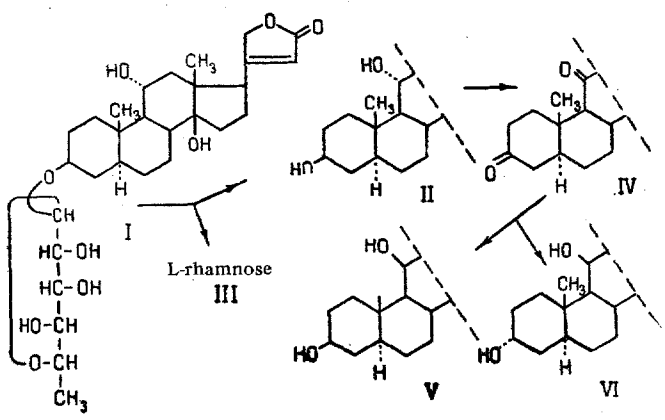
The presence of alcohol groups at C_3 and C_{14}, a butenolide ring at C_{17}, and their β-configuration in alliotoxigenin is is obligatory for cardiotonically active cardenolides. Under the action of Jensen's reagent, the aglycone fluoresces yellow in UV light. This confirms the normal β-position of the butenolide ring and, in addition, shows the absence of OH groups at C_{12} and C_{16} [2,3]. By acetylating the aglycone (II) with acetic anhydride in pyridine and analyzing the course of the reaction by a published method [4], we have established that it forms a diacetate and that both the OH groups acetylated are secondary and equatorial. One of them is obviously located at C_3. The presence of an equatorial β-OH group at C_3 simultaneously shows the trans-linkage of rings A and B.



The further study of alliotoxigenin reduced to the determination of the position of the second equatorial OH group. Alliotoxigenin is not oxidized by sodium metaperiodate (test for a 1,2-glycol group). Consequently, the presence in it of an OH group at C_2, C_4, or C_{15} is excluded. In order to show the presence or absence of an OH group in the α-position, we attempted to convert alliotoxigenin into the known aglycone mallogenin [5], making use of the circumstance that the reduction of 11-oxocardenolides leads to the stereo-specific formation of 11β-hydroxy derivatives [5]. For this purpose, 6 mg of the aglycone (II) was oxidized with chromic anhydride. The oxidized cardenolide (IV), with mp 281–285° C, was reduced with sodium borohydride. Of the two reaction products, the main one was obtained in the pure state with mp 263–270° C. A mixed melting point, paper chromatography, reaction with concentrated H_2SO_4, and the formation of the monoacetate [4] showed that the compound obtained was identical with mallogenin (V) (a sample of the latter was kindly given to us by Prof. T. Reichstein). The conversion of alliotoxigenin into mallogenin confirms the presence of an OH group in position 11 and structure II.

Thus, alliotoxigenin is the new cardiac aglycone 3β,11α,14β-trihydroxy-5α-H-card-20(22)-enolide. The monosaccharide of alliotoxin was identified by paper chromatography as L-rhamnose.

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STRUCTURE OF ALLISIDE

I. F. Makarevich and D. G. Kolesnikov

Khimiya Prirodnykh Soedinenii, Vol. 5, No. 3, pp. 190–191, 1969

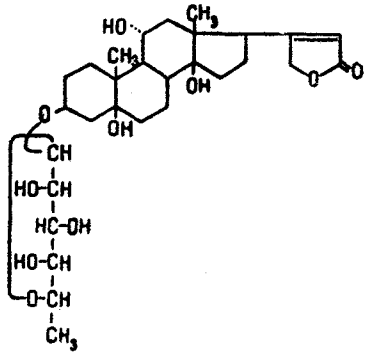
It has been reported previously [1] that a new cardiac glycoside, alliside, with the composition $C_{29}H_{44}O_{10}$ has been isolated from the seeds of Cheiranthus allioni Hort. Alliside possesses a comparatively high biological activity (0.157 mg/kg body weight in the cat), as has been shown by N. A. Kisten. On hydrolyzing this glycoside by the Mannich-Siewert method [2] we obtained the aglycone and a monosaccharide.

The aglycone crystallizes from acetone and ethanol; it has a double mp—232–235° C/294–301° C, $[\alpha]_D^{23}$ + 29, 3 ± 3° (c 1.0; methanol). UV spectrum: $\lambda_{max}^{ethanol}$ 217 mμ (log ε 4.20), and it dissolves in 84% H_2SO_4 giving a coloration changing with time: 1 min, yellow-orange; 25 min, violet; 140 min, lilac.

Found, %: C 68.32; H 8.61; mol. wt. 410 (spectroscopic method). Calculated for $C_{23}H_{34}O_6$, %: 67.95; H 8.43; mol. wt. 406.5.

Among the known cardiac aglycones with the composition $C_{23}H_{34}O_6$, the closest in properties to that described is the comparatively rarely found bipindogenin [3]. The results of a direct comparison (chromatography and IR spectra, taken by I. P. Kovalev) of the aglycone from alliside with bipindogenin (a sample of the latter was kindly supplied to us by N. F. Komissarenko) shows their identity.

The monosaccharide of alliside forms a phenylosazone melting at 180–182° C, $[\alpha]_D^{24}$ + 48.8 ± 6° (c 0.42; ethanol). The phenylosazone of the monosaccharide, as the result of a mixed melting point test, paper chromatography, and the IR spectrum shows, is identical with the phenylosazone of L-rhamnose. Nevertheless, the monosaccharide obtained is not L-rhamnose, as is shown by paper chromatography. This permits the assumption that the monosaccharide of alliside is 6-deoxy-L-glucose, which differs from L-rhamnose only by the configuration at C_2 and must give the same phenylosazone as L-rhamnose. On a direct comparison by paper chromatography of the monosaccharide and 6-deoxy-L-glucose (obtained by the demethylation of L-thevetose), their identity was established.



An analysis of the molecular rotations of the glycoside and the aglycone in accordance with Kline's rule [4] showed that the 6-deoxy-L-glucose (L-glucomethylose) is attached by an α-glycosidic bond. Thus, alliside is bipindogenin 3-α-L-glucomethyloside. This is apparently the first time that 6-deoxy-L-glucose has been found in cardiac glycosides.

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NEW DIGOXIGENIN GLYCOSIDES

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We have previously reported the synthesis of digoxigenin 3-α-L-rhamnose [1]. In the same work it was shown that the reaction of acetylrhamnosyl bromide with digoxigenin takes place only at the C_3 hydroxyl group. Continuing a search for methods of obtaining diglycosides in which the monosaccharides are attached to two positions—at C_3 and C_{12}—, we have synthesized glucosides and xylosides of digoxigenin. This led to the desired result. The synthesis was carried out by the Königs-Knorr method [2] in Chernobai's modification [3]. The acetylglycosides were saponified with ammonia