

ONONIN AND FORMONONETIN FROM REPRESENTATIVES  
OF THE GENUS *Trifolium*

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The present paper gives the results of an investigation of the isoflavones present in the epigeal parts of *Trifolium sativum* Crome (crop plant), *T. pratense* L. (red clover), *T. medium* L. (zigzag clover), and *T. alpestre* L. (purpleglobe clover) of the section *Trichostoma* Bobr., family Leguminosae, growing in the USSR.

The dry herbage of the plants collected in the flowering period in Stavropol' territory was treated successively with chloroform and ethanol. The ethanol was distilled off, the residue was treated with hot water, and the combined flavonoids were obtained from a concentrated ethyl-acetate extract by the addition of a fivefold volume of chloroform.

Chromatography on a column of alumina and also on a column of polyamide sorbent, with elution by 20-40% ethanol and subsequent fractional crystallization from methanol yielded two substances.

Substance (I) formed white plates with the composition  $C_{22}H_{22}O_9$ , mp 210-212°C (from methanol),  $[\alpha]_D^{20} -25.3^\circ$  (c 0.395; methanol). Acid hydrolysis with 5% sulfuric acid formed the aglycone, with the composition  $C_{16}H_{12}O_4$ , identified by its melting point and its UV and IR spectra as formononetin, and a sugar component identified as D-glucose. Cleavage of the glycoside with the enzyme from *Aspergillus oryzae*, differential IR spectroscopy [1], and the magnitude of the specific rotation showed the  $\beta$  configuration of the glycosidic linkage and the presence of a pyranose ring.

Thus, substance (I) is 4'-methoxyisoflavone 7-O- $\beta$ -D-glucopyranoside (ononin).

Substance (II), with the composition  $C_{16}H_{12}O_4$ , precipitated in the form of white crystals with mp 255-257°C (from methanol);  $\lambda_{max}^{C_2H_5OH} 300, 250 \text{ nm}$

From the results of UV spectroscopy with ionizing and complex-forming additives and IR spectroscopy, and also from the melting points of the acetyl and methyl derivatives, substance (II) was identified as 7-hydroxy-4'-methoxyisoflavone (formononetin).

LITERATURE CITED

1. I. P. Kovalev and V. I. Litvinenko, *Khim. Prirodn. Soedin.*, 233 (1965).

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