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SESQUITERPENE LACTONES OF Ferula clematidifolia AND Ligularia alpigena

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Ferula clematidifolia K.-Pol. belongs to the group of species of a typical subgenus including, in addition to this species, *F. penninervis* Regel et Schmalh. (*F. olgae* Regel et Schmalh.) and *F. korshinskyi* Korov. *F. clematidifolia* contains an essential oil [1]. There is no other reliable information on the chemical composition of this species.

We have studied an ethanolic extract of the roots of *F. clematidifolia* gathered in Tadzhikistan (Hissar range, gorge of the R. Shargun') in the flowering phase.

The dried and comminuted roots were extracted with ethanol (by the steeping method), the extract was concentrated, diluted with water and treated with ether, the ethereal extract was dried with sodium sulphate, the solvent was distilled off, and the resin so obtained was chromatographed on a column of silica gel (L 100/250, Chemapol, Czechoslovakia).

Elution with chloroform yielded a crystalline mixture of lactones which was separated by chromatography on a column of silica gel with the use as eluents of mixtures of hexane and ethyl acetate containing increasing concentrations of the latter.

Three crystalline compounds were obtained: (I) – $C_{27}H_{28}O_7$, mp 262-264°C (decomp.); (II) – $C_{29}H_{32}O_9$, mp 212-213°C; (III) – $C_{26}H_{28}O_9$, mp 216-218°C. From their physicochemical and spectral characteristics they were identified as diacylguaianolides, namely: (I) as giferolide, isolated previously from *F. gigantea* [2], and (II) and (III) as malaphyll and malaphyllin, isolated from *F. malacophylla* [3] and *F. gigantea* [2].

Thus, in its chemical composition, *F. clematidifolia* is close to *F. pinninervis*, which has also previously yielded guaianolides – olgin, laferin, olgoferin, talassin A, talassin B, oferin, grilactone [4], ferolide [5], and fegolide [6]. At the same time, it is impossible not to draw attention to the fact that *F. korshinskyi*, assigned by Korovin to the

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same group, Clematideae, differs sharply in composition from *F. penninervis* and *F. clematidifolia*.

Ligularia alpigena Poljark has not previously been studied chemically. The dried and comminuted roots and epigeal part of the plant, gathered in the flowering period in the gorge of the R. Angren (Uzbekistan, Tashkent province) were extracted separately with hexane. The hexane extracts were chromatographed on columns of silica gel with elution by hexane—ethyl acetate (10:1).

From the extract of the roots and from the extract of the epigeal part we isolated, in addition to unidentified neutral substances that were assigned to the hydrocarbons on the basis of their IR and PMR spectra, a crystalline compound $C_{15}H_{18}O_3$ (M^+ 246), mp 135-136°C of lactone nature (IR spectrum). The compound gave a positive response in Ehrlich's test (presence of a furan ring). From the combination of physicochemical constants and spectral characteristics (UV, IR, PMR, and mass spectra) this compound was identified as furanoeremophilan-14β,6α-olide, which has been isolated previously from *L. thomsonii* [8], *L. macrophylla* [9], *L. thyrsoidea* [10], *L. fauriei*, *L. angusta*, and *L. hodgsonii* [4], and *L. calthifolia* [11].

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