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Note

Simple synthesis of karahanaenone

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Karahanaenone **1** has been prepared from linalool **3**. Linalool **3** is cyclized to the corresponding tetrahydrofuran-type cyclic ethers **4a-c** on treatment with PhSeCl, *N*-bromosuccinimide, and 3-chloroperbenzoic acid, respectively. **4a-c** on further treatment with various reagents, provide allylic cyclic ether **6** which is converted to **1** *via* **2**.

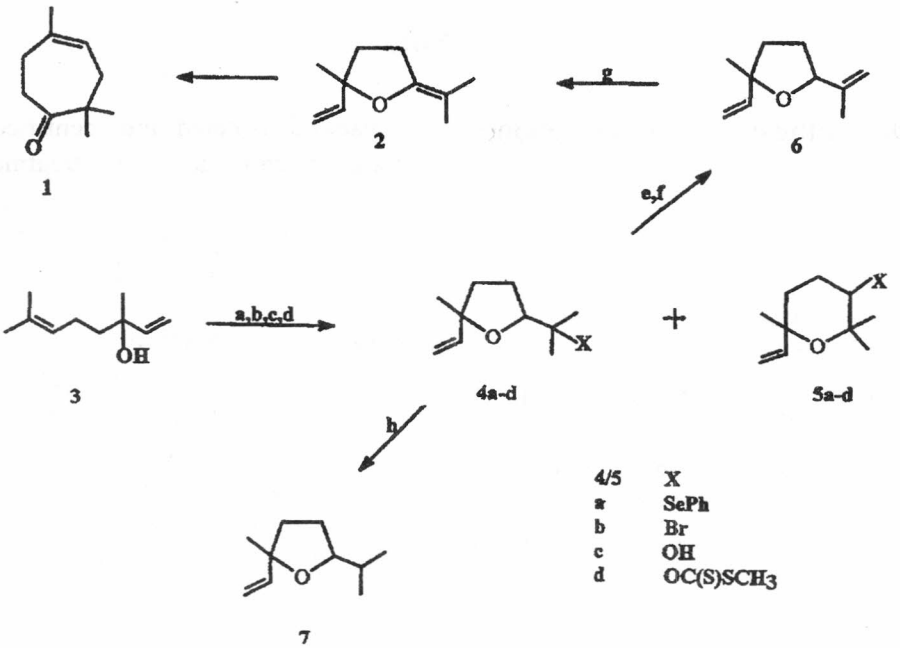
Karahanaenone (2,2,5-trimethyl-4-cyclohepten-1-one) **1** has been synthesized by a number of investigators[1,2]. As far as a convenient precursor of **1** is concerned, enolether **2** is promising, because Claisen rearrangement of **2** would provide **1**. On this basis, the question to be solved is how to get **2** by a simple synthetic route. Herein we describe a selective preparation of cyclic ethers **4a**, **4b**, and **4c** from linalool **3** and the efficient transformation of these ethers to **1** *via* **6** and **2** (c.f. Scheme I). As a result of intramolecular cyclization of linalool **3** by means of some electrophilic reagents (PhSeCl[3-5], *N*-bromosuccinimide[2,6], and 3-chloroperbenzoic acid[7,8], respectively) the corresponding substituted five-membered and six-membered cyclic ethers were obtained. It was found that the reactions of linalool **3** with these electrophilic reagents afford the tetrahydrofuran derivatives **4a-c** as the main products, accompanied by a small amount of the tetrahydropyran derivatives **5a-c**. The produced five-membered and six-membered cyclic ethers (**4a-c** and **5a-c**, respectively) were separated, isolated and identified on the basis of their spectral data. On treatment with various reagents, the cyclic ethers **4a**, **4b**, and **4c**, respectively, provided allylic cyclic ether **6** which was converted to **1** *via* **2**.

Experimental Section

The reaction with PhSeCl was performed at –78°C in methylene chloride under experimental conditions described earlier[3], and the produced cyclic phenyl selenoethers were isolated by column chromatography. The reaction of linalool **3** with PhSeCl at -78°C affords the corresponding five-membered cyclic ether 5-ethenyl-5-methyl-2-[1-methyl-1-(phenylseleno)ethyl]tetrahydrofuran **4a**, as the main product, accompanied by a small amount of the six-membered cyclic ether 6-ethenyl-2, 2, 6-trimethyl-3-(phenylseleno)tetrahydropyran **5a** (in a ratio of 91:9)[3]. Oxidation[4,5] of phenyl selenoether **4a** with hydrogen peroxide (1.5 equivalent) in THF at 0-25°C leads after 24 hr at 25°C to the allylic ether **6** (85%). In order to revail the structure of **4a**, the **4a/5a** mixture was reduced with tributyl tin hydride[4] in the presence of azoisobutyronitrile as catalyst. The only products isolated from this reaction were *cis*- and *trans*-2-methyl-2-ethenyl-5-isopropyltetrahydrofuran (*cis*- and *trans*-**7**), which were separated by preparative GC and identified on the basis of their spectral data[10].

The reaction of linalool **1** and *N*-bromosuccinimide[2,6] in CCl_4 at room temperature afforded a mixture of 5-ethenyl-5-methyl-2-(1-methyl-1-bromoethyl)-tetrahydrofuran **4b** and 6-ethenyl-2, 2, 6-trimethyl-3-bromotetrahydropyran **5b**, in which **4b** predominates (90:10). The mixture was separated by column chromatography on silica gel. **4b** on treatment with refluxing collidine yielded the intermediate allyl vinyl ether **6**, which immediately rearranged to 2, 2, 5-trimethyl-4-cyclohepten-1-one **1**. It was demonstrated that the collidine-promoted dehydrobromination of **4b** leads to **1**, most likely by way of **2**.

The reaction of linalool **3** with 3-chloroperbenzoic acid[7-9] was performed in methylene chlo-



a) $PhSeCl$, CH_2Cl_2, - 78 °C; b) NBS, CCl_4, RT; c) 3-Chloroperbenzoic acid, CH_2Cl_2, RT; d) NaH, CS_2, THF; e) Collidine,110 °C; f) 200 °C; g) $RhCl_3$, RT; h) Bu_3SnH, toluene, 110 °C

Scheme I

ride by stirring a mixture of **3**, peracid and solvent for 2 hr at 0°C and 22 hr at room temperature, followed by usual work-up. Linalool **3** was converted almost exclusively into the corresponding five-membered cyclic hydroxy ether, 5-ethenyl-5-methyl-2-(1-methyl-1-hydroxyethyl) tetrahydrofuran **4c** which was accompanied with a small amount of six-membered cyclic ether 6-ethenyl-2, 2, 6-trimethyl-3-hydroxytetrahydropyran **5c**. The obtained **4c/5c** mixture was separated and the isolated products **4c** and **5c** were identified on the basis of their spectral data. By using the reported procedure[2] the alcohol **4c** was converted to the corresponding xanthate derivative **4d** whose thermolysis at 200°C provided **6**. Rhodium trichloride catalyzed isomerization of the double bond of **6** to the tetrasubstituted double bond of **2** led to **1**.

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