Tetrahedron Letters No.40, pp. 4905-4907, 1966. Pergamon Press Ltd.
Printed in Great Britain.

THE SYNTHESIS AND ABSOLUTE CONFIGURATION OF LABALLENIC ACID

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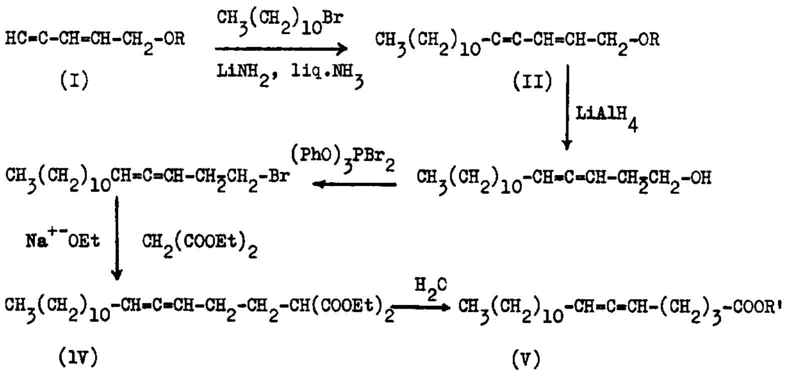
(Received 1 August 1966)

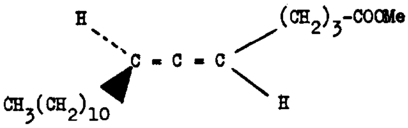
Esters of Laballenic acid, a new optically active eighteen carbon allenic acid, were isolated from the seed oil of Leonitis nepetaefolia, L. (R.Br.) of the family of Labiatae. First believed to be the allenic cyclopropane carboxylic acid, 2,3-methylene-heptadeca-4,5-dienoic acid[1], it has recently been shown to be octadeca-5,6-dienoic acid[2]. We have synthesised octadeca-5,6-dienoic acid by the following method:-

1-Tetrahydropyranyloxypent-2-en-4-yne (I) with lithium in liquid ammonia and n-undecyl bromide gave 1-tetrahydropyranyloxy-hexadec-2-en-4-yne (II, R = OC_6H_9) which was hydrolysed to hexadec-2-en-4-yn-1-ol (II, R = H). This was reduced with lithium aluminium hydride[3] to give hexadeca-3,4-dien-1-ol (III) which was converted to the corresponding bromide by the triphenylphosphite-dibromide method[4]. 1-Bromohexadeca-3,4-diene and diethyl malonate gave the hexadeca-3,4-dienylmalonic ester (IV) which was hydrolysed and decarboxylated to give laballenic acid (V, R' = H), ν_{max} 3500-3200 (broad), 1960 m, 1730 s cm^{-1}; p-bromophenacyl laballenate, m.p. 46-46.5°(lit.[2] m.p. 47-47.5°); methyl ester (V, R'=Me) b.p. 144-146°/$5x10^{-2}$mm., ν_{max} 1750 s, 1960 m cm^{-1}, g.l.c. using silicon oil at 176°, N_2 1.6 $l.hr^{-1}$ gave one component at t 74 min.



$$\begin{tikzcd}
\underset{(I)}{HC{=}C\text{-}CH{=}CH\text{-}CH_2\text{-}OR} \arrow[r, "CH_3(CH_2)_{10}Br", "LiNH_2,\ liq.NH_3"'] & \underset{(II)}{CH_3(CH_2)_{10}\text{-}C{=}C\text{-}CH{=}CH\text{-}CH_2\text{-}OR} \arrow[d, "LiAlH_4"] \\
CH_3(CH_2)_{10}CH{=}C{=}CH\text{-}CH_2CH_2\text{-}Br \arrow[d, "CH_2(COOEt)_2", "Na^{+-}OEt"'] & CH_3(CH_2)_{10}\text{-}CH{=}C{=}CH\text{-}CH_2CH_2\text{-}OH \arrow[l, "(PhO)_3PBr_2"'] \\
\underset{(IV)}{CH_3(CH_2)_{10}\text{-}CH{=}C{=}CH\text{-}CH_2\text{-}CH_2\text{-}CH(COOEt)_2} \arrow[r, "H_2O"] & \underset{(V)}{CH_3(CH_2)_{10}\text{-}CH{=}C{=}CH\text{-}(CH_2)_3\text{-}COOR'}
\end{tikzcd}$$

When (II, R = H) was reduced with lithium aluminium hydride-3-O-benzyl-1,2-cyclohexylidene-α-D-glucofuranose complex[5], (-)-hexadeca-3,4-dien-1-ol, $[\alpha]_D^{20}$-4.4° was obtained. It has been shown[6] that reduction of 2-en-4-yn-1-ols with this complex gives allenic alcohols of the (R)-configuration, and (-)-hexadeca-3,4-dien-1-ol must therefore be the (R)-form (VI). Conversion via the bromide to the malonic ester (IV) and hydrolysis and decarboxylation gave (-)-laballenic acid (V) $[\alpha]_D^{20}$-3.0° and the (-)-methyl ester $[\alpha]_D^{20}$-3.0°, and this therefore has the (R)-configuration.



(VI)

(R)-(-) laballenic acid

As the methyl ester from the naturally occuring laballenic acid is described as having $[\alpha]_D^{20} - 47.3^\circ$ it must have the (R)-configuration.

Acknowledgments. We thank Parke-Davis for a Research Fellowship (to N.P.).

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