GLYCOSYLATION OF CARDENOLIDES

I. METHYL ESTER OF STROPHANTHIDIN 3β-GALACTOSIDURONIC ACID

N. Sh. Pal'yants, M. B. Gorovits, and N. K. Abubakirov

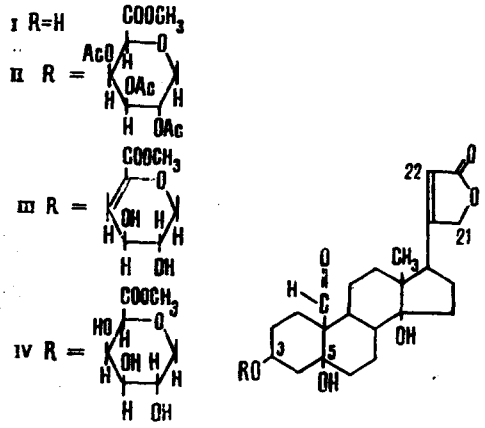
UDC 547.918:547.926

Uronic acid glycosides of cardenolides are considered as possible metabolites of cardiac glycosides in the organism [1].

The synthesis of the methyl ester of strophanthidin galactosiduronic acid (XIV) has been performed by the Koenigs–Knorr method [2]. The reaction of methyl 2,3,4-tri-O-acetyl-1-bromo-1-deoxy-α-D-galacturonate [3] with strophanthidin (I) gave a 66.6% yield of methyl strophanthidin 3β-O-2',3',4'-tri-O-acetyl-β-D-galactosiduronate (II), $C_{36}H_{48}O_{15}$, crystals from ethanol with mp 254-255°C (decomp.), $[\alpha]_D^{22}+28.9 \pm 3°$ (c 0.99; chloroform); $\lambda_{max}^{C_2H_5OH}$ 215 nm (log ε 4.18); ν_{max}^{KBr} 3520 (OH), 1750-1760 (C≡O group), 1630 (double bond of a butenolide), 1225 cm^{-1} (C–O–C). NMR spectrum of (II) ($CDCl_3$, ppm): 0.79 (3 H at C_{18}, s), 1.92-2.07 (9 H in 3 Ac), 3.69 (3 H in OCH_3, s), 4.20 (H at $C_{5'}$), 4.36 (H at C_3, m), 4.65 (H at $C_{1'}$, d, J = 7 Hz – β configuration of the glycosidic bond [4]), 4.85 (2 H at C_{21}, q), 5.05-5.25 (2 H at $C_{2'}$ and $C_{3'}$, m), 5.68 (H at $C_{4'}$, m), and 5.85 (H at C_{22}, s).

The saponification of the triacetate (II) with a catalytic amount of sodium methoxide in absolute methanol gave two amorphous products (III) and (IV) with R_f 0.30 and 0.14, respectively [TLC, SiO_2, benzene–chloroform–methanol (5 : 5 : 2)].

The less polar compound (III) had $[\alpha]_D^{22}-3.0 \pm 3°$ (c 1.31; methanol); $\lambda_{max}^{CH_2H_5OH}$ 220 nm (log ε 4.33). The presence in the IR spectrum of an absorption band at 1650 cm^{-1} ($CH_3OC\overset{O}{C}OC=C$) and in the NMR spectrum (C_5D_5N) of a signal at 6.41 ppm assigned to a proton on the double bond at $C_{4'}$ (d, J = 3 Hz) [5] shows that under the action of CH_3ONa a molecule of water is split out from compound (II) [6] with the formation of methyl strophanthidin 3β-O-$\Delta^{4',5'}$-β-D-galactosiduronate (III), $C_{30}H_{40}O_{11}$.



Compound (IV) is methyl strophanthidin 3β-O-β-D-galactosiduronate, $C_{30}H_{42}O_{12}$, $[\alpha]_D^{22}-2.6° \pm 3°$ (c 1.29; methanol), $\lambda_{max}^{C_2H_5OH}$ 216 nm (log ε 4.20). NMR spectrum (C_5D_5N): 0.84 (3 H at C_{18}, s), 3.65 (3 H in OCH_3, s), 4.15 (H at C_3, m), 5.05 (2 H at C_{21}, q), 5.95 (H at C_{22}, s), 10.15 (H at C_{19}, s). This is confirmed by the fact that the acetylation of (IV) with acetic anhydride in pyridine gave a crystalline substance identical with respect to its mp, specific rotation, and R_f value with compound (II).

Institute of the Chemistry of Plant Substances, Academy of Sciences of the Uzbek SSR. Translated from Khimiya Prirodnykh Soedinenii, No. 2, pp. 263-264, March-April, 1975. Original article submitted July 8, 1974.

The NMR spectra were taken on a JNM-4H-100 instrument (100 MHz, HMDS, δ, ppm).

When solutions of compounds (III) and (IV) were introduced into the femoral lymph sac of the frog, they had activities of 23,300 and 16,600 frog units per gram of preparation, respectively.

LITERATURE CITED

1. J. Herrmann and K. Repke, Arch. Exp. Path. Pharmak., 248, 370 (1964).
2. W. Koenigs and E. Knorr, Ber., 34, 957 (1901).
3. S. Morell, L. Baur, and K. P. Link, J. Biol. Chem., 110, 719 (1935).
4. M. Mamsui and M. Okada, Chem. Pharm. Bull., 19, 395 (1971).
5. H. Hashimoto, T. Sekiyama, H. Saka, and J. Yoshimura, Bull. Chem. Soc. Japan, 44, 235 (1971).
6. P. Heim and H. Neukom, Helv. Chim. Acta, 45, 1735, 1737 (1962).