Thus, on the basis of the facts given, the structure of 2,3-methylenedioxy-5-(1-oxopropv1)phenol is suggested for radiatinol.

IR spectra (NaCl, mull in paraffin oil) were taken on a UR-20 spectrophotometer; <sup>1</sup>H NMR spectra (in  $C_5 D_5 N$ , 0 – TMS,  $\delta$  scale) on a Varian HA 100D spectrometer; and mass spectra on a Varian CH-8 spectrometer; melting points were determined on a Kofler block.

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## FLAVONOIDS FROM Trifolium polyphyllum

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Continuing [1] investigations of the flavonoid compounds from *Trifolium polyphyllum* C.A.M. (polyphyllous clover), family *Fabaceae*, collected in July in the environs of the town of Cheget (Kabardino-Balkarsk ASSR), from this plant we have isolated in the individual state and have identified six flavonoid compounds.

The air-dry herbage and roots (simultaneously) were extracted exhaustively with 70% ethanol, the extracts were evaporated to an aqueous residue, and the lipophilic substances were eliminated with chloroform. The aqueous extracts were treated with ethyl acetate. Precipitation with dry chloroform gave the total flavonoids, which were separated on a column containing polyamide sorbent. Six flavonoid compounds were obtained in the individual state (A, B, C, D, E, and F).

Substance A - C<sub>22</sub>H<sub>22</sub>O<sub>9</sub>, mp 210-212°C (from methanol),  $[\alpha]_D^{2\circ}$  -25.3° (c 0.395; methanol);  $\lambda_{max}$  260 nm (ethanol).

The acid hydrolysis of compound A formed an aglycone with the composition  $C_{16}H_{12}O_4$ , which was identified from its melting point and UV and IR spectra as 7-hydroxy-4'-methoxyisoflavone (formononetin), and a sugar component, which was identified as D-glucose. By the cleavage of the glycoside with the enzyme from *Aspergillus oryzae*, differential IR spectroscopy [2], and the specific rotation, the presence of a pyranose ring and the  $\beta$  configuration of the glycosidic bond were established.

The glycoside was identified as 7-hydroxy-4'-methoxyisoflavone 7-O- $\beta$ -D-glucopyranoside (ononin).

Substance B =  $C_{2,7}H_{30}O_{16}$ , mp 180-190°C (water),  $[\alpha]_D$  =31.5° (c 0.32; in dimethylforma-mide);  $\lambda_{max}$  256, 354 nm (ethanol).

The hydrolysis of substance B yielded D-glucose, L-rhamnose, and an aglycone which was identified from its UV and IR spectra, melting point, and mixed melting point as 3,3',4',5,7-pentahydroxyflavone (quercetin). Quercetin and rutinose were found in the products of enzymatic hydrolysis, and the  $\beta$  configuration of the glycosidic bond was established by differential IR spectroscopy and from the value of the specific rotation.

The characteristics given permit compound B to be identified as quercetin  $3-0-]6-0-(L-rhamnopyranosy1)-\beta-D-glucopyranoside] (rutin).$ 

Substance  $C - C_{21}H_{20}O_{11} \cdot 2H_2O$ , mp 229-231°C,  $[\alpha]_D^{20} - 45.1°$  (c 0.14; in methanol);  $\lambda_{max}$  267, 354 nm (ethanol). The acid hydrolysis of compound C gave an aglycone with mp 257-276°C, corresponding to 3,4',5,7-tetrahydroxyflavone (kaempferol). A mixture of the aglycone of C and kaempferol gave no depression of the melting point. The aglycone kaempferol and a sugar -

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D-galactose — were found in the product of enzymatic hydrolysis. The results of enzymatic hydrolysis showed that the sugar component was attached to the aglycone by a  $\beta$ -glycosidic bond. These results were confirmed by differential IR spectroscopy.

Glycoside C was identified as 3,4',5,7-tetrahydroxyflavone  $3-O-\beta-D$ -galactopyranoside (trifolin).

Substance D - C15H1007, mp 310-313°C;  $\lambda_{max}$  256, 370 nm (ethanol).

Substance  $E = C_{15}H_{10}O_6$ , mp 257-277°C;  $\lambda_{max}$  370, 296, 265 nm (ethanol).

Substance  $F = C_{16}H_{12}O_4$ , mp 255-257°C;  $\lambda_{max} 300$ , 250 nm (ethanol).

The results of physicochemical study and also mixed melting points permitted substances D, E, and F to be characterized as quercetin, kaempferol, and formononetin, respectively.

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COUMARINS OF Heracleum asperum

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We have studied the coumarins of the roots of *Heracleum asperum* M. B. [ $\circ$  scabrous cow parsnip], endemic in the Caucasus, collected at the forest edge in the Buinaksk district, Daghestan ASSR, in September 1977 [1]. From the roots we have isolated piminellin, isobergapten, bergapten, and sphondin [2-4].

From an ethanolic extract of the roots of the plant (747 g) after the solvent had been distilled off, a resin was obtained (98.1 g), which was mixed with chloroform. The insoluble part (17.9 g), after treatment with ethanol and standing, deposited a crystalline substance of noncoumarin nature with mp 176°C (from ethanol). The part of the resin that had dissolved (80.2 g) was chromatographed on a column [5]. The substances were eluted with gasoline (400 ml) and with gasoline-chloroform (2:1) (500 ml). After the solvent had been distilled off from the gasoline eluates pimpinellin (0.64%) was isolated, and the eluates obtained when the column was eluted with gasoline-chloroform yielded isobergapten, bergapten, and sphondin.

The substances obtained were identified with authentic compounds from the results of IR spectroscopy, melting points and  $R_f$  values on paper chromatography with markers [2-4, 6]. In addition to the furocoumarins mentioned, the presence of osthole in the roots was detected by paper chromatography.

According to the literature [2-4], from the root of the same plant growing in the Kazbek district of the Georgian SSR, osthole, isobergapten, bergapten, and sphondin have been isolated, and psoralen, angelicin, imperatorin, and pimpernellin have been detected by paper chromatography.

The coumarin composition of the roots of H. as perum endemic in the Caucasus depends on its growth site and the time of collection of the plant material.

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