

SHORT COMMUNICATIONS

Derivatives of 1,1,2,2-Tetraaminoethane. Condensation of 1,2-Diacetoxy-1,2-bis(ethoxycarbonylamino)ethane and 1-Acetoxy-1,2,2-tris(ethoxycarbonylamino)ethane with Nitrogen-Containing Nucleophiles

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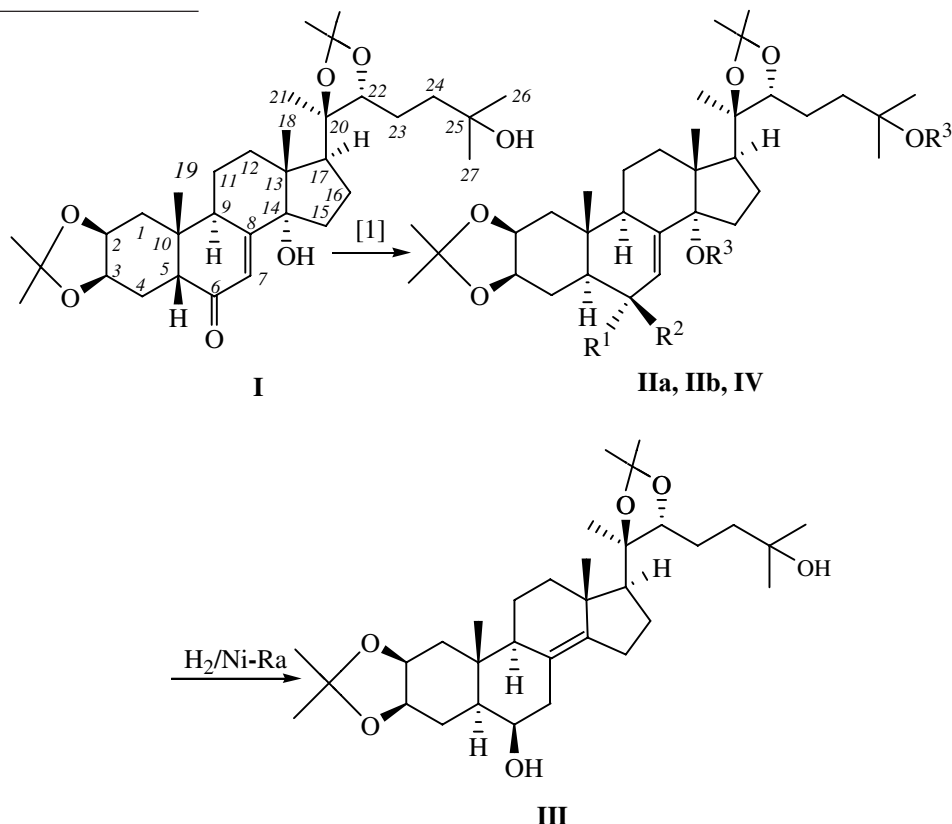
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We reported on stereochemistry of reduction of the 6-oxo group in derivatives of 20-hydroxyecdysone by complex alkali metal hydrides [1]. The reaction was accompanied by epimerization at the C⁵ atom, and the 20-hydroxyecdysone diacetone (I) was converted into

a mixture of 6 α - (IIa) and 6 β - (IIb) epimeric alcohols of the 5 α -series (IIa:IIb $\approx$ 1:2). We attempted to convert allyl alcohols IIa and IIb into 7,8-dihydroanalogs by catalytic hydrogenation. However their hydrogenation in ethanol over Raney nickel occurred with elimination of



II, R¹ = OH (a), H (b), R² = H (a), OH (b), R³ = H (a), H (b); IV, R¹ and R² = OH, H or H, OH, R³ = SiMe₃

the 14 α -hydroxy group and with a shift of the Δ^7 -bond into the 8(14) position. It turned out that only 6 β -epimer from the mixture of alcohols **IIa** and **IIb** was hydrogenated, and 6 α -epimer **IIa** was recovered intact. In accordance with this fact individual 6 β -alcohol **IIb** under the same conditions cleanly converted into 6 β -hydroxy- $\Delta^{8,14}$ -derivative **III**, whereas individual 6 α -alcohol **IIa** was not involved into the reaction. Passivity of 6 α -alcohol **IIa** in this hydrogenolysis reaction may be due [2] to the hindrance of the metal (Ni) approach to the oxygen of the 14 α -hydroxy group by the contiguous 6 α -hydroxy group of the initial alcohol.

When the 14-hydroxy group was protected, the hydrogenolysis did not proceed, and under the used hydrogenation conditions the mixture of 6 α - and 6 β -epimers of 14 α ,25-bis-(trimethylsilyl) ethers **IV** (prepared according to procedure [1]) returned intact.

The presence in compound **III** of a tetrasubstituted double bond was derived from the appearance in the ^{13}C NMR spectrum recorded in JMOD mode of singlet signals of C_{sp^2} atoms (δ 123.0 and 144.6 ppm) instead of a doublet (δ 120.0 ppm) and a singlet (δ 143.3 ppm) signals in the spectrum of initial compound **IIb**. The sole doublet signal of C^6 atom (δ 71.8 ppm) indicates the β -orientation of the hydroxy groups at the C^6 atom (cf. [1]: δ 66.3 and 70.0 ppm for epimers **IIa** and **IIb** respectively). The doublet of C^5 atom in the ^{13}C NMR spectrum of compound **III** in the region δ 44.5 ppm confirms the α -orientation of the hydrogen attached to C^5 [1]. Thus in the course of hydrogenation on Raney nickel of 6-dihydro-5 α -20-hydroxyecdysones occurs a stereoselective hydrogenolysis of the 6 β -epimeric alcohol at the 14 α -hydroxy group accompanied by the shift of the Δ^7 -bond in the direction of the departing hydroxy group.

(20R,22R)-2 β ,3 β :20,22-Bis(isopropylidene-dioxy)-6 β ,25-dihydroxy-5 α -cholest-8(14)-ene (III).

a. Through a dispersion of 0.226 g (0.4 mmol) of alcohol **IIb** {mp 125–127°C, $[\alpha]_D^{24}$ 8.4° (*c* 2.97, CHCl_3), prepared by procedure from [1]}, 0.15 g of Raney nickel, and 7 ml of ethanol was passed hydrogen at room temperature (~40 h, TLC monitoring), then the catalyst was filtered off, the filtrate was evaporated, and the residue was subjected to column chromatography (10 g of SiO_2 , eluent CHCl_3 –MeOH, 20:1). We isolated 0.115 g of initial β -epimer **IIb**, R_f 0.61 (CHCl_3 –MeOH, 10:1) and 0.10 g (45%) of compound **III**, R_f 0.33, (CHCl_3 –MeOH, 10:1).

Compound **III**, mp 106–108°C, $[\alpha]_D^{20}$ 1.7° (*c* 2.5, CHCl_3). ^1H NMR spectrum, δ , ppm: 0.99 s (3H, H_3C^{18}),

1.02 s (3H, H_3C^{19}), 1.17 s (3H, H_3C^{21}), 1.22 s (6H, H_3C^{26} , H_3C^{27}), 1.30 s, 1.32 s, 1.41 s and 1.50 s (12H, Me_2C), 1.51–2.28 m (20H, CH, CH_2), 2.39 d.d (1H, HC^{17} , J 4.2 and 16.0 Hz), 3.64 d.t (1H, HC^6 , J 5.2 and 9.5 Hz), 3.78 d.d (1H, HC^{22} , J 2.0 and 8.8 Hz), 4.25–4.33 m (2H, HC^2 , HC^3). ^{13}C NMR spectrum, δ , ppm: 19.8 q, 19.8 t, 21.9 q, 22.7 t, 23.8 t, 24.6 q, 24.8 t, 26.5 q, 26.7 q, 27.1 q, 28.9 q, 29.1 q and 29.6 q, 28.9 t, 34.6 t, 35.8 s, 37.3 s, 37.5 t, 39.6 d, 41.4 t, 43.6 t, 44.5 d, 55.4 d, 70.3 s, 71.8 d, 72.3 d, 72.4 d, 81.7 d, 84.1 s 106.9 s, 107.3 s, 123.0 s, 144.6 s.

b. Through a dispersion of 0.16 g (0.28 mmol) of alcohols mixture **IIa** and **IIb** (**IIa:IIb** $\approx$ 1:2, prepared by method [1]), 0.1 g of Raney nickel, and 5 ml of ethanol was passed hydrogen at room temperature (~40 h, TLC monitoring), then the catalyst was filtered off, the filtrate was evaporated, and the residue was subjected to column chromatography (6 g of SiO_2 , eluent CHCl_3 –MeOH, 20:1). We obtained 0.057 g of β -epimer **IIb** and 0.047 g of α -epimer **IIa**, R_f 0.61 and 0.52 respectively (CHCl_3 –MeOH, 10:1), spectral characteristics identical to the published ones [1], and 0.045 g (43% calculated on β -epimer **IIb** in the initials mixture of alcohols **IIa** and **IIb**) of compound **III**, R_f 0.33 (CHCl_3 –MeOH, 10:1), ^1H and ^{13}C spectra identical to those of obtained in the experiment *a*.

^1H and ^{13}C NMR spectra were registered on a spectrometer Bruker AM-300 (operating frequencies 300.13 and 75.46 MHz respectively) from solutions in CDCl_3 . Chemical shifts were measured from internal reference TMS. Melting point was estimated on a Boëtius heating block. The specific rotation was measured on a polarimeter Perkin-Elmer 141. TLC was carried out on Silufol plates, development with ethanol solution of vanillin acidified with sulfuric acid.

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