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A NEW SAPOGENIN FROM CYCLAMEN EUROPAEUM

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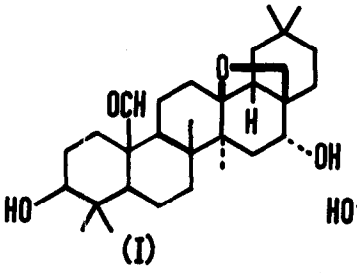
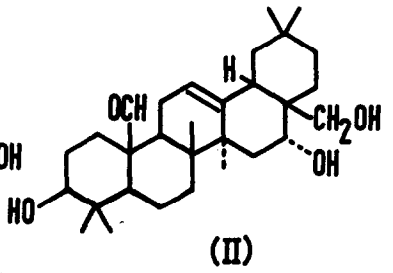
In a recent publication (1) it was shown that acid hydrolysis of cyclamin, the crystalline saponin from the corms of Cyclamen europaeum L., gives cyclamiretin A (I) and the artifacts cyclamiretins B, C and D (II) [Barton's "cyclamiretin" (2)]. We have obtained a similar group of compounds, the cyclamigenins, from the amorphous saponin remaining after removal of cyclamin by crystallisation. One of these sapogenins, cyclamigenin B, is now shown to be 16,30-dioxo-13β,28-epoxyoleanan-3β-ol (III).

Cyclamigenin B is saturated to tetranitromethane and shows no high intensity absorption in the UV. The IR spectrum has bands at 2710, 2717 and 1725 cm.$^{-1}$ (aldehyde), 1701 cm.$^{-1}$ (cyclohexanone), 1044 and 890 cm.$^{-1}$ (ether). The NMR spectrum of the acetate (IV) confirms the presence of the formyl group, which is tertiary (singlet at τ0.63), and shows that the ether function is of the type CH_2-O-C (pair of doublets centred at τ6.12 and 6.66, J = 8 c.p.s.).

Cyclamigenin B was shown to be an aldehyde derivative of aegicerin (V) (3) by Raney Ni desulphurisation of the ethylene dithioacetal (VI), m.p. 315-316° (vacuum) or 327-328° (vacuum) (dimorphous), $[\alpha]_D$ +1.5° ($CHCl_3$), to yield aegicerin acetate (VII), m.p. 276-278° (open capillary), 290-290.5° (vacuum), $[\alpha]_D$ -18° ($CHCl_3$) [lit. (3) m.p. 273-275°, $[\alpha]_D$ -17.7°]. The



(I)



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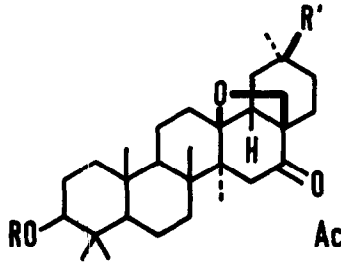
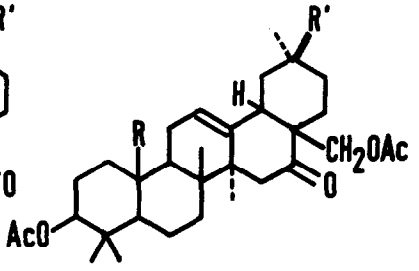
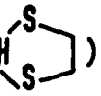




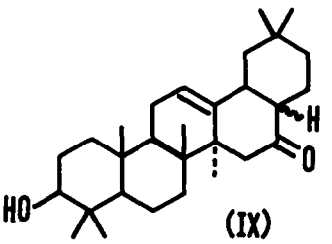
(III, R=H, R'=CHO)
(IV, R=Ac, R'=CHO)
(V, R=H, R'=Me)

(VIII, R=R'=Me)
(X, R=Me, R'=CHO)
(XI, R=CHO, R'=Me)

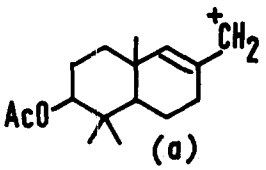
(VI, R=Ac, R'= 

)

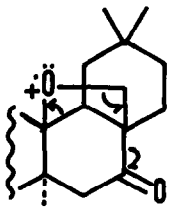
(VII, R=Ac, R'=Me)
(XII, R=Ac, R'=CO_2H)
(XIII, R=Ac, R'=CO_2Me)

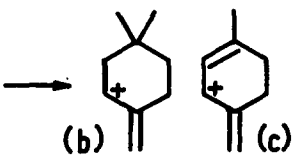


(IX)



(a)





product (VII) was characterised by hydrolysis to the alcohol (V), m.p. 254-256° (open capillary), 271-272° (vacuum), $[\alpha]_D$ -16 ± 2° ($CHCl_3$) [lit. (3) m.p. 254-256°, $[\alpha]_D$ -23.6°], and by acetolysis (3) to 16-keto-olean-12-ene-3β,28-diol diacetate (VIII), m.p. 210-211° (open capillary), 211-212° (vacuum), $[\alpha]_D$ -9° [lit. m.p. 210-211° (3), 216-217° (2), $[\alpha]_D$ -7.6° (3), -9° (2)]. Alkaline hydrolysis of the latter furnished norechynocystenolone (IX), m.p. 223-224° (open or vacuum sealed capillary), $[\alpha]_D$ -110° ($CHCl_3$), -96° (dioxane) [lit. (2) m.p. 223-225°, $[\alpha]_D$ -96° (dioxane)].

The formyl group in cyclamigenin B is not at C-10 since acetolysis (3) of the acetate (IV) yields a keto-aldehyde (X), m.p. ca. 175° (decomp., open capillary), 212-217° (vacuum), $[\alpha]_D$ +38° ($CHCl_3$), differing (mixed m.p. and IR spectrum) from 16,25-dioxo-olean-12-ene-3β,28-diol diacetate (XI) (2,4), m.p. 175-177°.

The appearance in the mass spectra of both aegicerin acetate (VII) and cyclamigenin B acetate (IV) of conspicuous fragments (5) at m/e 249 (a) and 189 (a - AcOH)suggested that the CHO group in the latter compound is at C-14 or C-20. In agreement with this hypothesis, a number of abundant fragments, e.g. m/e 248 and 235, formed from aegicerin acetate (VII) and which may be attributed (6) to species containing rings D and E, are replaced in the spectrum of the acetate (IV) by ions of 16 mass units less (due to loss of CH_2O). A moderately strong peak at m/e 123 in the spectrum of aegicerin acetate (VII) may be the ion (b). The corresponding fragment from cyclamigenin B acetate (IV) occurs at m/e 107 (c) - suggesting that the CHO group is at C-20.

Mild chromic acid oxidation of the aldehyde (IV) furnishes the

acid (XII), m.p. 319-320° (decomp., vacuum), $[\alpha]_D$ -3 ± 2° ($CHCl_3$); Me ester (XIII), m.p. 289-290° (decomp., vacuum), $[\alpha]_D$ +5 ± 2° ($CHCl_3$). The rate of saponification (58-65% after 8 hrs. reflux with 10% methanolic KOH) of the ester (XIII) is greater, under the same conditions, than that (0-20%) (7) for angular CO_2Me groups in the oleanane series but is comparable with the rate (40-47%) (7) for a 20β-CO_2Me group. A 20α-CO_2Me may be excluded since the IR spectrum of the ester (XIII) shows bands at 1151, 1195 and 1225 $cm.^{-1}$ characteristic (8) of an axial CO_2Me group. Finally, the molecular rotation change (+43°) on methylation of the acid (XII) is in good agreement with that (+55°) for methylation of the 20β-CO_2H in desoxyglycyrrhetic acid acetate (9). The corresponding shift for angular carboxyl groups is generally negative (9). Cyclamigenin B is, therefore, 30-oxoaegicerin (III).

Satisfactory analyses were obtained for all compounds described in this paper. Full details will be published elsewhere.

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(6) Removal of a lone-pair electron from the ether oxygen, followed by H transfer, may be expected to lead to fragments analogous to those from olean-12- and/or -13-enes (see Ref. 5). The mass spectra will be discussed elsewhere.

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