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J. Nat. Prod., **1991**, 54 (1), 295-297 • DOI:

10.1021/np50073a038 • Publication Date (Web): 01 July 2004

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DC 20036

(R)-4-METHYL-2-PENTYL ACETATE FROM *EUCALYPTUS LOXOPHLEBA*

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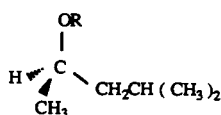
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ABSTRACT.—(R)-4-Methyl-2-pentyl acetate [1] is a major component of the essential oil from *Eucalyptus loxophleba*.

Eucalyptus loxophleba Benth. (Myrtaceae) (commonly known as York gum), is a small tree widely distributed throughout the southern half of Western Australia. The leaves and terminal branchlets afford a substantial yield of a steam-volatile oil with three predominant components. Two of these are the monoterpenoids α -pinene and 1,8-cineole, which are found in many *Eucalyptus* species (1). However, a major component of the oil, a substance with a shorter retention time on gc than either monoterpenoid, is not known to occur in other *Eucalyptus* species. We have identified this substance as (R)-4-methyl-2-pentyl acetate [1].

The new substance was isolated from the steam distillate by simple distillation followed by cc on alumina. Because of the volatility of the substance, some care was necessary to avoid its loss in the fractionation steps.

The mass spectrum of the substance showed only a very weak molecular ion (m/z 144), but ions corresponding to the loss of methyl (m/z 129) and butyl groups (m/z 87) and of CH_2CO (m/z 102) and MeCO_2H (m/z 84) were major contributors to the fragmentation pattern. Taken together with the interpretation of the ^1H -nmr (Table 1) and ^{13}C -nmr spectra (Experimental), this has shown that the substance constitutionally is 4-methyl-2-pentyl acetate. Hydrolysis of



1 R = Ac
2 R = H

the substance with an aqueous EtOH solution of KOH afforded the alcohol 2, which had ms and nmr spectra consistent with the assigned structure. Comparison of the hydrolysis product with a sample of 4-methyl-2-pentanol confirmed this identification.

4-Methyl-2-pentyl acetate and 4-methyl-2-pentanol have not been isolated previously from natural sources, but evidence has been obtained for the presence of 4-methyl-2-pentanol in two plant species of the family Solanaceae (2,3), in a bacterium (4) and in cocoa liquors (5). The racemic alcohol is also known from synthetic studies; it has been resolved to afford the dextrorotatory (6,7) and levorotatory (8) enantio-

TABLE 1. ^1H -nmr Spectral Data (300 MHz).

Proton	Compound	
	1 (CCl_4)	2 (CDCl_3)
H-1	1.17 (d)	1.18 (d)
H-2	4.91 (ddq)	3.89 (ddq)
H-3a	1.20 (ddd)	1.24 (ddd)
H-3b	1.39 (ddd)	1.41 (ddd)
H-4	1.62 (ddqq)	1.73 (ddqq)
H-5	0.90 (d)	0.91 (d)
Ac	0.91 (d)	0.92 (d)
Ac	1.95 (s)	
Coupling Constants (Hz)		
$J_{1,2}$	6.2	6.2
$J_{2,3a}$	5.1	5.0
$J_{2,3b}$	8.3	8.2
$J_{3a,4}$	7.8	7.8
$J_{3b,4}$	5.8	6.0
$J_{3a,3b}$	13.6	13.6
$J_{4,5}$	6.5	6.6

*Chemical Shift (δ , m).

mers. The latter enantiomer has also been obtained, apparently with incomplete optical purity, from reaction between isopropylmagnesium bromide and (+)-propylene oxide (9). The outcome of the latter stereospecific synthesis and correlations of optical rotations (10, 11) have allowed the two enantiomers to be assigned the *S* configuration and the *R* configuration, respectively (12).

Both the natural substance **1** from *E. loxophleba* and the hydrolysis product **2** were found to be optically active. The value of the specific rotation for the hydrolysis product (-18.4°) clearly establishes the two substances to have the *R* configuration as shown in the structures **1** and **2**.

EXPERIMENTAL

GENERAL EXPERIMENTAL PROCEDURES.—Nmr spectra were measured with a Brüker AM300 spectrometer at 300 MHz (^1H) and 75 MHz (^{13}C) using CCl_4 and CDCl_3 solutions with TMS as internal standard. Mass spectra were obtained using a Hewlett-Packard 5986 gc-ms system containing a 25 m capillary column with a methyl silicone packing which was kept at 60° for 1 min followed by a temperature rise of $10^\circ/\text{min}$; a 35 eV electron beam was used for ionization.

PLANT MATERIAL.—*E. loxophleba* leaves and terminal branchlets were collected near York, Western Australia, in September 1989. An herbarium specimen is deposited in the WA Herbarium, South Perth, Western Australia.

ISOLATION OF COMPOUND 1.—Fresh leaves and terminal branchlets of *E. loxophleba* (600 g) were subjected to exhaustive steam distillation. The two phases of the steam distillate were separated. The oily layer (6.3 g) showed major gc peaks at 2.57, 3.08, and 4.27 min and other minor peaks with longer retention times. The peaks with Rt 3.08 and 4.27 min were identified as α -pinene and 1,8-cineole, respectively, from their mass spectra (13) and from comparison of their Rt values with those of authentic samples.

The oil was distilled at 70 mm pressure to give fractions boiling at $80\text{--}82^\circ$ (2.6 g) and $84\text{--}88^\circ$ (1.4 g) and a pot residue (1.6 g). Gc analysis showed that the 1,8-cineole had been largely separated from the other two major substances. The ratio of compound **1** to α -pinene to 1,8-cineole for the respective fractions was 68:12:20, 48:7:45, and 1:0:99.

The first fraction was chromatographed on neutral alumina (70 g, freshly activated by heat-

ing at 150° under 25 mm pressure for 4 h). Elution of the column with pentane and with 2% Et_2O in pentane removed the α -pinene and the 1,8-cineole; the column was then stripped with Et_2O to remove compound **1**. This fraction showed a single peak on gc. Evaporation of the solvent gave compound **1** as a colorless mobile oil (0.1 g): $[\alpha]_D -21.8^\circ$ (CHCl_3 , $c = 2.0$); ms m/z (%) $[\text{M}]^+$ 144 (0.1), 129 (2), 102 (8), 87 (86), 84 (45), 69 (78), 61 (11), 58 (8), 57 (7), 43 (100); ^{13}C nmr (CCl_4) δ 20.45, 20.80, 22.28, 22.89 ($3 \times \text{Me}$), 45.15 (CH_2), 24.59, 68.26 ($2 \times \text{CH}$), 168.55 ($\text{C}=\text{O}$).

HYDROLYSIS.—The new compound **1** was treated with 5% KOH in $\text{EtOH-H}_2\text{O}$ (1:1) at room temperature for 24 h. The product **2** recovered by extraction into Et_2O gave a single gc peak (1.36 min) on the gc-ms instrument: $[\alpha]_D -18.4^\circ$ (EtOH , $c = 1.2$) [lit. (8) -20.8°]; ms m/z (%) 87 (14), 84 (12), 69 (25), 45 (100), 43 (24), 41 (22); ^{13}C nmr (CDCl_3) δ 22.30, 23.15, 23.98 ($3 \times \text{Me}$), 24.81, 66.17 ($2 \times \text{CH}$), 48.60 (CH_2). The gc-ms and ^1H -nmr characteristics of this substance were identical with those of an authentic sample of 4-methyl-2-pentanol.

ACKNOWLEDGMENTS

We thank Dr. A.F.M. Barton for making available copies of gc traces of leaf extracts of many *Eucalyptus* species, and Mr. M.I.H. Brooker for drawing our attention to the hitherto unidentified peak from *E. loxophleba*.

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Received 10 July 1990

NOTE ADDED IN PROOF: Since submitting this paper, we have found compound **1** also in *Eucalyptus micranthera* F. Muell. ex Benth.