

STRUCTURE AND SYNTHESIS

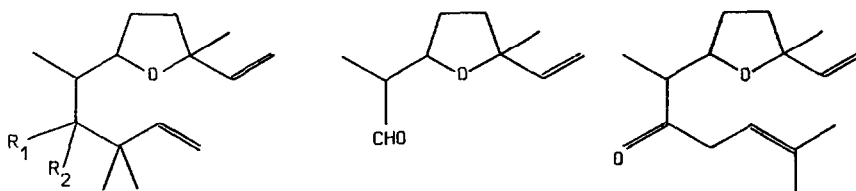
OF ARTEMONE

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We wish to report upon a new sesquiterpene ketone isolated from the essential oil of *Artemisia pallens* (Wall.). Since it exhibits a structural feature of the monoterpene artemisia ketone, we propose the name artemone.



Ia-d: $R_1; R_2: =O$

II

IV

III : $R_1: H$
 $R_2: OH$

Artemone, liquid at room temperature, does not react with Girard P reagent and exhibits a shorter GLC retention time (Triton X 305 and XE 60 as liquid phase) than davanone (IV), also isolated from the neutral part of the same source¹⁾. In addition, it shows the following physicochemical data:

$[\alpha]_D^{20} = +41.4^0$ ($c = 1.895$ in $CHCl_3$) taken on a 95% purity sample.

λ_{max} (cyclohexane): 202 nm; $\epsilon = 3200$ (no conjugated double bond system)²⁾.

ν_{max} (liquid film): 3085, 1710, 1635, 1460, 1415, 1405, 1370, 1305, 1248, 1128, 1100, 1078, 1048, 1032, 1008, 992, 952, 918, 884 cm^{-1}

(indicating the presence of saturated carbonyl, monosubstituted double bond and probably ether linkage). See Fig. 1.

NMR (CDCl_3 + TMS): δ = 6.05 (1H, dd; $J_1=17.5, J_2=9.5$ cps); 5.94 (1H, dd; $J_1=17, J_2=10$ cps); 5.37-4.80 (4H, m); 4.40-3.85 (1H, m); 3.30-2.75 (1H, m); 2.30-1.40 (4H, m); 1.26 (3H, s); 1.22 (6H, s); 0.94 ppm (3H, d, $J=7$ cps). See Fig. 2

MS: molecular peak at m/e : 236

characteristic fragments at m/e : 180, 167 ($M - \text{C}_6\text{H}_5$), 125, 111 (base peak C_6H_5^+), 93 ($111 - \text{H}_2\text{O}$; m^+), 81, 69

The mass spectrum is similar to the one of davanone¹⁾³⁾.

These data led us to assume structure I for artemone, which could be confirmed by the following synthesis:

Aldehyde II³⁾, a mixture of the four racemates, was treated with a dilute ethereal solution of 3-methyl-but-2-enyl magnesium bromide in the presence of zinc bromide⁴⁾ to give in 85% yield a mixture of the diastereomeric alcohols III:

ν_{max} (liquid film): 3500, 3080, 1638, 1460, 1415, 1370, 1040-1000, 990, 915 cm^{-1}

NMR (CDCl_3 + TMS): δ = 6.3-5.6 (2H, several dd); 5.35-4.75 (4H, 3m); 4.30-3.60 (2H, m); 2.30-1.45 (5H, m); 1.30-1.28 (3H, 3s); 1.08-1.06 (6H, 2s); 1.00-0.76 ppm (3H, several d)

MS: molecular peak very weak

characteristic fragments at m/e : 223 ($M - \text{CH}_3$), 169 ($M - \text{C}_6\text{H}_5$), 151 ($169 - \text{H}_2\text{O}$; m^+), 111 (base peak C_6H_5^+), 93 ($111 - \text{H}_2\text{O}$; m^+), 81, 70

Repeated chromatography on silicagel allowed the separation of four pure alcohol fractions which were individually converted into the four diastereomeric artemones Ia-Id (in order of elution on silicagel and retention time on a Triton X 305 coated glasscapillary VPC-column) by rapid oxidation with Jones reagent in acetone solution at -5°C .

Data of Ia:

λ_{max} (cyclohexane): 202 nm, ϵ = 3600

ν_{max} (liquid film): 3090, 1707, 1635, 1413, 1402, 1378, 1370, 1130, 1102, 1040, 1010, 992, 920, 885 cm^{-1}

NMR (CDCl_3 + TMS): δ = 5.98 (1H, dd; $J_1=16, J_2=9.5$ cps); 5.88 (1H, dd; $J_1=17, J_2=10$ cps); 5.38-4.82 (4H, 3m); 4.30-3.75 (1H, m); 3.35-2.80 (1H, m); 2.20-1.38 (4H, m); 1.25 (3H, s); 1.22 (6H, s); 1.13 ppm (3H, d; $J=7$ cps)

MS: molecular peak at m/e : 236

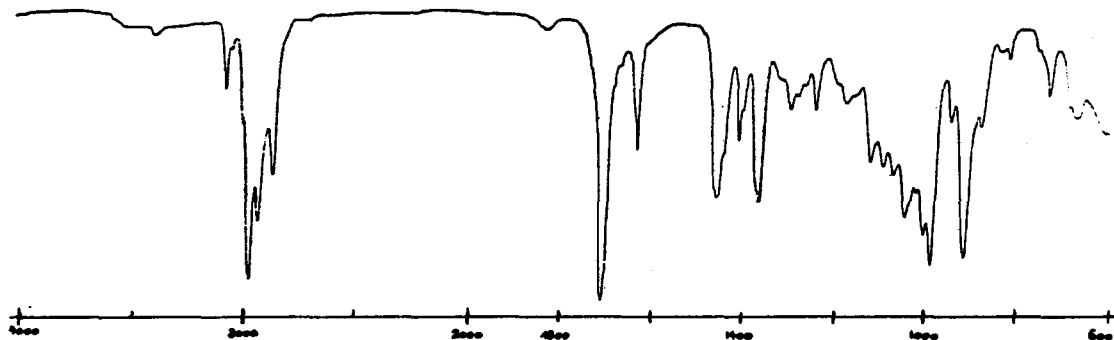
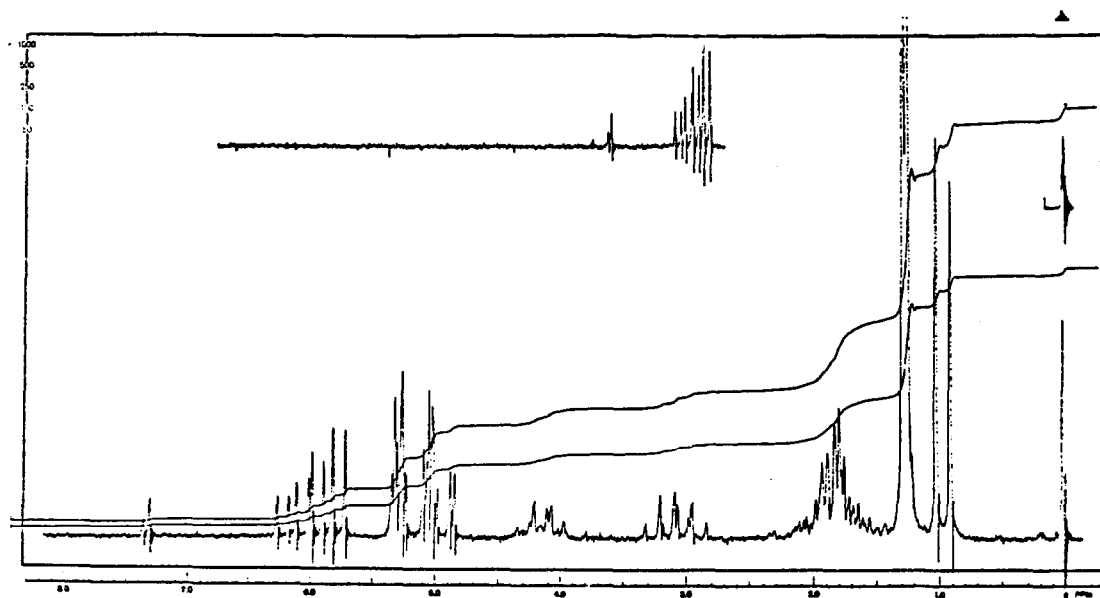
characteristic fragments at m/e : 180, 167, 125, 111, 93, 81, 69

Data of Ib:

λ_{max} (cyclohexane): 202 nm, ϵ = 3600

ν_{max} (liquid film): 3085, 1712, 1635, 1414, 1403, 1370, 1130, 1100, 1080, 1042, 1010, 992, 920, 882 cm^{-1}

NMR (CDCl_3 + TMS): δ = 6.01 (1H, dd; $J_1=17.5, J_2=10$ cps); 5.82 (1H, dd; $J_1=17, J_2=10$ cps); 5.36-4.76 (4H, 3m); 4.30-3.77 (1H, m); 3.30-2.80 (1H, m); 2.20-1.45 (4H, m); 1.24 (6H, s); 1.21 (3H, s); 0.92 ppm (3H, d; $J=7$ cps)

Figure 1Figure 2

MS: molecular peak at m/e: 236

characteristic fragments at m/e: 180, 167, 125, 111, 93, 81, 69

Data of Ic:

λ_{\max} (cyclohexane): 202 nm, $\epsilon = 3600$

ν_{\max} (liquid film): 3085, 1704, 1634, 1413, 1402, 1368, 1126, 1100, 1058, 1038, 1020, 1006, 988, 918, 885 cm^{-1}

NMR (CDCl_3 + TMS): $\delta = 5.96$ (1H, dd; $J_1=18, J_2=9.5\text{cps}$); 5.93 (1H, dd; $J_1=17.5, J_2=10\text{cps}$); 5.40-4.85 (4H, 3m); 4.30-3.86 (1H, m); 3.40-2.80 (1H, m); 2.40-1.40 (4H, m); 1.30 (3H, s); 1.24 (6H, s); 1.20 ppm (3H, d, $J=7\text{cps}$)

MS: molecular peak at m/e: 236

characteristic fragments at m/e: 180, 167, 125, 111, 93, 81, 69

Isomer Id shows identical UV-, IR-, MS- and NMR-spectra as well as identical retention time on a 50 m glasscapillary Triton X 305 VPC-column as natural artemone. (cf. first and second page of this communication.)

Comparing the NMR-spectra of the four racemic davanones, synthesized earlier³⁾, one can observe a definite difference ($\Delta\delta$) in position of the secondary methyl group within the pair of the diastereoisomers most probably exhibiting a trans relationship of vinyl group and ketonic side chain at the tetrahydrofuran moiety as well as within the pair most probably exhibiting a corresponding cis relationship ($\Delta\delta = 0.12$ ppm and $\Delta\delta = 0.19$ ppm in CDCl_3 respectively). Similar differences can be observed within the chromatographically analogous series of the racemic artemones ($\Delta\delta = 0.21$ ppm and $\Delta\delta = 0.26$ ppm in CDCl_3).

This suggests that natural artemone could have the same relative stereochemistry as natural davanone.

Furthermore, the optical rotation of natural artemone together with the data presented by Ohloff et al.⁵⁾ for davanone suggest that natural artemone could also possess the same absolute stereochemistry as natural davanone.

We thank Dr. P. Schudel for helpful discussions.

References:

- 1) G. Sipma, B. van der Wal, Recueil 87, 715 (1968)
- 2) UV spectra were measured on a Beckman DB-G instrument, IR spectra on PE 157 and 257 spectrometers. NMR spectra were taken on a Varian A60A instrument and mass-spectra at 70eV on a double focussing CEC 21-110B instrument with an all glass inlet system (temperature 150°C).
- 3) P. Naegeli, G. Weber, Tetrahedron Letters 959 (1970)
- 4) D. Abenham et al., Bull. Soc. Chim. France (11), 4043 (1969)
- 5) G. Ohloff, W. Giersch, Helv. Chim. Acta 53, 841 (1970)