BRIEF COMMUNICATIONS

POLYSACCHARIDES OF *Solidago virgaurea*

A. I. Yakovlev and P. A. Pychenkova

UDC 547.917

The epigeal part of European goldenrod (*Solidago virgaurea*) contains substances with a pronounced pharmacological activity. Tinctures and dedoctions are widely used in folk medicine in the treatment of cold-like diseases, jaundice, and diseases of the kidneys, as a styptic agent, and in homeopathy. Preparations from the plant possess antibacterial activity [2]. However, the chemical composition of the plant has been little studied, and it is known only that the epigeal part contains alkaloids, saponins, nicotinic acid, and nicotinamide [1].

From inflorescences of the European goldenrod we have previously isolated a polysaccharide complex [3] which, according to results obtained in the Department of Pharmacology of the Ryazan' Medical Institute, has a pronounced antiinflammatory activity.

The aim of the present investigation was to study the polysaccharide composition and also to determine the qualitative monosaccharide composition and quantitative amounts of the individual monosaccharides in the polysaccharide fractions by the methods of potentiometric titration, PC in the butanol—pyridine—water (6:4:3) and ethyl acetate—formic acid—water—acetic acid (18:2:4:3) systems, and by GLC on a Tsvet-4-67 instrument with a flame-ionization detector of the acetylated aldononitriles derived from them [4].

The material for the investigation was collected in 1978-1979 (Ryazan' province).

To eliminate saponins and other impurities of low molecular weight, the raw material was extracted with water-saturated butanol and with a mixture of ether and ethanol [5]. The polysaccharides were isolated from the air-dry residue by extraction with water [3]. Yield 6-8%, $[\alpha]_D$ +138° (c 0.15%; in water); amount of uronic acid 40-45%, pH 4.5. Galacturonic acid, galactose, glucose, arabinose, xylose, and rhamnose were detected in the products of complete acid hydrolysis (1 N H_2SO_4, 100°C, 24 h) with the aid of PC.

When the preparation was saponified with alkali, followed by precipitation with ethanol, two fractions of polysaccharides, I and II, were obtained, which were present in a ratio of 1:1 (preparatively). Fraction I contained 80% of galacturonic acid and the neutral monosaccharides galactose, glucose, arabinose, xylose, and rhamnose in a quantitative ratio of 10:6:12:1:4; $[\alpha]_D$ +268° (c 0.12%; in water in the form of the sodium salt); and fraction II contained 27% of uronic acid and the neutral monosaccharides galactose, glucose, arabinose, xylose, and rhamnose in a quantiative ratio of 24:1:10:3:8, $[\alpha]_D$ +38° (c 0.2%; in water).

From fraction I with the aid of sodium acetate [6] a galacturonan was isolated with $[\alpha]_D$ +336° (c 0.1%; in water in the form of the sodium salt), and from the mother solution by precipitation with ethanol a pectic acid was obtained with $[\alpha]_D$ +210° (c 0.15%; in water in the form of the sodium salt). The homogeneity of the pectic acid was confirmed by chromatography on DEAE-cellulose in the phosphate form. The quantitative ratio between the galactose, glucose, arabinose, xylose, and rhamnose was 17:13:9:1:8.

With the aid of Cetavlon [7], fraction II yielded two polysaccharides, and their monosaccharide compositions were studied by PC and GLC. The polysaccharide PA contained galactose, glucose, arabinose, xylose, and rhamnose in a ratio of 26:1:12:3:12, and polysaccharide PB the same monosaccharides in a ratio of 20:10:7:2:1, respectively.

Thus, it has been established that the polysaccharide complex of the inflorescences of the European goldenrod consists of four polysaccharides differing in their monosaccharide compositions and physical properties. The results of the investigation are in harmony with the polysaccharide composition of some other representatives of the family Compositae [8-11].

I. P. Pavlov Ryazan' Medical Institute. Translated from Khimiya Prirodnykh Soedinenii, No. 6, pp. 790-791, November-December, 1981. Original article submitted June 3, 1981.

 0009-3130/81/1706-0580$07.50

LITERATURE CITED

1. F. I. Deryabina, "A pharmacological study of the medicinal plants of the folk medicine of the Komi-Permyatskii National District," Author's Abstract of Candidate's Dissertation, Leningrad (1965), p. 181.
2. E. Ya. Roshba, S. I. Yakovlev, and A. B. Kaganskaya, Mikrobiol. Zh., Akad. Nauk UkrSSR, 16, No. 2, 69 (1954).
3. A. I. Yakovlev and P. A. Pychenkova, in: Abstracts of Lectures on Chemistry and Chemical Technology [in Russian], Tobolsk (1977), p. 225.
4. O. M. Easterwood and B. I. L. Huff, Svensk Papperstidn., 72, 768 (1969).
5. O. R. Mel'nichuk, Tr. Leningr. Khim.-Farm. Inst., Vop. Farmakognoz., 12, No. 1, 263 (1961).
6. V. Zitko and C. T. Bischop, Can. J. Chem., 43, 3206 (1965).
7. B. N. Stepanenko and L. B. Uzdennikova, Biokhimiya, 38, 52 (1973).
8. C. T. Bischop, Can. J. Chem., 33, 1521 (1955).
9. A. G. Gorin and A. G. Yakovlev, Khim. Prir. Soedin., 515 (1971).
10. A. I. Yakovlev and A. G. Gorin, Proceedings of the 2nd All-Russian Conference of Pharmacists [in Russian], Sverlovsk (1975), p. 314.
11. A. I. Yakovlev, Khim. Prir. Soedin., 248 (1980).

COMPOSITION OF THE RESINOUS SUBSTANCES OF CONIFEROUS NEEDLES.

II. ACIDS FROM THE RESINOUS SUBSTANCES OF THE NEEDLES OF *Pinus silvestris*

O. I. Lebedeva, G. V. Tikhomirova, and S. M. Repykh

UDC 634.0.866.1:674.0.32.475.4

In a study of the composition of pine needles, the resinous substances isolated from it were separated into individual groups of substances [1]. Among them is a group of acids (2.2% of the neutral fraction of the resinous substances). We give the results of an investigation of the composition of the acids by the GLC method. The acids were isolated by two methods: 1) column chromatography on silica gel; and 2) the acid-alkali method [2]. Table 1 gives the results of the identification of the acids (the acids isolated by the acid-alkali method are denoted by dots and their percentage yields are not given).

On chromatography, the acids isolated from the neutral fraction gave 28 peaks, and those isolated from the extract by the acid-alkali method gave nine peaks.

Among the acids methylatable by diazomethane, C_{10}-C_{24} saturated and unsaturated, and also aromatic, acids were detected. According to Table 1, under the conditions of separation selected the acids issued in double peaks and in the acids isolated by the acid-alkali method very small amounts of myristic and vanillic acids were detected.

Of the unsaturated acids, the highest percentage was represented by linoleic, which is present together with oleic acid to some degree in the group of substances combined under the name of vitamin F usually forming the bulk of the acids of extracts of coniferous needles. Of the aromatic acids, syringic and veratric were present in very small amount, and acids of the cinnamic type (vanillic and caffeic) were also detected.

The presence of high-boiling acids (above C_{24}) in the resinous substances was established, but in view of the absence of pure substances they were not identified.

The methyl esters of the acids were identified. Separation was carried out on an LKhM-72 chromatogram with a thermal conductivity detector with a three-meter stainless-steel column having a diameter of 4 mm of which 2 m was filled with Chromaton N-AW (0.25-0.315 mm) upon which Apiezon L had been deposited in an amount of 20% of the weight of the solid support and 1 m was filled with chromaton N-AW (0.43-0.60 mm) upon which Apiezon L had been

Siberian Branch of the Technological Institute, Krasnoyarsk. Translated from Khimiya Prirodnykh Soedinenii, No. 6, pp. 791-792, November-December, 1981.. Original article submitted July 23, 1981.

0009-3130/81/1706-0581$07.50