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SESQUITERPENIC LACTONES FROM SMYRNIUM OLUSATRUM L. ROOTS[+]

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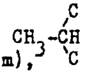
Recently the presence of two flavonoid glycosides in the leaves and stems of Smyrnium olusatrum L. (Umbelliferae) has been described[1]. We investigated now the components from the roots of the mentioned species and isolated two sesquiterpenic lactones to which we gave the names istanbulin-A and istanbulin-B.

Istanbulin A, m.p. 246°C and $[\alpha]_D^{24}+81.5^\circ$, has the composition $C_{15}H_{20}O_4$ (m/e 264). From its IR ($CHCl_3$) and UV spectra (ethanol) it followed that a keto-group in a six-membered or larger ring is probably present in its molecule (1711 cm^{-1}; 285 nm, log ε 2.2), further an α,β-unsaturated γ-lactone group (1758 cm^{-1}; 221 nm, log ε 4.16), and a free hydroxy-group (3380 and 3565 cm^{-1}). In the PMR- spectrum of istanbulin-A (HA-100; $CDCl_3$, TMS) the hydroxy-group proton gave a broad signal at 4.05 ppm, and after conversion to an amidic proton with trichloroacetylisocyanate[2] a broadened singlet at 9.35 ppm (1 H). In the PMR-spectrum of istanbulin-A and of its adduct with trichloroacetylisocyanate[2] no characteristic signals of the $C\underline{H}-O$ type protons or of vinylic protons were observed. From this it followed that the hydroxy-group is tertiary, and that under the assumption that an α,β-unsaturated γ-lactone ring is present in the molecule the corresponding double bond must be endocyclic and tetrasubstituted. The PMR-spectrum also indicated the presence of one tertiary C-methyl group (singlet, 3 H, 0.53 ppm), one secondary methyl group of the  $CH_3-CH\begin{smallmatrix}\diagup C\\ \diagdown C\end{smallmatrix}$ type (doublet, 3 H, 1.01 ppm, J=6.5; the corresponding methine proton found by DR at 2 ppm), an ABX_3 spin system (confirmed by DR) formed by protons of one methyl group (doublet, 3 H, 1.80ppm, J=1.3 Hz) and two methine protons of sp^3-type ($\underline{H}_A$: sharp doublet, 2.61 ppm, J_{AB}=13.5, $J_{AX} \sim 0$; $\underline{H}_B$: broadened doublet, partly overlapped by the signals of other protons, 2.30 ppm, J_{BA}=13.5 Hz, J_{BX}=1.3 Hz), corresponding probably to a fragment of the $CH_3-\overset{|}{C}=\overset{|}{C}-CH_2-\overset{|}{\underset{|}{C}}$-type, and an isolated three-spin system (found by tickling experiments) composed of three quartets of methine protons of sp^3-type (δ_1=2.82 ppm, δ_2=2.40 ppm, δ_3=1.70 ppm, $J_{1,2}$=+3.5 Hz, $J_{1,3}$=+13 Hz, and $J_{2,3}$=-14 Hz; first-order analysis, confirmed by tickling experiments in benzene solution) which corresponds to a fragment of the $-\overset{|}{\underset{|}{C}}-CH_2-\overset{|}{C}H-\overset{|}{\underset{|}{C}}$-type.

From the sum of these spectral data it followed that istanbulin-A is probably a sesquiterpenic lactone of the eremophilenolide type and that its structure corresponds to 1-oxo-8-hydroxyeremophilenolide I. The identity of the hydroxy butenolide chromophor of istanbulin-A (I) and 8-hydroxyeremophilenolide (II)[3] also followed from the direct comparison of IR, UV, and PMR spectra and the

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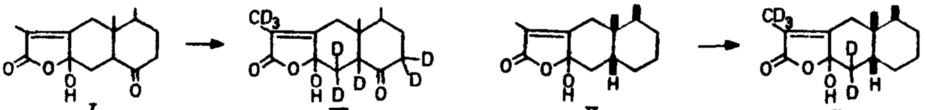
[+] On Terpenes. CCXII. Preceding communication: Tetrahedron Letters 1971, 2679.

deuteration of both substances, I and II. 8-Hydroxyeremophilenolide (II) has a similar maximum at 223 nm (log ε 4.01) in its UV spectrum, as well as similar frequencies characteristic of a hydroxyl group (3380 and 3580 cm^{-1}) and a α, β-unsaturated γ-lactone carbonyl (1759 cm^{-1}) and in the PMR spectrum (HA-100; CDCl$_3$, TMS) an isolated ABX$_3$-system of protons bound to C$_{(13)}$ and C$_{(6)}$ (H$_{(13)}$: doublet, 1.79 ppm, $J_{13,6ax}$=1.6 Hz; $\underline{H}_{(6eq)}$: sharp doublet, 2.77 ppm, $^{2}J_{6,6'}$= 13.7 Hz, $J_{6eq,13}\sim 0$; $\underline{H}_{(6ax)}$: broadened doublet, 2.09 ppm, partly overlapped by the signals of other protons, $J_{6ax,13}$=1.6 Hz)[4,5]. On deuteration of 8-hydroxyeremophilenolide (II) we obtained a substance which according to its mass spectrum (m/e 255, 236 (255-19)), and PMR spectrum (the doublet of H$_{(13)}$ at 1.79 ppm absent; $\underline{H}_{(6eq)}$: doublet, 2.77 ppm, $^{2}J_{6,6'}$=13.5 Hz; $\underline{H}_{(6ax)}$: doublet, 2.09 ppm) was composed predominantly of molecules the structure of which is expressed by formula III. Deuteration of istanbulin-A (I) gave a substance which according to its mass spectrum (m/e 272, 253 (272-19)) and PMR spectrum (the doublet of a methyl at 1.80 ppm and an isolated three-spin system of the $-\overset{|}{\underset{|}{C}}-CH_2-\overset{|}{C}H-\overset{|}{\underset{|}{C}}-$ fragment were absent; $\underline{H}_A$: doublet, 2.63 ppm, and $\underline{H}_B$: broadened doublet, 2.30 ppm, J_{AB}= 13.3 Hz) contained predominantly a compound represented by formula IV, in agreement with the proposed formula I for istanbulin-A.

Istanbulin-B, m.p. 167°C, of the composition $C_{15}H_{20}O_3$ (m/e 248) was isolated only in a very small amount and the study of its structure is not yet completed.

Istanbulin-A (I) is the first sesquiterpenic lactone related to the eremophilane found and identified in a plant of the Umbelliferae family.



I IV II III

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4. L. Novotný, Z. Samek, F. Šorm, Collection Czechoslov. Chem. Commun. **31**, 371 (1966).
5. A more detailed study of the PMR-spectra of various eremophilenolides which were isolated in the Prague laboratory as autooxidation products of furanoeremophilenes will be a subject of a separate communication.