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A NEW STEROL FROM VERNONIA anthelmintica SEED OIL

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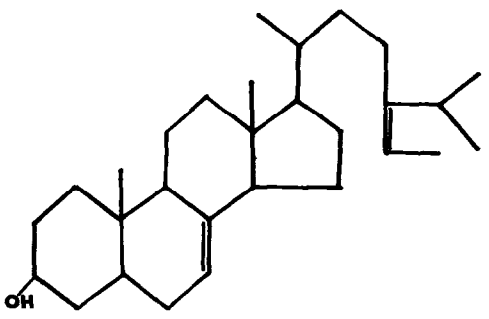
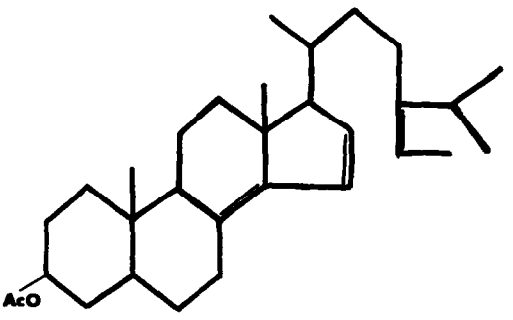
A recent publication has dealt with the isolation and stereochemistry of 7, 24(28)-stigmastadien-3β-ol (Δ 7-avenasterol) (I) from Vernonia anthelmintica seed oil.(1) This compound was described as the main sterol in the oil, constituting about 70% of the sterol mixture. We have carried out an extensive analysis of the unsaponifiable fraction of Vernonia oils grown in this country(2) and have found that the main component in the sterol fraction is a previously unknown sterol shown below as the acetate (II).



I



II

(II) was separated from the other sterol acetates by chromatography on acid-washed Florisil impregnated with $AgNO_3$. After recrystallization, its purity exceeded 95% by GLC. M.p. 99-100°; $[\alpha]_D^{28} = 13 \pm 3°$ (c 1.0 in $CHCl_3$); UV in methanol, min 215 mμ; max 249 mμ, ε max = 18,200. High resolution mass spectrometry (C.E.C. Model 21-110C) established the empirical formula $C_{29}H_{46}O$ for the free sterol of (II). NMR spectrum (obtained with a Varian A-60): CH_3-19, S, δ 0.80; CH_3-18, S, δ 1.02; CH_3-21, CH_3-26 and CH_3-27 fused doublets, δ 0.98; CH_3-29, d, δ 1.59 (J = 7H_z); CH_3CO, S, δ 2.01; H-25, septet, δ 2.82 (J = 7H_z); H-3 (axial) broad complex, δ 4.66; and H-28, quartet, δ 5.15. Two broad overlapping singlets at δ 2.12 and δ 2.26 are most likely due to allylic hydrogens in the C_7, C_9 and C_{17} position. The δ 2.12 peak is greatly diminished by hydrogenation. Another broad singlet at δ 5.34 is probably due to C_{15} and C_{16} olefinic protons. High resolution MS analysis of the free sterol of (II) gave the following major ions: 410 (M, 100%); 395 (M-CH_3, 24%); 367 (M-C_3H_7, 19%); 314 [M-C_7H_{13}-H), 9%]; 297 [M-(C_8H_{15}+2H), 31%]; 285 [M-(CH_3+C_8H_{15}-H), 11%]; 271 (M-side chain, 20%); 255 (16%), large ion at (M-$C_{11}H_{23}$) and small ion at [M-(side chain -2H+H_2O)].

Hydrogenation of (II) with Adam's catalyst, under non-isomerizing conditions (3) gave 8(14)-stigmastenyl acetate, m.p. 113.5° (ref. 5, m.p. 114°). The identity of the latter was verified by GLC, IR and NMR comparison with a known. The UV absorption of (II) is characteristic of a heteroannular (conjugated transoid diene.(4) The presence of one of the conjugated double bonds at the $\Delta^{8(14)}$ position left the Δ^6 and Δ^{15} positions as the only alternatives for the second annular double bond. The published methyl resonances for C_{18} and C_{19}(6) eliminates the Δ^6 position as a possibility. There are no published values for the contribution of Δ^{15} to C_{18} and C_{19} methyl protons. Approximate values

can be computed by considering Δ^5-androstenolone and its $\Delta^{5,15}$ analog.(7) The difference in these two compounds is due to Δ^{15} alone and this gives a +0.21 increment for C_{18} and +0.04 increment for C_{19}. This would make the computed values δ 1.05 for C_{18} and δ 0.76 for C_{19} which are not too different from the observed values.

The NMR δ's for the side chain protons are identical to those published for (I) indicating that (II) has the isofucosterol structure.(1) IR absorption at 3150 cm^{-1} and 1625 cm^{-1} suggest the presence of double bond in the five membered D ring. (8, 9) The strong absorption at 800 cm^{-1} is typical of $\Delta^{24(28)}$ absorption (5, 10) but is much stronger than in (I) probably due to the effect of the conjugated system. Peak at 695 cm^{-1} is indicative of a cis di-substituted ethylene and also lends support to the presence of a double bond in the C_{15} position.(11)

In the oils analyzed we have also found a considerable amount of (I) (ca. 35% of the total sterol) but the new sterol; which we believe is 5-α-stigmasta-8(14),15,24(28)-triene-3β-ol and for which we propose the name "vernosterol"; comprises ca. 60% of the total. The remaining 5% is composed of at least four more sterols which are presently being investigated.

Acknowledgments

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