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TRITERPENOIDS FROM *SALVIA PINNATA*

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Key Word Index—*Salvia pinnata*, Labiatae, vergatic acid, oleanolic acid, lupeol, lup-20(29)-ene-3β,11α-diol, olean-13(18)-ene-2α,3β,11α-triol

Abstract—A new and four known triterpenoids have been isolated from the leaves of *Salvia pinnata* The structures of these compounds have been established by spectral data and by some chemical reactions

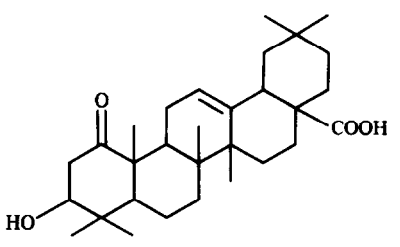
INTRODUCTION

As a part of our continuing chemical investigation of the genus *Salvia* we have obtained several triterpenoids from the leaf extract of *Salvia pinnata* We now describe the structure elucidation of these compounds by spectral data as well as by chemical reactions

RESULTS AND DISCUSSION

The spectra (IR, ^{1}H NMR and MS) of the first two compounds indicated that they were olean-12-en-28-oic acid type compounds while the third one was lupeol Comparison with authentic samples (TLC, IR, mp) revealed their identities as vergatic acid (3β-hydroxy-1-oxo-olean-12-ene-28-oic acid, **1**) [1], oleanolic acid [2] and lupeol [3] respectively The next compound, $C_{30}H_{50}O_2$, mp 212° (lit 215°) [4] was more polar Its ^{1}H NMR spectrum indicated a lupene type skeleton, showing isopropenylidene group protons at δ4 58 and 4 72 as broad singlets and the methyl at 1 68 also as a broad singlet All other ^{1}H NMR signals, as well as its mass spectral data, were in agreement with those of nepeticin (**2**) which was isolated from another Labiatae plant, *Nepeta hindostana* [4]

The new compound was a triol, $C_{30}H_{50}O_3$ (**3**), mp 185° The IR spectrum of **3** showed a strong hydroxyl band at 3360 cm^{-1} and no carbonyl band Acetylation of **3** yielded a triacetate (**4**), mp 105°, the IR spectrum of which showed no hydroxyl bands, only the acetyl carbonyl bands were present, thus establishing the nature of three oxygen atoms The ^{1}H NMR spectrum of **3** showed signals for eight C–Me singlets at δ0 72, 0 92, 0 98, 1 04, 1 10, 1 15, 1 18 and 1 25, no vinylic methyl group being present The hydrogen geminal to one of the three hydroxyl groups must be between a tetra substituted sp^3 C atom and a methyne grouping (δ3 12, *d*, J_{aa} = 10 Hz) Its chemical shift indicated that it should be at C-3 [4, 5] and its *J* value showed that it must be axial Also there could be only one other axial vicinal proton at C-2 (δ3 85, *ddd*, J_{aa} = 10 Hz, J_{aa} = 10 Hz, J_{ae} = 6 Hz) The presence of a hydroxyl group at C-2 was further proved by the formation of an acetonide, as well as of a diosphenol The other proton geminal to the third hydroxyl group (δ4 00, *ddd*, J_{aa} = 10 Hz, $J_{aa'}$ = 10 Hz, J_{ae} = 6 Hz) must also be axial and situated between methyne and methylene groups Since there was no vinylic proton in the spectrum the double bond must be tetra-substituted In the mass spectrum of **3** the strong peaks at *m/z* 205 and at *m/z* 218 indicated a double bond between C-13 and C-18 [6] These peaks also indicated that the hydroxyl groups were not on the D or E rings In such a molecule there are only two possible positions for the third hydroxyl group, namely C-6 and C-11 A one proton doublet of triplets at δ2 5 (J_{gem} = 14 Hz and J_{ee} = 3 5 Hz, J_{ea} = 3 5 Hz) in the ^{1}H NMR spectrum was attributed to the equatorial C-1 proton in a C-11 equatorially hydroxylated triterpene structure [7], as was observed in nepeticin [4] and lupane-3β,11α,20-triol [5] On the other hand, acetylation of the C-6 hydroxyl group under regular conditions is not possible and requires perchloric acid as catalyst [8] The broad singlet at δ4 35 which disappeared after acetylation showed the presence



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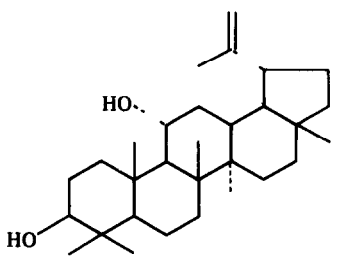

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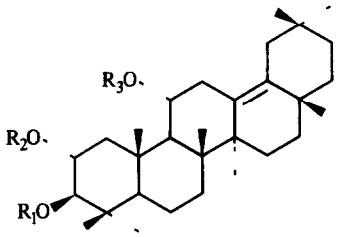
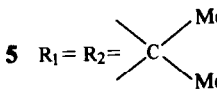
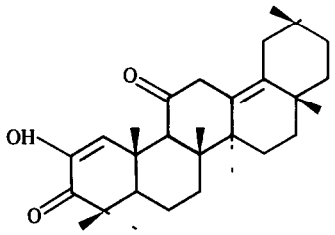


3 $R_1=R_2=R_3=H$

4 $R_1=R_2=R_3=Ac$



5 $R_1=R_2=$, $R_3=H$



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of the hydroxyl groups Based on the above data the structure of the new triterpene was established as olean-13(18)-ene-2α,3β,11α-triol

EXPERIMENTAL

Mp's were taken in a Reichert microscope apparatus and are uncorr The plant material was collected from Silivri (near Istanbul) in May 1980 A voucher specimen was identified by Dr E Tuzlaci (Istanbul) and deposited in the Herbarium of Faculty of Pharmacy (ISTE 44246)

Extraction and isolation of triterpenoids Dried and powdered leaves of *S pinnata* L (500 g) were extracted with C_6H_6 in a Soxhlet The extract was evaporated *in vacuo* The C_6H_6 concentrate (15 g) was chromatographed on a silica gel (E Merck) column (5 × 60 cm) Elution was started with C_6H_6 and continued by gradual addition of $CHCl_3$ up to 100% The compounds were obtained in the following order vergatic acid (20 mg), oleanolic acid (80 mg), lupeol (25 mg), lup-20(29)-ene-3β,11α-diol (45 mg) and olean-13(18)-ene(2α,3β,11α-triol (75 mg)

Olean-13(18)-ene-2α,3β,11α-triol (**3**) Mp 185° (EtOH), IR ν_{max}^{KBr} cm^{-1} 3360, 2970, 2930, 2850, 1630, 1460, 1380, 1170, 1060, 1050, 1030, 990, 950 ^1H NMR δ(200 MHz NT-FT, pyridine-d_5) details given in the text EIMS (probe) 70 eV, *m/z* (rel int) 458 $[M]^+$ (5), 440 $[M-18]^+$ (27), 422 $[M-2\times18]^+$ (30), 407 $[M-2\times18-15]^+$ (15), 389 $[M-3\times18-15]^+$ (5), 235 (45), 218 (42), 205 (60), 189 (65) (Found C, 78 73, H, 10 88 $C_{30}H_{50}O_3$ requires C, 78 60; H, 10 91%)

2α,3β,11α-Triacetoxy-olean-13(18)-ene (**4**) Treatment of compound (**3**)/ (15) mg) with Ac_2O–pyridine at room temp for 18 hr yielded a triacetate, mp 105° (EtOH) IR ν_{max}^{KBr} cm^{-1} 2950, 2860, 1730, 1450, 1370, 1250, 1030, 965, 755 ^1H NMR (200 MHz NT-FT, $CDCl_3$) δ0 7 (3H, *s*), 0 9 (3H, *s*), 0 98 (3H, *s*), 1 08 (3H, *s*), 1 10 (3H, *s*), 1 12 (3H, *s*), 1 14 (3H, *s*), 1 22 (3H, *s*), 1 94 (3H, *s*), 1 96 (3H, *s*), 2 05 (3H, *s*), 2 5 (1H, *dd*, J_{gem} = 14 Hz, J_{ae} = 4 Hz, H-1 equatorial), 4 75 (1H, *d*, *J* = 10 Hz, H-3 axial), 4 96 (1H, *ddd*, J_{aa} = 11 Hz, J_a = 11 Hz, J_{ae} = 5 Hz, H-2 axial), 5 18 (1H, *ddd*, J_{aa} = 10 Hz, J_{aa} = 10 Hz, J_{ae} = 5 Hz, H-11 axial) EIMS (probe) 70 eV, *m/z* (rel int) 584 $[M]^+$ (1), 524 $[M-60]^+$ (85), 509 $[M-60-15]^+$ (8), 464 $[M-2\times60]^+$ (8), 404 $[M-3\times60]^+$ (10), 389 $[M-3\times60-15]^+$ (15), 216 (25), 203 (40), 189 (15) (Found C, 73 68, H, 9 52 $C_{36}H_{56}O_6$ requires C, 73 97, H, 9 58%)

Olean-13(18)-ene-2α,3β-acetonide-11α-ol (**5**) Compound **3** (20 mg) was dissolved in 1 ml dry Me_2CO and a few drops of conc H_2SO_4 were added The mixture was kept at room temp for 2 hr and the product purified by chromatography on Sephadex LH-20, mp 128° IR ν_{max}^{KBr} cm^{-1} 3350, 2920, 2850, 1455, 1380, 1170, 1120, 1070, 1040 ^1H NMR (200 MHz NT-FT, $CDCl_3$) δ0 72 (3H, *s*), 0 9 (3H, *s*), 0 98 (3H, *s*), 1 09 (3H, *s*), 1 12 (6H, *s*), 1 14 (3H, *s*), 1 22 (3H, *s*), 1 36 (3H, *s*, acetonide), 1 40 (3H, *s*, acetonide), 3 2 (1H, *d*, *J* = 10 Hz, H-3 axial), 3 9 (1H, *ddd*, J_{aa} = 10 Hz, J_{aa} = 10 Hz, J_{ae} = 4 Hz, H-2 axial), 4 05 (1H, *ddd*, J_{aa} = 10 Hz, J_{aa} = 10 Hz, J_{ae} = 4 Hz, H-11 axial) (Found C, 79 43, H, 10 79 $C_{33}H_{54}O_3$ requires C, 79 51, H, 10 84%)

Diosphenol (**6**) Compound **3** (30 mg) dissolved in dry Me_2CO was treated with CrO_3–AcOH (25 mg of CrO_3 in 1 ml AcOH) at room temp for 5 min The mixture was diluted with H_2O, extracted with Et_2O and the Et_2O was evaporated *in vacuo* to leave an amorphous solid UV λ_{max}^{EtOH} nm 274 (ε7300) IR ν_{max}^{KBr} cm^{-1} 3420, 2960, 2850, 1725, 1600, 1580, 1460, 1380, 1270, 1120, 1070, 740 ^1H NMR (200 MHz NT-FT, $CDCl_3$) δ0 72 (3H, *s*), 0 91 (3H, *s*), 0 98 (3H, *s*), 1 10 (6H, *s*), 1 14 (3H, *s*), 1 16 (3H, *s*), 1 24 (3H, *s*), 6 2 (1H, *s*, H-1)

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