*iso*Thiocyanates XXXVIII *. Glucocapangulin, a Novel *iso*Thiocyanate-Producing Glucoside

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Capparis angulata Ruiz et Pav. *(Capparidaceae)* is a shrubby xerophyte indigenous to the coastal regions of Northern Peru. A seed specimen of this plant, made available to us **, possessed a pungent taste, suggestive of the presence of *iso*thiocyanate-producing glycosides. In fact, paper chromatography of an aqueous-methanolic extract of the seed embryos revealed the presence of a single glycoside with an R_B-value [1] of 1.05 in *n*-butanol: acetic acid:water (4:1:5). Enzymic fission with myrosinase produced an ether-soluble *iso*thiocyanate, convertible by methanolic ammonia into a thiourea derivative which on paper chromatography in water-saturated chloroform, migrated at a rate corresponding to an R_{ph}-value [2] of 1.04.

When a crude glycoside fraction, prepared in the usual way from defatted seed embryos (30 g) by extraction with 70 % methanol and subsequent purification on acid-washed alumina [3], was subjected to acetylation [4,5], a water-soluble, crystalline glycoside acetate monohydrate (3 g) was obtained in form of the potassium salt. A pure specimen (from 96 % ethanol), m. p. 168–169° (3°/min.)***, $[\alpha]_D^{22}$ −16.5° (*c* 0.85, CH_3OH), −19.0° (*c* 1.2, H_2O), gave analytical data concordant with the composition $C_{23}H_{32}O_{14}NS_2K,H_2O$. (Found: C 40.46; H 5.27; N 2.10; S 10.08; K 5.99; H_2O 3.0 (Karl Fischer). Calc.: C 40.30; H 5.23; N 2.13; S 9.78; K 5.96; H_2O 2.8), differing from that of all heretofore isolated *iso*thiocyanate glucosides [6]. Upon hydrolysis with conc. HCl at room temperature, the glycoside acetate afforded *hydroxylamine*, identified by paper chromatography [7]. Treatment of the acetate with methanolic ammonia resulted in formation of the free glucoside as a colourless, glassy product. Enzymic fission of the latter in phosphate buffer at pH 6.7 with a sulphate-free myrosinase preparation resulted in liberation of *sulphate* and formation of an ether-extractable mustard oil. In the aqueous phase, enzymically liberated *glucose* could be identified by paper chromatography in several solvent systems. Hence, the new glycoside is of the usual type [7] and accordingly has been named *glucocapangulin*.

On the likely assumption that acetylated glucocapangulin is a tetraacetate, its composition allows for a side-chain of $C_7H_{13}O$. The clue to its identification was found in a conspicuous band at 1 705 cm^{-1} (KBr) in the otherwise orthodox IR-spectrum of acetyl-glucocapangulin, indicative of a carbonyl function in its side-chain. This suspicion was confirmed by a positive qualitative test with 2,4-dinitrophenylhydrazine. Aldehyde or methyl ketone structures were ruled out by standard tests. Since the enzymic hydrolysis of glucocapangulin did not proceed entirely satisfactory, recourse was taken to hydrolytic degradation of the crystalline acetate with 20 % HCl at 50° for 2.5 h. As expected from acid formation in analogous cases [7], a colourless crystalline keto-acid, m. p. 32° (from hexane), was isolated in about 50 % yield. The partial structure, $C_6H_{13}(CO)(COOH)$, was established for this acid by analysis of its *S-benzylthiuronium salt*, m. p. 132°. (Found: C 58.90; H 7.58; N 8.54; S 10.07. Calc. for $C_{16}H_{24}O_3N_2S$: C 59.26; H 7.46; N 8.64; S 9.88), *p-bromophenacyl ester*, m. p. 89°, (Found: C 54.21; H 5.48; Br 22.36. Calc. for $C_{16}H_{19}O_4Br$: C 54.11; H 5.39; Br 22.51), and *semicarbazone*, m. p. 186°. (Found: C 50.22; H 7.97; N 19.52. Calc. for $C_9H_{17}O_3N_3$: C 50.22; H 7.96; N 19.52).

Wolff-Kishner reduction [8] of the keto-acid (88 mg) afforded a reduced acid, characterized as its S-benzylthiuronium salt (40 mg), m. p. 147°, and identical with *octanoic acid*, as apparent from undepressed mixed melting point and coinciding infrared spectra and X-ray diffraction patterns

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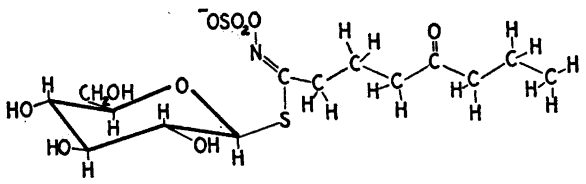
*** All melting points are determined in capillary tubes on immersed thermometers in an Anschütz-Hershberg apparatus. When not otherwise indicated, the rate of heating near the melting points has been less than 1°/min.



II

of the above salt and one prepared from authentic octanoic acid.

Assignment of the keto-grouping to the 5-position of the unbranched C_8-acid was indirectly rendered possible on basis of the following data. 2-Oxooctanoic acid was ruled out when its S-benzylthiuronium salt was prepared and found to melt at 156°. (Found: C 59.32; H 7.43; N 8.62), the 3-oxo-isomeride is incompatible with the stability properties of the present acid, 4-oxooctanoic acid semicarbazone melts at 153° [9], 6-oxooctanoic acid has the m. p. 52° [10] and, furthermore, is disqualified by the fact that the IR-spectrum of the 'natural' acid is devoid of the skeletal vibration at 720 – 750 cm^{-1} diagnostic of the $(CH_2)_4$-grouping. Finally, negative haloform reaction of the naturally derived acid excludes 7-oxooctanoic acid as a possibility.

$$CH_3CH_2CH_2COCH_2CH_2CH_2COOH$$

I

Confirmation of structure (I) for the acid hydrolysis product of acetylated glucocapangulin was eventually obtained by synthesis of authentic 5-oxooctanoic acid (m. p. 32.8°) according to Yoho and Levine [11]. Comparison of the S-benzylthiuronium salts, *p*-bromophenacyl esters and semicarbazones of the naturally derived and synthetic keto-acid by means of mixed melting points and infra-red spectra left no doubt as to their identity.

From the above experimental data, it follows that the glucocapangulin ion most likely possesses the traditional structure (II) and thus represents the first example of a glucoside of this type containing a carbonyl function. Biogenetically, it may arise from intermediates formed in the fatty acid cycle.

A full account of the present work will be presented in a forthcoming communication in this journal.

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