

FLAVONOIDS OF *Trifolium echinatum* AND *T. diffusum*

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UDC 547.972

The isolation and identification of a whole series of flavones, flavonols, and isoflavones from various species of *Trifolium* — clovers of the Georgian flora — has been reported previously [1]. There is no information in the literature on the chemical composition of *Trifolium echinatum* Bieb, while the flavonoids quercetin, kaempferol, and their glycosides have been isolated from *Trifolium diffusum* Ehrh. [2].

We have investigated the flavonoid composition of the epigeal organs of these species growing on Georgian territory. The flavonoids were extracted with 80% ethanol separately from the epigeal parts of *T. echinatum* and *T. diffusum*, the extracts were evaporated, the aqueous residues were purified with chloroform, and flavonoid compounds were extracted with ethyl acetate. The total flavonoids were separated on a column of polyamide sorbent. Elution was performed with increasing concentrations of aqueous ethanol [1]. This yielded five substances of flavonoid nature. They were identified on the basis of their physicochemical properties, UV and IR spectra, and comparison with authentic specimens.

Substances 1 from *T. echinatum* and 4 from *T. diffusum* proved to be identical. They consisted of white acicular crystals with the composition $C_{16}H_{12}O_5$, mp 213-214°C, λ_{\max}^{MeOH} 263 nm and a shoulder at 363 nm, and they were identified as 5,7-dihydroxy-4'-methoxyisoflavone or biochanin A [3]. Substance 2, isolated from *T. echinatum* formed yellow crystals with the composition $C_{15}H_{10}O_6$, mp 273-275°C, λ_{\max}^{MeOH} 368 and 268 nm, and was characterized as 3,4',5,7-tetrahydroxyflavone or kaempferol [4]. Substance 3, isolated from *T. echinatum* formed dark yellow crystals with the composition $C_{21}H_{20}O_{12}$, mp 226-228°C, λ_{\max}^{MeOH} 362 and 255 nm and proved to be quercetin 3-O- β -D-glucopyranoside (isoquercitrin). Substance 5 from *T. diffusum* formed white crystals with the composition $C_{22}H_{22}O_{10}$, mp 206-208°C, λ_{\max}^{MeOH} 262 nm with a shoulder at 323 nm and was identified as biochanin A 7-O- β -D-glucopyranoside [2].

This is the first time that any of these substances has been isolated from *T. echinatum* and *T. diffusum*,

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