AcOH (344 → 326, *m** 308·9), 308 = M^+-3H_2O–AcOH. The presence of an unconjugated carbonyl group,[6] a Δ^5 steroidal double bond,[7] a C-21 methyl group, two angular methyl groups[8,9]and an acetate grouping was shown by UV, IR, and NMR spectroscopy and by losses of methyl groups in the mass spectrum. Proton multiplets in the NMR spectrum represent 20-H at δ 4·12, 12α-H at δ 5·08 (about δ 4·9 if hydroxyl at C-12 is acylated, and δ 4·4 if not acylated), 3α-H at δ 3·90 and 17α-H at δ 3·28.[10]

The mass spectral break-down pattern[9,11] is consistent with retro-Diels–Alder type fragmentation of ring B producing *m/e* 153, $C_9H_{13}O_2$ (from ring A) and *m/e* 210, $C_{12}H_{18}O_3$ (from rings C and D) followed by further readily recognizable fragmentations. The major fragmentation however occurs, as common to steroid 8,14 diols, at ring C producing *m/e* 190, $C_{12}H_{14}O_2$ (from rings A and B) and *m/e* 155, $C_9H_{15}O_2$ (from ring D), followed by the expected further fragmentation pattern. This establishes the 3,8,12,14,20-pentahydroxy substitution in the molecule. The fact that the hydroxy group on C-12 is the acetylated one is further confirmed by the small peak at *m/e* 85 (1·8%), $C_4H_5O_2$.

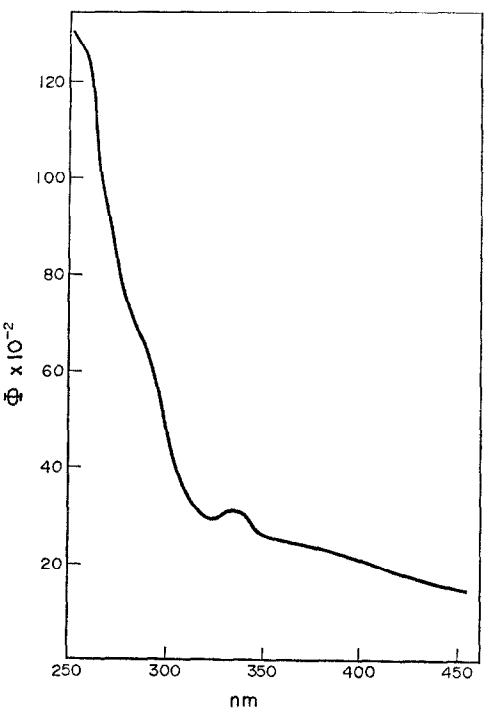

FIG. 1. ORD CURVE OF FLAVESCIN.
Measured in a1 cm cell at 23°, *c*, 0·0548, in MeOH.

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Spectroscopic evidence, together with the lack of ketol reactions, suggests that the keto group is located on C-1. This was confirmed by the ORD spectrum (Fig. 1), which is characteristic of 1-keto-steroids.[12,13] Consequently flavescin, the first naturally occurring 1-keto-polyhydroxypregnane derivative, is represented by structure I.

EXPERIMENTAL

M.ps were determined on a Reichert micro apparatus and are uncorrected. Optical rotation was determined on an ETL-NPL automatic polarimeter; the ORD curve was recorded on a JASCO ORD/UV-5 instrument; the NMR spectra were recorded on a JEOL 100 MHz spectrometer; the MS were recorded on a Varian Mat 711 mass spectrometer. R_fs refer to chromatograms on Kieselgel G plates developed in $CHCl_3$-MeOH (9:1); spots were visualized by spraying with H_2SO_4:Ac_2O (1:1) and warming the plates to 100°. Dried, milled plant material (1·9 kg) of *M. flavescens*, A. Cunn. from the Illawarra escarpment* was extracted by exhaustive percolation with MeOH at room temp. The extract was concentrated to a small vol., diluted with aq. H_2SO_4, and allowed to stand for 2 days. The filtered aqueous acidic solution was first washed with Et_2O, then basified with conc. NH_3, and extracted exhaustively with $CHCl_3$. The $CHCl_3$ extract, after establishing the absence of alkaloidal material in it, was evaporated to dryness yielding 9·9 g (0·5%) of an oily residue. Column chromatography of this residue on alumina (Merck, grade II/III) yielded several fractions consisting of a complex mixture of compounds with high R_fs (which were not further investigated) followed by fractions containing crystalline material. Rechromatography on alumina of the crystalline material yielded 70 mg *flavescin* as colourless prisms, R_f 0·28.

Favescin, m.p. 252–254° (from acetone), Found: C, 65·6; H, 8·2; O, 26·3%. $C_{23}H_{34}O_7$ requires: C, 65·4; H, 8·1; O, 26·5%. $(\alpha)_D^{25}$ +121° (*c* 0·12, MeOH), λ_{max} (EtOH) 207, 221 and 297 nm, log ϵ 3·20, 3·26 and 2·20 resp. ν_{max} (KBr) 3440, 3360, 3270, 2960, 1740, 1715, 1672 and 870 cm^{-1}. *m/e* 422 (1·7%) M^+, 404 (10) M^+-H_2O, 386 (1·4) M^+-2H_2O, 344 (12) M^+-H_2O–AcOH, 326 (6·3) M^+-2H_2O–AcOH, 308 (3·0) M^+-3H_2O–AcOH, 301 (1·7) M^+-2H_2O–85, 283 (6·0) M^+-3H_2O–85, 265 (2·4) M^+-4H_2O–85, 210 (14) $C_{12}H_{18}O_3$, 203 (17) $C_{13}H_{15}O_2$, 190 (71) $C_{12}H_{14}O_2$, 177 (13) $C_{11}H_{13}O_2$, 159 (12) $C_{11}H_{11}O$, 155 (36) $C_9H_{15}O_2$, 153 (17) $C_9H_{13}O_2$, 147 (20) $C_{10}H_{11}O$, 137 (13) $C_9H_{13}O$, 135 (11) $C_9H_{11}O$, 123 (13) $C_8H_{11}O$, 121 (13) C_8H_9O, 111 (22) $C_7H_{11}O$, 107 (21) C_8H_{11}, 105 (16) C_8H_9, 97 (38) C_6H_9O, 85 (1·8) $C_4H_5O_2$, 43 (100) C_2H_3O base peak. Its *phenylhydrazone* was obtained by heating flavescin with $PhNHNH_2$.HCl and NaOAc in the usual manner. The molecular ion in the MS was shown to be *m/e* 512, as calculated.

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* The botanical identity of the material was confirmed by Dr. J. S. Beard, Director and Chief Botanist, National Herbarium, Sydney, N.S.W., Australia.

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