

Geraniol and Nerol in Organic Synthesis. Useful Intermediates for the Synthesis of C₁₇-Juvenile Hormone

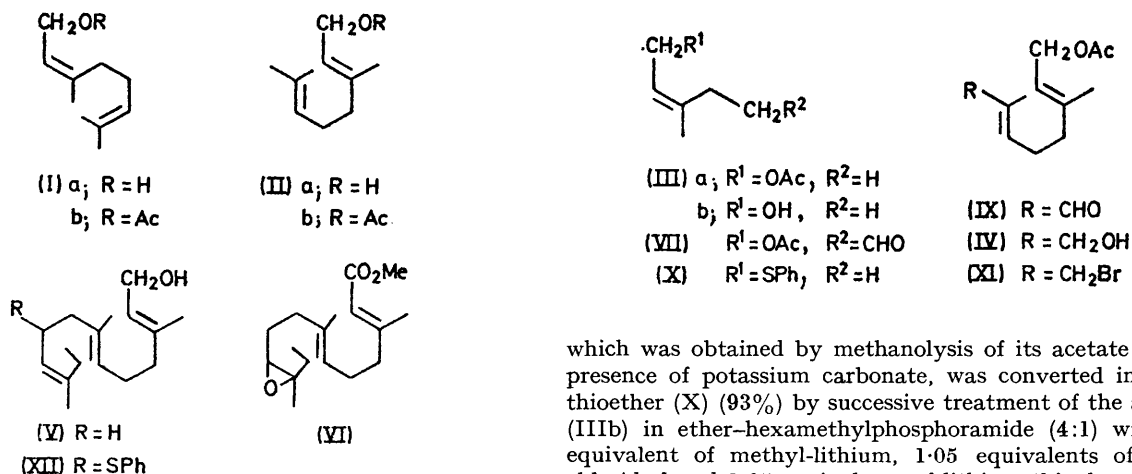
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Summary Nerol and geraniol have been utilized for the convenient preparation of 3-methyl-*cis*-pent-2-en-1-ol and 8-acetoxy-2,6-dimethyl-*trans,trans*-octa-2,6-dien-1-ol respectively, which represent useful intermediates for the construction of C₁₇-juvenile hormone.

MANY naturally occurring systems have either *cis*- or *trans*-trisubstituted double bonds in which one of the substituents is a methyl group (*cf.* VI). The importance of these systems in the synthesis of polyisoprenoids has led to a number of new methods for the construction of trisubstituted olefins which exhibit very high stereoselectivity.¹

a different route. The decarbonylation takes place under mild conditions in high yield with preservation of configuration about the olefinic bond and stoichiometric formation of (PPh₃)₂(CO)RhCl. A convenient method⁴ for the regeneration of (PPh₃)₃RhCl has recently been reported making decarbonylations a more useful and attractive synthetic reaction. That the double bond present in (IIIa) did not undergo isomerization was demonstrated by treating the aldehyde² obtained by ozonolysis of geranyl acetate with (PPh₃)₃RhCl and showing that the product obtained has a retention time on g.l.c. which was different than that observed for its geometrical isomer (IIIa). The alcohol (IIIb)



Ozonolysis of neryl acetate (Ib) at -78° in CH₂Cl₂ followed by treatment with Me₂S gave (VII)² (*ca.* 60%) [b.p. 82° (0.5 mm); ν_{\max} CO (CHCl₃) 1698 cm⁻¹; δ (CCl₄) 9.58 p.p.m. (t, 1H); $R_f = 0.32$ (hexane-ether, 2:1)]. When (VII) was treated with an equimolar amount of (PPh₃)₃RhCl,³ in either C₆H₆ or CH₂Cl₂ at room temperature for 24 h, (IIIa) was produced (70%) [ν_{\max} CO (CHCl₃) 1730 cm⁻¹; δ (CHCl₃) 1.00 p.p.m. (t, 3H)]. The acetate (IIIa) was further identified by comparison with an authentic sample prepared by

which was obtained by methanolysis of its acetate in the presence of potassium carbonate, was converted into the thioether (X) (93%) by successive treatment of the alcohol (IIIb) in ether-hexamethylphosphoramide (4:1) with 1.0 equivalent of methyl-lithium, 1.05 equivalents of tosyl chloride,⁵ and 1.05 equivalents of lithium thiophenoxide.⁶

Specific functionalisation of the isopropylidene terminus of geranyl acetate (Ib) was achieved by selenium dioxide oxidation⁷ to the aldehyde (IX) [ν_{\max} (CHCl₃) 1727 (OAc), 1681 (CHO), 1645 (C=C) cm⁻¹; δ (CCl₄) 9.28 p.p.m. (s, 1H); $R_f = 0.70$ (benzene-ether, 2:1)] followed by reduction with sodium borohydride in 95% ethanol at 0° to the desired all *trans* allylic alcohol (IV) [$R_f = 0.44$ (benzene-ether, 2:1)] in 40% overall yield from (Ib). Conversion of (IV) into the allylic bromide (XI) [δ (CCl₄) 3.90 (s, 2H), 5.30 (t, 1H),

5.52 (t, 1H); $R_f = 0.75$ (benzene-ether, 4:1)] was achieved in 90% yield using PBr_3 in ether at 0° .

The allylic bromide (XI) and the thioether (X) constitute respectively the right- and left-hand portions of the C_{17} -juvenile hormone molecule (VI).^{6,8} These two fragments were combined by alkylation^{6,9} of the anion of the thioether (X) at -78° in tetrahydrofuran with the bromide (XI), thus avoiding the use of any complex trisubstituted olefin synthesis and featuring positional and stereochemical control. Conversion of alcohol (XII) into C_{17} -juvenile hormone in-

volving reductive cleavage of the thioether^{6,9,10} function and oxidation to triene-carboxylic ester¹¹ followed by selective terminal epoxidation¹² have already been described.†

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† All new compounds had satisfactory analytical and/or spectral data.

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