COMPOSITE CONSTITUENT: NOVEL TRITERPENOID, IXERENOL, FROM AERIAL PARTS OF *IXERIS CHINENSIS*

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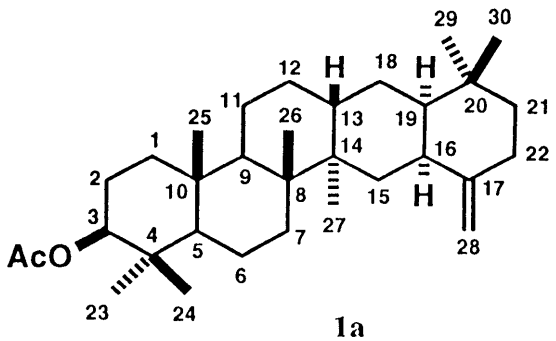
A novel triterpenoid, ixerenol (1), has been isolated together with twelve known triterpenoid alcohols as acetates; its structure was determined by extensive spectroscopic analyses.

KEYWORDS *Ixeris chinensis*; triterpenoid; ixerenol; Compositae

In the previous communication,[1] we reported the structure of a novel triterpenoid, 17-epi-lupenyl acetate, isolated from the acetate fraction of dried aerial parts of *Ixeris chinensis* (Thunb.) Nakai. Further investigation of the alcohol fraction of the same source resulted in the isolation of a novel triterpenoid, named ixerenol (**1**), together with twelve known compounds, lupeol,[2] germanicol,[2] β-amyrin,[2] taraxerol,[3] taraxasterol ,[2] ψ-taraxasterol,[2] α-amyrin,[2] bauerenol,[2] tirucalla-7,21-dien-3β-ol,[4] butyrospermol,[5] cycloartenol,[6] and 3β-hydroxytaraxaster-20-en-30-al,[7] as acetates. In this paper, we wish to report the structure elucidation of compound **1** on the basis of spectral evidence.

The hexane extract of dried materials was chromatographed on silica gel to give the alcohol fraction (0.5 g, 0.11 % of the dried materials) as benzene eluate. This fraction was acetylated with Ac_2O-pyridine, and the mixture was chromatographed repeatedly on 20% $AgNO_3$-impregnated silica gel, followed by prep. HPLC [C-18 reverse phase, CH_3CN–$CHCl_3$ (9:1)] to give ixerenyl acetate (**1a**), mp 158–160 °C, $[\alpha]_D$ +39.5° ($CHCl_3$, c= 0.1). The MS of **1a** showed the molecular ion at m/z 468.3959 ($C_{32}H_{52}O_2$), and many significant fragment ions at m/z (rel. int.): 453 (9, M^+–CH_3), 425 (5, a), 408 (32, M^+–AcOH), 393 (25, M^+–CH_3–AcOH), 365 (4, a–AcOH), 262 (25, b), 249 (12, c), 218 (31, d, e), 204 (61, f, g), 202 (24, b–AcOH), 189 (100, h, i), and 135 (35, j) (Chart 1). This fragmentation pattern indicated that the structure of rings A, B and C of **1a** was essentially identical with those of lupenyl acetate (**2a**).[8] The ^{1}H-NMR spectrum of **1a** showed the presence of seven tertiary methyl groups, exocyclic methylene group, and 3β-acetoxyl group in the molecule. The ^{1}H- and ^{13}C signals of rings A, B and C(except C-12 and C-13 in **1a**) were very similar to those of **2a**,[1] suggesting the same structure. The analysis of ^{1}H-^{1}H COSY, HSQC, and HMBC spectra suggested that **1a** had a methylene (C-18)



1a

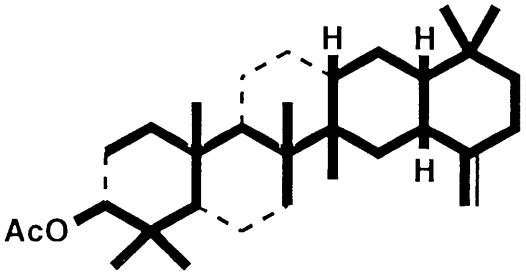


Fig. 1. Partial Structure of **1a** by HMBC Spectrum

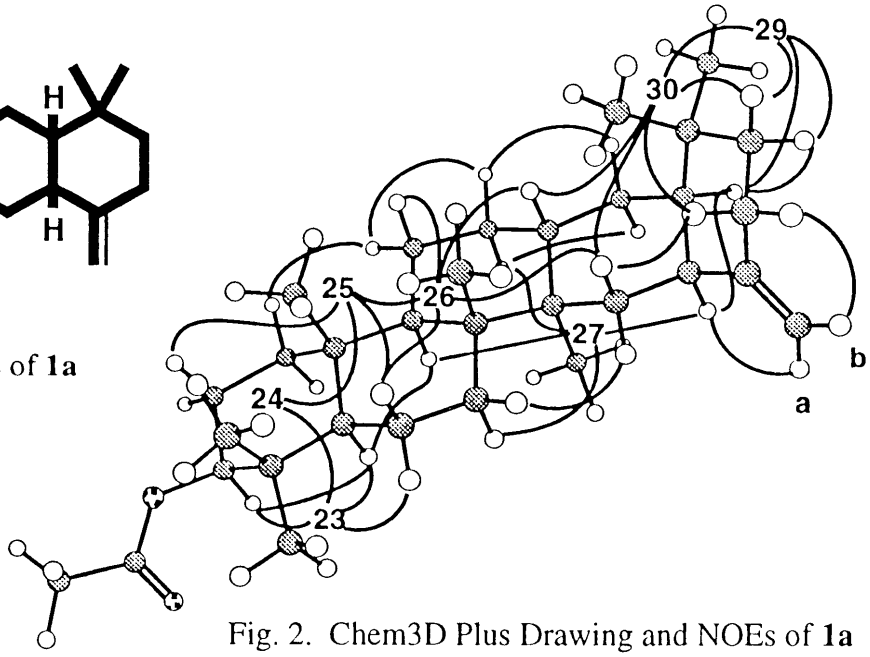


Fig. 2. Chem3D Plus Drawing and NOEs of **1a**

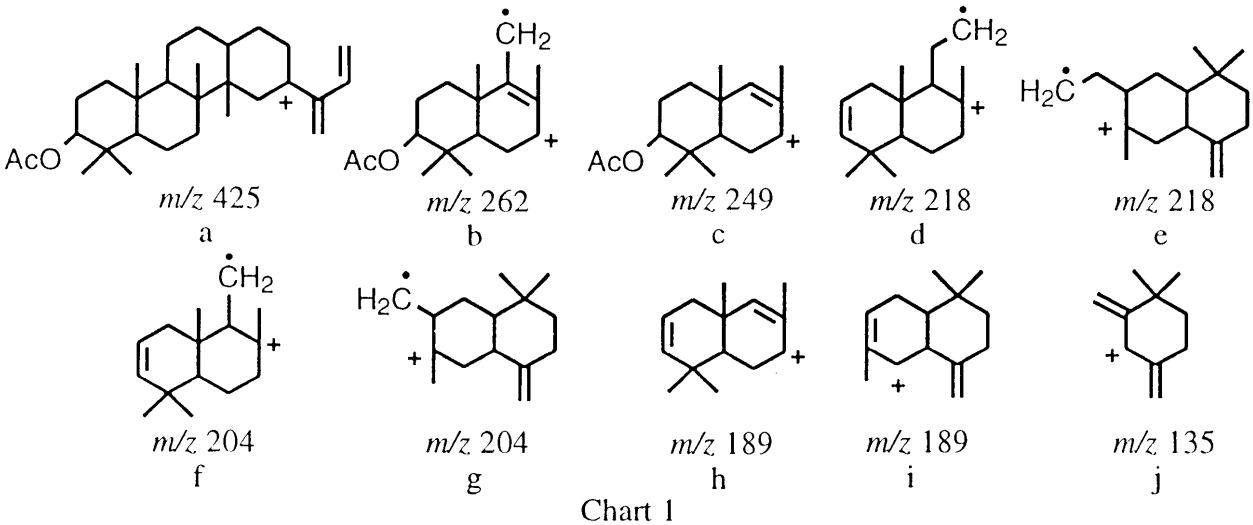


Chart 1

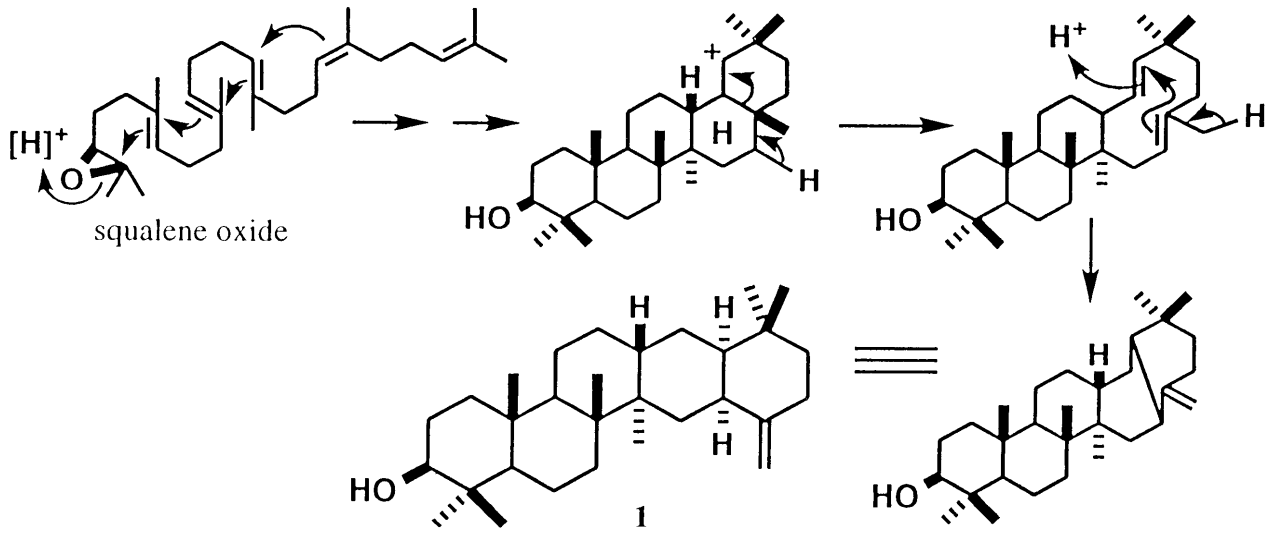


Chart 2

between C-13 and C-19, a methine (C-16), and an exocyclic methylene (C-28) attached to C-17. The partial structure of **1a**, shown by heavy lines in Fig. 1, was established by the HMBC spectrum. In addition, all methylene and methine carbons were correlated from the corresponding proton signals, confirmed by the ^{1}H-^{1}H COSY spectrum with the signals of proton(s) attached to the neighboring carbon(s).[9] Useful information for stereochemistry of **1a** was obtained by the NOE spectrometry. That is, cross-peaks were observed between H-24 and 25, H-25 and 26, H-26 and 13β, H-13β and 30, H-15β and 30, H-15β and 22β, H-21β and 30, H-22β and 30; H-9α and 27, H-27 and 16α, H-16α and 19α, H-16α and 28a, H-19α and 29, and H-22α and 28b (Fig. 2 and Note 10). The D and E ring juncture was the *cis* configuration of 16α-H and 19α-H. Therefore, **1a** was a new type of skeleton, as shown in Chart 2.

It is noteworthy to mention that a new skeletal triterpenoid having three rings (C, D and E) side by side was isolated from a natural source. Biogenetically, we estimate that cyclization of squalene oxide gives the germanicane cation, whose C-17 and C-18 bond open followed by recyclization to afford **1** (Chart 2).

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10) ^{1}H-NMR ($CDCl_3$, 500MHz, δ, αH;βH for methylene signals): 1.02;1.71 (H-1), 1.63;1.63 (H-2), 4.481 (dd,*J*=5.8, 10.9Hz, H-3), 0.81 (H-5), 1.50;1.37 (H-6), 1.37;1.37 (H-7), 1.39 (H-9), 1.47;1.28 (H-11), 1.00; 1.33 (H-), 1.81 (H-13), 0.85;1.79 (H-15), 2.50 (H-16), 1.31;1.48 (H-18), 1.46 (H-19), 1.26;1.45 (H-21), 2.02;2.31 (H-22), 0.844 (H-23), 0.838 (H-24), 0.876 (H-25), 0.981 (H-26), 0.954 (H-27), 4.576;4.579 (H-28), 0.892 (H-29), 1.087 (H-30), 2.044 (-OCOC$\underline{H}_3$).
^{13}C-NMR ($CDCl_3$, 125MHz ,δ) 38.62 (C-1), 23.71 (C-2), 80.97 (C-3), 37.84 (C-4), 55.66 (C-5), 18.06 (C-6), 33.74 (C-7), 40.77 (C-8), 51.24 (C-9), 37.23 (C-10), 21.37 (C-11), 30.25 (C-12), 33.17 (C-13), 40.90 (C-14), 36.45 (C-15), 40.94 (C-16), 155.44 (C-17), 29.58 (C-18), 43.30 (C-19), 33.77 (C-20), 44.18 (C-21), 28.66 (C-22), 27.92 (C-23), 16.49 (C-24), 16.56 (C-25), 15.56 (C-26), 14.30 (C-27), 106.47 (C-28), 32.59 (C-29), 25.83 (C-30), 21.34 (-OCO$\underline{C}H_3$), 171.04 (-O$\underline{C}OCH_3$).

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