

SHORT COMMUNICATIONS

DITERPENOIDS

XXXII.* LABDA-8,14-DIEN-13 β -OL

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Abstract

The 13S compound 13-epiisomanool (labda-8,14-dien-13 β -ol) has been synthesized and its optical rotation compared with that of the 13R isomer (isomanool) in order to correct errors in the literature.

The 13S compound labda-8,14-dien-13 β -ol (1) has been reported¹ ("13-epiisomanool") to be an oil, $[\alpha]_D +27.5^\circ$ ($[\phi]_D +80$). The rotation of this compound, reputedly lower than that of the 13R epimer (2) ("isomanool"), was used erroneously to assign the C13 stereochemistry to a number of compounds in this series.[‡] The results have been commented upon.^{2§} During a survey of optical rotation and structure in the labdanoids,³ we calculated that compound (1) should have a molecular rotation at 589 nm of +260 units, and that it should have a larger positive rotation than epimer (2). Compound (1) is entry 103 in the earlier paper,³ while (2) is entry 102, with the compounds now renamed to meet modern nomenclature requirements.⁴ The discrepancy between observed and calculated rotations for (1) was so great that it was considered³ that either the compound did not have the assigned structure or else its optical rotation had been incorrectly determined.

Compound (1) ("isoepimanool") has also been isolated from a natural source⁵ but no rotation was reported.

We now record the synthesis of compound (1) from 13-epimanool (3). Isomerization of the 8(17) double bond of (3) under acid conditions is attended with considerable rearrangement of the allylic alcohol, but basic conditions using lithium

* Part XXXI, *Aust. J. Chem.*, 1973, **26**, 209.

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[‡] The workers in reference 1 made two errors which fortuitously compensated. They had the rotations of (1) and (2) in the wrong order, but they took (–)-linalool to be S and it was not until later (Cornforth, R. H., Cornforth, J. W., and Prelog, V., *Liebigs Ann.*, 1960, **634**, 197) that (–)-linalool was proved to have the R configuration.

[§] The Italian workers misapply the R,S nomenclature in some instances.

¹ Bigley, D. B., Rogers, N. A. J., and Barltrop, J. A., *J. chem. Soc.*, 1960, 4613.

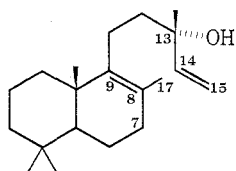
² Mangoni, L., and Belardini, M., *Gazz. chim. ital.*, 1962, **92**, 1379.

³ Carman, R. M., *Aust. J. Chem.*, 1966, **19**, 629.

⁴ Rowe, J. W., "The Common and Systematic Nomenclature of Cyclic Diterpenoids," 3rd Revision (Mimeograph) (Forest Service, U.S.D.A.: Washington 1968).

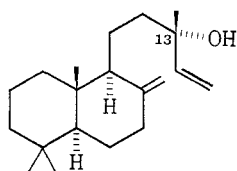
⁵ Rowe, J. W., and Scroggins, J. H., *J. org. Chem.*, 1964, **29**, 1534.

in diaminoethane⁶ gave a mixture of the required compound (1) and the Δ^7 isomer (5). Separation was tedious and the isomers were unstable. In particular, the compounds partly decomposed upon gas chromatography and showed a number of minor peaks due to olefinic elimination products. Thus both (1) and abienol (7) showed a common g.l.c. peak, possibly a $\Delta^{8,12,14}$ triene. In addition, all the compounds described (1, 2, 5, 6) oxidized and yellowed in air at room temperature and satisfactory analytical figures were difficult to obtain. The oils polymerized at 0° to give hexane-insoluble polymers.



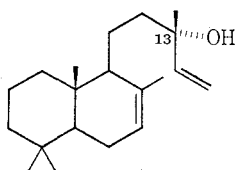
(1)

(2) 13R isomer



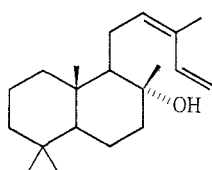
(3)

(4) 13R isomer



(5)

(6) 13R isomer



(7)

Compound (1) showed the expected p.m.r. and infrared characteristics, and gave $[\phi]_D +256$ in excellent agreement with the predicted figure³ and contrasting with the previously reported¹ low value.

The isomeric olefin (5), formed initially from compound (3), rearranged into (1) upon further base treatment. The optical rotation of (5) was also within the predicted range.³

Synthesis of alcohol (2) from manool (4) by the same route gave (2) with $[\phi]_D +184$, and now giving the *R* isomer (2) a lower rotation than the *S* isomer (1), as predicted.³ Again, (2) was difficult to obtain pure, and the physical constant measurements were hampered by rapid oxidation of the compound. Also obtained was compound (6), again with a rotation in the expected range.

Experimental

P.m.r. spectra were recorded at 100 MHz in $CDCl_3$ with TMS (δ 0) as internal reference. Infrared spectra are of films, and optical rotations are for hexane solutions. Chromatography was performed over Woelm neutral alumina (activity I), and over silver nitrate impregnated alumina (1 : 3 w/w). Gas chromatography was performed at 200° over a 3% SE 30 column (60 by 1/8 in., c. 3000 plates) using nitrogen gas.

⁶ Cambie, R. C., and Franich, R. A., *Aust. J. Chem.*, 1970, **23**, 93.

Labda-8,14-dien-13 β -ol (1)

Lithium (3.5 g) in small pieces was dissolved in refluxing diaminoethane (50 ml, dried over 3A molecular sieves), and 13-epimanool (3) (3 g) was then added. After reflux (20 hr), the mixture was poured onto ice and extracted with ether. The ether extract was washed with water and evaporated to give a yellow oil containing (1) as the major component. Repeated chromatography gave labda-8,14-dien-13 β -ol (1) as a colourless oil, b.p. 130°/0.01 mm, $[\alpha]_D +88^\circ$ (c, 0.8) (for literature value see above), showing only one alcohol peak on gas chromatography (with small hydrocarbon decomposition peaks; these peaks increased with increasing injector port temperature) (Found: C, 82.3; H, 11.8. $C_{20}H_{34}O$ requires C, 82.7; H, 11.8%). ν : 3400, 3090, 1640, 993, 920 cm^{-1} . P.m.r. spectrum: δ 4.9–6.1 (3H, ABC system, vinyl protons), 1.53 (3H, broadened singlet, C 8 methyl), 1.23 (3H singlet, C 13 methyl), 0.93, 0.87, 0.82 (three 3H singlets, C 4 and C 10 methyls).

If the reaction was quenched after only 0.5 hr, labda-7,14-dien-13 β -ol (5) predominated in the mixture and was separated by repeated chromatography as a viscous colourless oil, b.p. 130°/0.01 mm, $[\alpha]_D +20^\circ$ (c, 0.7) (Found: C, 82.6; H, 11.8. $C_{20}H_{34}O$ requires C, 82.7; H, 11.8%). ν : 3400, 3085, 1640, 993, 918 cm^{-1} . P.m.r. spectrum: δ 4.8–6.2 (3H, ABC system, C 14 and C 15 protons), 5.30 (1H, broad singlet, C 7 proton), 1.64 (3H, broadened singlet, C 8 methyl), 1.23 (3H, singlet, C 13 methyl), 0.87, 0.87, 0.75 (three 3H singlets, C 4 and C 10 methyls).

Compounds (1) and (5) both yellowed within 1 hr at 25° and polymerized at 0° during 1 month.

Labda-8,14-dien-13-ol (2)

Manool (4) and lithium in diaminoethane were refluxed for 20 hr as described above to give labda-8,14-dien-13-ol (2) as a colourless viscous oil after repeated chromatography, b.p. 130°/0.01 mm, $[\alpha]_D +64^\circ$ (c, 1.1) (lit.¹ $[\alpha]_D +73.5^\circ$) (Found: C, 82.3; H, 11.7. $C_{20}H_{34}O$ requires C, 82.7; H, 11.8%). ν : 3425, 3080, 1640, 990, 915 cm^{-1} . P.m.r. spectrum: δ 4.9–6.1 (3H, ABC system, vinyl protons), 1.56 (3H, broadened singlet, C 8 methyl), 1.31 (3H, singlet, C 13 methyl), 0.96, 0.90, 0.85 (three 3H singlets, C 4 and C 10 methyls).

Workup of the reaction after 0.5 hr gave labda-7,14-dien-13-ol (6) as a colourless viscous oil, b.p. 130°/0.01 mm, $[\alpha]_D -1.8^\circ$ (c, 1.5) (Found: C, 82.6; H, 11.9. $C_{20}H_{34}O$ requires C, 82.7; H, 11.8%). ν : 3400, 3090, 1640, 990, 915 cm^{-1} . P.m.r. spectrum: δ 5.29 (1H, broadened singlet, C 7 proton), 4.9–6.1 (3H, ABC system, C 14 and C 15 protons), 1.65 (3H, broadened singlet, C 8 methyl), 1.28 (3H, singlet, C 13 methyl), 0.86, 0.84, 0.74 (three 3H singlets, C 4 and C 10 methyls).

Compounds (2) and (6) were of stability similar to that of compounds (1) and (5).

Acknowledgment

The 13-epimanool was kindly donated by Dr J. W. Rowe.