

methyls of an isopropyl grouping). With this composition and no double bonds, the alcohol must have a bicyclic structure.

The NMR spectrum of taufenin shows, in addition to the signals of the protons of the acid residue, singlets at 0.88 ppm (3 H, angular methyl) and 1.18 ppm (3 H, hemihydroxyl tertiary methyl), doublets at 0.95 and 0.85 ppm, $J = 6$ Hz (3 H, methyls of an isopropyl group), and quartet at 4.94 ppm, $J_1 = 10$ Hz, $J_2 = 3$ Hz (hemiacetyl proton).

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LACTONES OF *Inula helenium*

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UDC 547.992

In a study of the inflorescences, leaves, roots, and rhizomes of *Inula helenium* L. we found that they contained lactones.

As was shown by preliminary paper-chromatographic investigations using specific reagents, the epigeal organs contained lactones fluorescing bright blue in UV light, which were assigned to benzo- α -pyrone derivatives [1].

The compounds detected were isolated from the epigeal part of the plant by a method described elsewhere [2]. For this purpose, ethanolic extracts were concentrated and the concentrates were mixed with polyamide sorbent, which was then dried and deposited on columns of polyamide. The columns were eluted with benzene, benzene with gradually increasing concentrations of chloroform, chloroform, and chloroform-ethanol. The benzene fractions yielded, after crystallization from chloroform-ethanol (9:1) a substance (I) with the empirical formula $C_{10}H_8O_4$, mp 202-204°C; and the fractions eluted by chloroform +5% of ethanol yielded substance (II) with the composition $C_9H_6O_3$, mp 230-232°C (from methanol).

By a comparison of IR and UV spectra, a mixed melting point, and a comparison of R_f values on chromatography in various systems and fluorescence in UV light, the substances isolated were identified as scopoletin [1] and umbelliferone [2, 3].

No derivatives of benzo- α -pyrone nature were detected in the hypogeal organs. Thin-layer chromatography [fixed layer of silica gel; benzene-methanol-ethyl acetate (12:3:1) system; chromogenic agent a 1% solution of vanillin in concentrated sulfuric acid] showed the presence of no less than five substances of terpenoid nature in purified ethanolic extracts of the roots and rhizomes [4].

By the usual methods of adsorption chromatography on alumina using as eluents mixtures of petroleum ether and benzene in various ratios we isolated four substances with mp 76-78°C, 112-114°C, 133-134°C, and 174-176°C which were identified by direct comparison with authentic samples as, respectively, alantolactone, isoalantolactone, dihydroalantolactone, and dihydroisoalantolactone [5].

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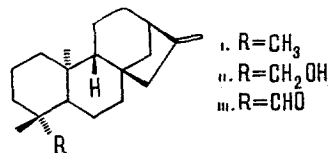
ISOLATION OF (-)-KAURENAL FROM THE CULTURE LIQUID

OF *Fusarium moniliforme*

V. A. Raldugin and V. A. Pentegova

UDC 547.597

The fungus *Fusarium moniliforme* Sheld. is known for its ability to produce gibberellic acid [1], and the industrial preparation of gibberellic acid is based on this [2]. The neutral substances accompanying gibberellic acid and isolatable from the culture liquid of this fungus are represented mainly by kaurane diterpenoids [3], of which only (-)-kaurene (I) participates in the biosynthesis of the gibberellins [4]. The products of its subsequent biosynthetic transformations, (-)-kaurenol (II) and (-)-kaurenal (III) [5], have not been found in the culture liquid of this fungus. They have been detected in extremely small amounts in an extract of mycelium of some strains of *Fusarium moniliforme* [6-8]. It has been suggested [9] that they are rapidly metabolized by the fungus to highly oxygenated derivatives — the gibberellins.



In an investigation of the total metabolites of *Fusarium moniliforme* (strain 857, variant 919) impoverished in gibberellin A₃ and forming the wastes of the industrial product of gibberellin (fermentation based on the method of Muromtsev et al. [2]), we have isolated by the chromatography of its neutral fraction a substance with mp 113-114°C (from heptane), $[\alpha]_D^{25} -78.5^\circ$ (c 2.81; chloroform), the NMR spectrum of which corresponds to that of (-)-kaurenal [10, 11], which has mp 114°C and $[\alpha]_D -95^\circ$ [10]. The reduction of the aldehyde isolated with sodium tetrahydroborate in ethanol yielded (-)-kaurenol with mp 142-143°C (from heptane), $[\alpha]_D^{19} -71^\circ$ (c 1.67; chloroform); literature data [10]: mp 140-141°C, $[\alpha]_D -82^\circ$. The amount of (-)-kaurenal in the mixture of neutral compounds studied was 0.8%, which somewhat exceeds the amount of (-)-epimanoyl oxide, a well-known metabolite of *Fusarium moniliforme* [3], found in the same mixture (0.5%).

The presence of a relatively large amount of (-)-kaurenal in the mixture of metabolites of *Fusarium moniliforme* is of definite interest if one takes into account the high efficiency of the biosynthesis of the gibberellins by this strain. As Bearder [8] has found in the mutant strain B1-41a there is a blockage at the stage of the transformation of (-)-kaurenal into (-)-kaurenic acid. Apparently, in the strain investigated, as well, there is a partial blockage of this type the presence of which in this case is shown by an accumulation of (-)-kaurenal. (-)-Kaurenal was first isolated as a natural product from two plants of the family Compositae [10, 11].

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