

THE PROTOPECTIN OF THE LEAVES AND PETIOLES OF SOSNOVSKII'S  
COWPARSNIP AND HEARTLEAF COLEWORT

M. S. Dudkin, M. A. Parfent'eva, and N. G. Shkantova

UDC 547.917

The pectin substances of wild-growing herbs have scarcely been studied.

We have isolated the protopectin complexes (PPC's) by a known method [1] from the leaves and petioles of cowparsnip and colewort [1]. They were subjected to dialysis and fractionation on DEAE-cellulose in the phosphate form [2]. Fractionation of the PPC's of the petioles and the leaves gave three fractions (Fig. 1a).

The characteristics of the carbohydrate composition of the individual fractions of the PPC's after their hydrolysis are given in Table 1. The characteristics of PPC's are given below (the yields of PPC's are given as percentages of the absolutely dry weight of the raw material, and the other figures as percentages of the PPC's):

	Cowparsnip leaves	Colewort leaves	Cowparsnip petioles	Colewort petioles
Yield of PPC's	9,64	11,72	9,70	12,32
Free carboxy groups	8,90	13,02	9,60	14,28
Bound carboxy groups	11,00	5,50	10,45	7,14
Acetylated hydroxy groups	0,54	0,48	0,80	0,62
Ash	4,50	3,35	3,70	5,02
Total amount of galacturonic acid determined				
by the carbonyl method	67,20	82,70	71,60	68,04
by the titrimetric method	63,90	79,80	73,07	70,20

The yield of PPC's from the colewort was somewhat higher than from the cowparsnip, but in both cases the protopectins were distributed uniformly between the leaves and the petioles.

The protopectins of the cowparsnip were characterized by a smaller amount of free carboxy groups and a larger amount of bound carboxy groups.

The protopectins isolated were heterogeneous. In all cases when a 0.5 M solution of  $\text{NaH}_2\text{PO}_4$  was used as eluent a weakly acid fraction was eluted which contained a small amount of galacturonic acid, the main sugars of this fraction being arabinose and galactose.

Elution with a 0.5 M solution of NaOH yielded acid polysaccharides containing from 68.38

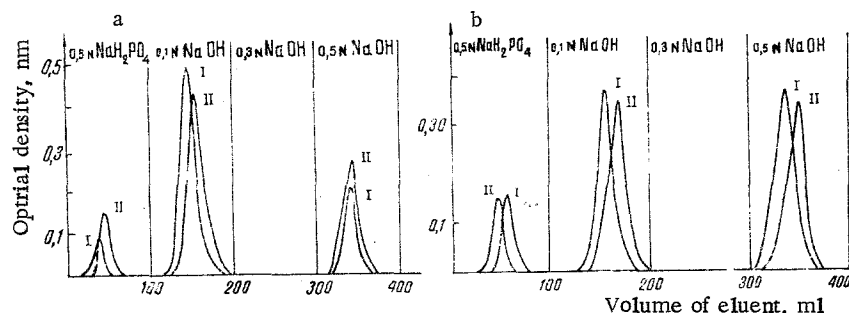


Fig. 1. Chromatograms of the protopectins of the leaves (I) and the petioles (II) of Sosnovskii's cowparsnip (a) and of heartleaf colewort (b) on DEAE-cellulose.

M. V. Lomonosov Odessa Technological Institute of the Food Industry. Translated from *Khimiya Prirodnykh Soedinenii*, No. 6, pp. 760-763, November-December, 1977. Original article submitted July 13, 1977.

TABLE 1. Monosaccharide Compositions of the Fractions of the Protopectins of the Leaves and Petioles (in percentages of the absolutely dry weight)

Elution conditions	Yields of the fractions		Galacturonic acid		Galactose		Arabinose		Xylose		Rhamnose	
	leaves	petioles	leaves	petioles	leaves	petioles	leaves	petioles	leaves	petioles	leaves	petioles
Sosnovskii's cowparsnip												
0,5 M NaH <sub>2</sub> PO <sub>4</sub>	6,20	8,6	14,00	15,00	32,40	34,16	42,70	48,50	1,90	2,00	8,60	4,70
0,1 M NaOH	48,80	45,50	68,38	70,20	14,90	15,02	16,20	17,18	2,00	1,90	2,00	2,86
0,5 M NaOH	36,70	40,00	74,30	75,70	4,86	7,04	5,74	8,12	С.п.	С.п.	С.п.	С.п.
Heartleaf colewort												
0,5 M NaH <sub>2</sub> PO <sub>4</sub>	9,10	8,70	15,90	18,15	29,00	28,90	42,10	39,50	4,70	5,18	6,60	7,40
0,1 M NaOH	40,60	34,30	71,00	70,60	10,67	12,17	14,00	13,15	2,80	2,05	3,75	3,20
0,5 M NaOH	37,12	33,00	72,00	70,00	5,02	6,60	8,08	7,42	2,00	1,90	С.п.	С.п.

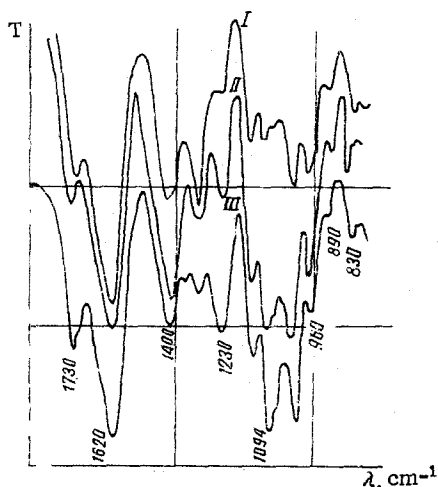


Fig. 2. IR spectra of the protopectins of the leaves of cowparsnip (I) and of colewort (II) and of apple protopectin (III).

to 75.70% of galacturonic acid with a very small amount of neutral sugars. A 0.1 M solution of NaOH eluted intermediate fractions containing neutral and acidic polysaccharides which could not be separated (Fig. 1a, b).

Thus, the protopectins of each species consist of two fractions. The molecular weights were 16,000-18,000 in the leaves and petioles of the cowparsnip and 13,000-15,000 in the colewort.

The considerable magnitude of positive specific rotation shows the α configuration of the chain. According to a chromatographic analysis of hydrolyzates, the main chain of the protopectins is constructed of galacturonic acids connected with one another by α-1 → 4 bonds.

The IR spectra of the protopectins of the leaves and petioles of the cowparsnip and colewort are similar to those of apple and citrus pectins (Fig. 2).

#### EXPERIMENTAL

The Sosnovskii's cowparsnip and heartleaf colewort were collected in the Kiev experimental station of animal husbandry, Terezino, in 1974 in the flowering phase.

Preparation of the Raw Material. The previously dried leaves and petioles were comminuted in a mill and were sieved to obtain particles homogenous in size. The comminuted raw material was defatted in a Soxhlet apparatus. The residue was treated with 82% ethanol on the water bath to eliminate free sugars and with water at 90°C to extract water-soluble polysaccharides.

Isolation of the Pectin. The residue after the treatment with water was extracted with 0.5% aqueous ammonium oxalate at 90°C. The pectin was precipitated from the extract with

ethanol (1:5). It was purified by repeated reprecipitation from ammonium oxalate solution.

The yields of protopectins (as percentages of the dry samples) were 9.64 and 9.70, respectively, for the leaves and stems of the cowparsnip and 11.72 and 12.32 for the colewort.

Hydrolysis of the Pectins. The protopectins were hydrolyzed with 2 N H<sub>2</sub>SO<sub>4</sub> in sealed tubes at 100°C for 6 h. The hydrolysis products were identified by paper chromatography using pyridine-butanol-benzene-water (3:5:1:3) as the solvent. The chromogenic agents used were aniline hydrogen phthalate and saturated AgNO<sub>3</sub> solution.

Characteristics of the PPC's. The molecular weight was determined viscosimetrically and, in parallel, by the Hagedorn-Jensen end-group method [3].

The specific rotation for the PPC's of the leaves of the cowparsnip and the colewort were  $[\alpha]_D^{20}$  +226 and +220°, and for the petioles +215 and +205°, respectively.

Fractionation was performed on DEAE-cellulose in the phosphate form treated by the method of Ovodov and Solov'eva [2]. The fractions were monitored by the carbazole and titrimetric methods [4].

Isolation of the Polyuronide. The polyuronide was isolated by the partial acid hydrolysis of the pectin as described in a handbook [4]. The yields of polyuronide from the PPC's of the cowparsnip and colewort leaves were (in percentages of the absolutely dry sample) 46.0 and 50.18 and from the petioles 48 and 49, respectively.

#### SUMMARY

1. The protopectins of the petioles and leaves of Sosnovskii's cowparsnip and heartleaf colewort have been studied. It has been shown that the protopectins of wild-growing herbs are similar to the pectins of fruit and vegetables.

2. The heterogeneity of the pectins isolated has been shown by the fractionation method. Two main fractions were obtained — neutral (weakly acidic) and acidic.

#### LITERATURE CITED

1. V. P. Tishchenko and E. V. Sapozhnikova, Prikl. Biokhim. Mikrobiol., 8, No. 5, 586 (1972).
2. Yu. S. Ovodov and T. F. Solov'eva, Khim. Prirodn. Soedin., No. 5, 299 (1966).
3. V. S. Asatiani, Methods of Biochemical Investigations [in Russian], Moscow (1956).
4. V. V. Arasimovich, S. V. Baltaga, and N. P. Ponomareva, Methods of Analyzing Pectin Substances, Hemicelluloses, and Pectolytic Enzymes in Fruit [in Russian], Kishinev (1970).