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SELECTIVE SYNTHESES OF DENDROLASIN AND SESQUIROSEFURAN BY THE COUPLING OF 3-FURYLMETHYLMAGNESIUM BROMIDE WITH GERANYL DIETHYL PHOSPHATE

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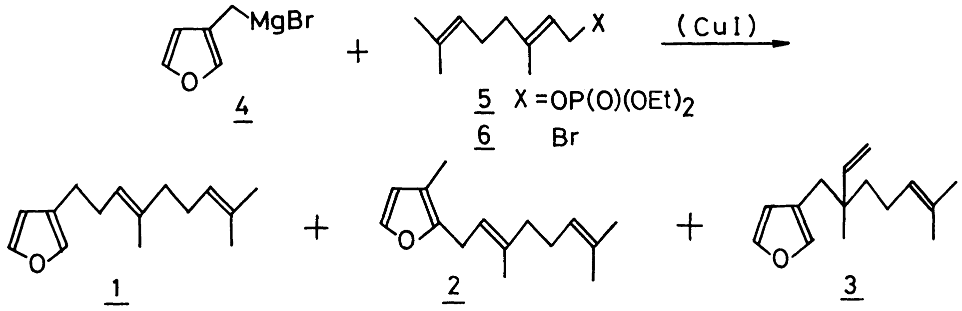
Coupling reaction of 3-furylmethylmagnesium bromide with geranyl diethyl phosphate in the presence and the absence of copper(I) iodide affords dendrolasin and sesquirosefuran, respectively, in ca. 80 % selectivity.

Dendrolasin (1), isolated from the ant Lasius (Dendrolasius) fuliginosus Latr.1) and from the oil of Torreya nucifera Sieb. & Zucc.,2) is a typical example of 3-substituted furanoid terpenes, and sesquirosefuran (2) is a constituent of the leaves of Actinodaphne longifolia (Blume) Nakai.3) These two isomeric sesquiterpenes have been synthesized in various methods.4) However there have been no studies reporting the syntheses of both 1 and 2 by the regioselective geranylation of a 3-methylfuran system. Now we wish to describe the reaction of 3-furylmethylmagnesium bromide (4) with geranyl diethyl phosphate (5) which, in the presence of copper(I) iodide, affords 1, whereas in the absence of the catalyst gives 2, both in ca. 80 % selectivity.



To a solution of 4, prepared from magnesium and 3-furylmethyl bromide5) in tetrahydrofuran, was added geranyl phosphate 5 at -78° and the mixture was allowed to stand overnight at room temperature. Usual work-up followed by distillation (bp 130°/3 Torr) gave an oil, which was revealed by glc to consist of three components (1, 2 and 3) in the ratio of 16:77:7. The main product 2 was isolated by preparative glc and identified as sesquirosefuran by the spectroscopic data.6) The minor components, 1 and 3, were assigned as dendrolasin and 3-(2,6-dimethyl-2-vinyl-5-heptenyl)furan, respectively.6) This unique behavior of the Grignard reagent 4 is consistent with the observations of Sherman and Amstutz7) who examined the reactions of 3-furylmethylmagnesium chloride with carbon dioxide and formaldehyde leading to 3-methyl-2-furoic acid and 3-methyl-2-furfuryl alcohol, respectively.

When the reaction of 4 with 5 was conducted in the presence of a catalytic amount of copper(I) iodide, dendrolasin 1 formed in 79 % selectivity accompanied by 21 % of the regioisomer 3, in the total yield of 81 %. They could be readily separated from each other by glc. No trace of 2 was detected in this catalytic reaction. As shown in Table, the use of geranyl bromide instead of the phosphate 5 caused the apparent lowering in the selectivity, especially in the noncatalytic reaction.8)

By the use of prenyl phosphate in the place of 5, perillen and rosefuran, the monoterpene homologs of 1 and 2, should be possible to be selectively prepared by the present process. Full details will be reported soon.

Table. Grignard reaction of 4 with geranyl phosphate 5 and bromide 6 in the presence and the absence of copper(I) iodide

X		CuI	product ratio 1 : 2 : 3	total yield
OP(O)(OEt)$_2$	(5)	absence	16 : 77 : 7	83 %
"		presence	79 : 0 : 21	81
Br	(6)	absence	22 : 45 : 32	82
"		presence	68 : 6 : 25	83

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6) ^{1}H-nmr and ir data of 1 and 2 were in good agreement with literature values.4) The structure of 3 was confirmed by the following spectra: ^{1}H-nmr(CCl$_4$) δ 7.20 (m,1H,furan),7.08(s,1H,furan),6.13(m,1H,furan),5.73(dd,J=17,11Hz,CH$_2$=C$\underline{H}$-),5.2-4.5(m,3H,olefin),2.31(s,2H,ring-CH$_2$),2.2-1.0(m,4H,CH$_2$),1.60(s,3H,CH$_3$),1.51(s,3H, CH$_3$),0.91(s,3H,CH$_3$); ir(neat) 2930,1640,1520,1454,1416,1376,1168,1069,1028,1002, 912,872,786, and 732 cm^{-1}; MS(20eV) m/e(rel. intensity) 218(22,M$^+$),69(100).

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