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KUDTDIOL, NEW SESQUITERPENE ALCOHOL FROM JASONIA GLUTINOSA D.C.[1)]

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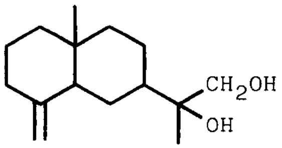
Jasonia glutinosa D.C. (Compositae; subfam. Inulae) is a species that grows in abundance at the Spanish East on basic soils. It has medicinal uses and it is named "mountain tea" and "rock tea". We have found no report on the chemical composition of J. glutinosa, but some works related to the flavonoids[2)] and other constituents[3)] of J. tuberosa, species that grows at the West of the Iberian Peninsula on acidic soils, have been done.

The benzene extract from the air-dried aerial parts of J. glutinosa was fractionated with bases. By chromatography of the neutral fraction on a dry SiO_2 column (eluent, benzene-ether 3:2), a crystalline substance was isolated (0.4% on dry weight), for which we have proposed the name kudtdiol.

The mass spectrum of kudtdiol shows a molecular peak at m/e 238 ($C_{15}H_{26}O_2$), and absorbs in the IR (film) at $\nu(cm^{-1})$: 3390, 1145, 1040 (-OH) and 3060, 1640, 880 ($R_2C{=}CH_2$). The ^1H-NMR spectrum ($CDCl_3$) shows signals at δ(ppm): 0.69 (3H,s; $R_3C\text{-}\underline{H}_3$), 1.11 (3H,s;$>C(OH)\text{-}C\underline{H}_3$), 3.38 and 3.52 (2H,AB q,J=11Hz;$-C\underline{H}_2OH$), 4.42 and 4.69 (2H,2 br.s.;$R_2C{=}C\underline{H}_2$).

Acetylation of kudtdiol (Ac_2O/pyr, rt) gives a monoacetate, remaining a free -OH group [$[\alpha]_D$ +63.2º; MS, M^+ at m/e 280; IR (film), $\nu(cm^{-1})$ at: 3460, 1740, 1235, 1165, 1045; ^1H-NMR ($CDCl_3$), δ(ppm): 2.06 (3H,s;$-CH_2O\underline{Ac}$), 4.01 (2H,s; $-C\underline{H}_2OAc$) and the other signals of the spectra remaining without major modifications]. Moreover, treatment of kudtdiol with $Me_2C(OMe)_2/Me_2CO$ (HOTs) [4)], gives a cyclic ketal.

All the above data as well as the fragmentation pattern of the MS [m/e (%): 238 (5) M^+; 223 (19) M^+-Me; 220 (2) M^+-H_2O; 207 (100) M^+-CH_2OH; 189 (76) $M^+-(CH_2OH+H_2O)$; and 163 (15) loss of $MeC(OH)CH_2OH$] support the structure 1 suggested for kudtdiol.



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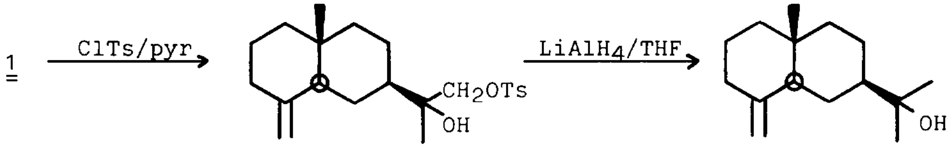
The structure 1 was also proposed for sesquibenhidiol, a substance isolated from *Chamaecyparis formosensis*, but its physical constants[5] (m.p. 120-30º $/\alpha/_D$ -36.02º) are very different from those of kudtdiol (m.p. 90º CH_2Cl_2-Hex, $/\alpha/_D$ +72.9º $CHCl_3$). The structure of sesquibenhidiol was established by chemical degradation, but no stereochemical assignments were made.

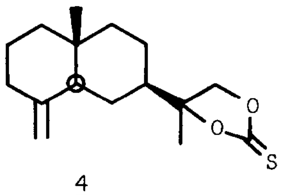
To determine the stereochemistry of kudtdiol, we have transformed it into (+)β-eudesmol 3, as follows



2 3

Tosylation[6] of 1 gives 2 [$/\alpha/_D$ +45.5º $CHCl_3$; IR (νcm^{-1}): 3370 (-OH), 3060, 1640, 880 ($\geq C=CH_2$); ^{1}H-NMR (δppm): 2.42 (3H,s,Ar-$C\underline{H}_3$), 7.25 and 7.69 (4H,A_2B_2 q,J=8Hz;Me-$C_6\underline{H}_4$-SO_3-), 3.76 and 3.87 (2H,AB q,J=12Hz;-$C\underline{H}_2$-OTs)] which on reduction with $LiAlH_4$ led to (+)β-eudesmol 3, that shows physical constants (m.p. 81-2º subl., $/\alpha/_D$ +61.2º) identical to those reported[7].

To establish the absolute configuration at C_{11} we have synthesized[8] the thiocarbonate 4. The Cotton effect of 4 ($\Delta\varepsilon_{308}$= -0.21, MeOH) suggests that the thiocarbonate ring adopts the conformation 4a. For this conformation the decaline system must be equatorial (sterically favoured) and the configuration at C_{11} must be "R" [9].



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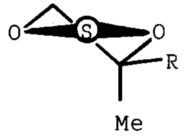
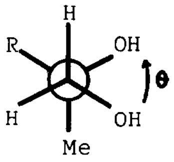
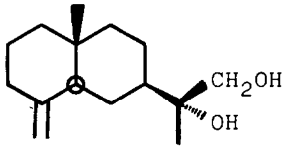


4a



4b



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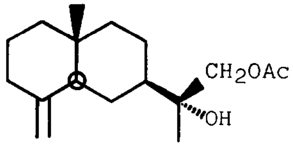
The CD curves of kudtdiol were also recorded in solution 10^{-4}M $Pr(fod)_3$/CCl_4 ($\Delta\varepsilon_{312}$= -3.2, $\Delta\varepsilon_{286}$= +3.4) and 10^{-3}M $Ni(acac)_2/CCl_4$ ($\Delta\varepsilon_{315}$= -2.7, $\Delta\varepsilon_{293}$= +1.5). Although there is no rule to predict the Cotton effect of a primary-tertiary diol in the presence of Ni[10] or Pr[11] complexes, there is a paper[10] where the configuration of a primary-tertiary diol is established. According to that paper, the observed CE of kudtdiol in $Pr(fod)_3/CCl_4$ is in agreement with the assigned "R" configuration for C_{11} (negative dihedral angle θ, 4b). The opposed conclusion is reached from the CD curve in $Ni(acac)_2/CCl_4$ but this may be due to the crowded position of the tertiary OH group[12].

Therefore, the proposed structure and stereochemistry for kudtdiol is 5: (+)(11R)-eudesm-4(14)-en-11,12-diol.

As additional proofs of the structure of kudtdiol, the dehydration of monoacetate 6 was performed ($POCl_3$/pyr) and compounds 7, 8, 10 and 11 were obtained



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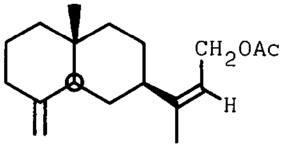

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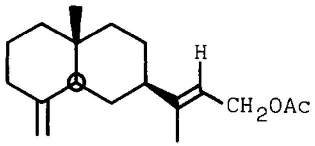

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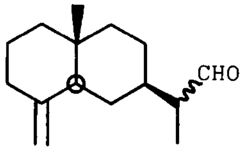

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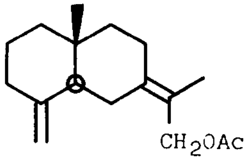

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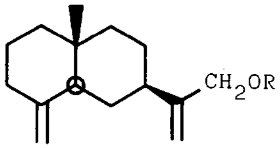

11 R=Ac

12 R=H

Compounds 7 and 8 are the expected Z and E enolacetates; they were not isolated but the ^{1}H-NMR of the mixture shows two different signals for the vinylic protons at 6.76 and 6.91 ppm in a 2:3 ratio. Mild saponification of 7+8 in HCO_3^- solution[13)] led us to isolate the epimeric aldehydes 9 [IR: 2690, 1720 cm^{-1} and ^{1}H-NMR: 9.50 (1H,d,J=2Hz) ppm] .

Compound 10 is an allylic acetate [$/\alpha/_D$ +110.9º; IR: 1730, 1225, 1010 cm^{-1} ^{1}H-NMR (δppm): 1.71 (3H,s;C$\underline{H}_3$-C=C), 1.98 (3H,s;-$\underline{Ac}$), 4.53 (2H,s;C=C-C$\underline{H}_2$OAc)] . Compound 11 is an allylic acetate [$/\alpha/_D$ +35.16º; IR: 3060, 1740, 1640, 1225, 1040, 880 cm^{-1}; ^{1}H-NMR (δppm): 2.01 (3H,s;-$\underline{Ac}$), 4.49 (2H,s;C=C-C$\underline{H}_2$OAc), 4.95 (2H,s;$>$C=C$\underline{H}_2$)] . The acetate 11 on hydrolysis (KOH/MeOH) gives the alcohol 12 [$/\alpha/_D$ +35.4º] which was identified as (+)β-costol[14)] by IR and ^{1}H-NMR spectral data.

NOTES AND REFERENCES

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