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A CHEMICAL INVESTIGATION OF *Matteuccia struthiopteris*

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The ostrich fern *Matteuccia struthopteris* (L.) Tod, family Onocleaceae, is a traditional food product of the peoples of Japan, South-East Asia, and Canada [1], and is also used in folk medicine for the treatment of various diseases [2]. Young shoots with spirally curled leaf blades are used in food.

We have investigated young leaves of the ostrich fern gathered in the month of May in Novosibirsk province. The air-dry raw material, 5 and 4 kg, was extracted with methanol and with 80% ethanol, respectively. The alcohlic extracts were concentrated in vacuum, diluted with water, and treated successively with hexane, chloroform, ethyl acetate, and n-butanol.

By chromatography on silica gel in the pentane–acetone, hexane–acetone, and chloroform–acetone systems, the fractions soluble in hexane and chloroform yielded hydrocarbons, fatty acid esters, fatty acids, and sterols. The compounds isolated were identified by chromato-mass spectrometry on a LKB-2091 instrument with a capillary column 30 m long containing the deposited phase SE-30 at 130—300°C, 8°C/min. Qualitative analysis showed that the fraction eluted from the column by pentane or hexane consisted of a mixture of squalene and n-paraffins with from 17 to 33 carbon atoms.

Elution from the column with hexane–acetone (99:1) led to the isolation of palmitic acid and the methyl and ethyl esters of saturated ($C_{16}-C_{22}$) and unsaturated ($C_{18}-C_{19}$) fatty acids. However, the esterified derivatives were most probably not native compounds but were formed in the process of extraction and chromatography, since they were absent from the extracts obtained by treating the raw material with hexane and chloroform.

The sterols were isolated and identified by a method described previously [3]. As a result, in the total steroid fraction we detected campesterol (M^+ 400), stigmasterol (M^+ 412), and β-sitosterol (M^+ 414), with a predominant amount of the last-mentioned, and also β-sitosteol glucoside.

The ethyl acetate and butanol extracts were chromatographed on column of polyamide in a chloroform–methanol gradient system, and two compounds were isolated.

Kaempferol 3-O-β-D-glucopyranoside (astragalin), $C_{21}H_{22}O_{11}$, FAB-MS, m/z: 449 $(M + H)^+$, mp 178-180°C; λ_{max}^{MeOH} 267, 354 nm; ^{1}H NMR (DMSO-d_6, δ, ppm): 12.61 (1H, s, 5-OH), 8.03 (2H, d, 9 Hz, H-2^1, 6^1), 6.87 (2H, d, 9 Hz, H-3′, 5′), 6.42 (1H, d, 2.5 Hz, H-8), 6.20 (1H, d, 2.5 Hz, H-6), 5.30 (1H, d, 7.5 Hz, H-1″). The ^{13}C NMR spectrum corresponded to that described in the literature [4].

Caffeic acid, $C_9H_8O_4$. M^+ 180, mp 196-198°C, λ_{max}^{MeOH} 240, 300, 325 nm [5].

Analysis of the phenolic acids in the individual fractions was carried out by the HPLC method on a Melikhrom liquid chromatograph under conditions of reversed-phase chromatography. The stationary phase was Nucleosil-5, C18; 2 × 80 mm column. The mobile phase was MeOH–acetic cid (10%) (1:9, v/v). Two-wavelength detection at 260 and 310 nm.

Chlorogenic, p-hydroxybenzoic, and caffeic acids predominated in the crude extract. In addition, p-coumaric, ferulic, vanillic, and protocatechuic acids were identified in the enriched individual factions.

This is the first time that any of the compounds described have been isolated from *Matteuccia struthiopteris*.

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REFERENCES

1. V. L. Cherepnin, Food Plants of Siberia [in Russian], Nauka, Novosibirsk (1987).
2. A. I. Shreter, Medicinal Flora of the Soviet Far East [in Russian], Meditsina, Moscow (1975), p. 7.
3. A. I. Syrchina, A. L. Vereshchagin, and A. A. Semenov, Khim. Prir. Soedin., No. 5, 731 (1989).
4. K. R. Markham, B. Ternai, R. Stanley, et al., Tetrahedron, **34**, 1389 (1978).
5. G. G. Zapesochnaya, T. V. Dyazdevich, and B. S. Karasartov, Khim. Prir. Soedin., No. 3, 409 (1990).