Intraspecific chemical variability of *Eleutherococcus senticosus* (Rupr. et. Maxim.) Maxim.

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INTRODUCTION

Eleutherococcus senticosus **(Rupr. et Maxim.) Maxim.** ***(Araliaceae)*** **is one of the most interesting plant classified as an adaptogen. This shrub, 2-3 m high, is native to North Eastern Asia. Underground parts of eleutherococcus (rhizomes with roots) are classified as a drug with adaptogenic activity. Its stimulant and tonic effects are considered to be even stronger than true ginseng's. Biologically active compounds of this plant responsible for pharmacological activity, named eleutherosides, belong to different chemical groups such as lignans, phenylpropanoids, coumarins and sterols. The most important seems to be eleutheroside B (syringin) and eleutheroside E (syringaresinol-4,4-O-D-diglucoside). According to British Pharmacopoeia the sum of eleutherosides B and E in underground organs should not be lower than 80 mg × 100 g^{-1}. Eleutherococcus is used in herbal industry. Standardized raw materials with high content of eleuterosides are specially requested [1-4].**

The aim of undertaken study was to define the range of chemical variation of ten selected clones of Eleutherococcus senticosus.

MATERIALS AND METHODS

Ten eleutherococcus clones were selected from local collection of plants originating from natural sites in Siberia. The stem-root cuttings of chosen plants were planted in spring 2003 at 75x75 cm distance. For chemical evaluation plant materials: rhizomes, roots and stem bark were taken. Raw materials were collected in late autumn of 2007 and dried at 40°C.
For the determination of eleutherosides and phenolic acids, 1 g of grounded raw material was extracted with 100 ml of ethanol in Büchi B-811 Extraction System. After evaporation of solvent, the residue was dissolved in 10 ml of methanol, filtered through a Supelco IsoDisc PTFE 25 mm × 0.45 µm filter, and subjected to HPLC. The analysis was carried out using the Shimadzu chromatograph with DAD detector. Luna 5 µm C18 (2) 250 × 4.6 mm column was used. Gradient elution of 10% and 55% ACN in water (pH 3.0) was applied. Peaks were identified by comparison of retention time and spectral data with adequate parameters of standards. Quantification was based on the peak area at 206 nm (eleutheroside E), 254 nm (rutoside, protocatehuic acid), 264 nm (eleutheroside B) and 330 nm (chlorogenic, rosmarinic, caffeic, and ferulic acids).

RESULTS AND DISCUSSION

Investigated clones differed both in the mass of raw materials (rhizomes, roots and stem bark) and in the content of determined biologically active compounds. Differences between clones concerning underground organs mass reached 500 per cent (Figure 1). Differences in the content of eleutherosides were even higher. Sum of eleutherosides B and E fluctuated in the roots from 38.89 (clone C) to 228.58 mg × 100g^{-1} (clone H), in the rhizomes from 47.51 (clone G) to 326.19 mg × 100g^{-1} (clone H) and in the stem bark from 207.21 (clone J) to 565.98 mg × 100g –1 (clone B). The higher content of these compounds was observed in the stem bark (mean – 376.03 mg × 100g^{-1}), lower - in the rhizomes and roots (means: 180.40 and 141.58 mg × 100g^{-1} respectively) (Figure 2).

In all three investigated plant organs presence of five polyphenolic acids (chlorogenic, caffeic, rosmarinic, ferulic, protocatechuic) and rutoside were detected as well. Among them chlorogenic acid was a dominant compound. The content of above mentioned phenolic compounds in all ten investigated eleutherococcus clones was also differentiated (Table 1).

Pic. 1. Stems and stem bark

Pic. 2. Grinded and cut roots

Pic. 3. 4-year old plant at the stage of winter dormancy

Fig. 1. Dry mass of rhizomes, roots and stem bark of ten eleutherococcus clones (g per plant)

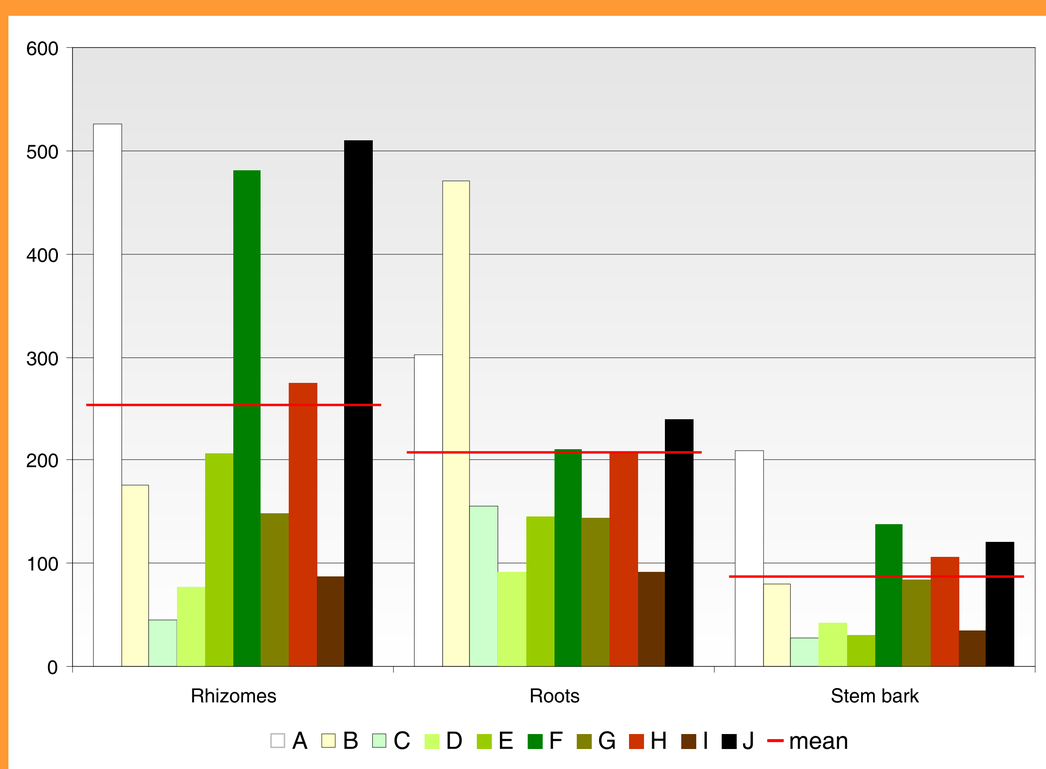

Fig. 2. The content of sum of eleutherosides B and E in rhizomes, roots and stem bark of ten eleutherococcus clones (mg × 100g^{-1})

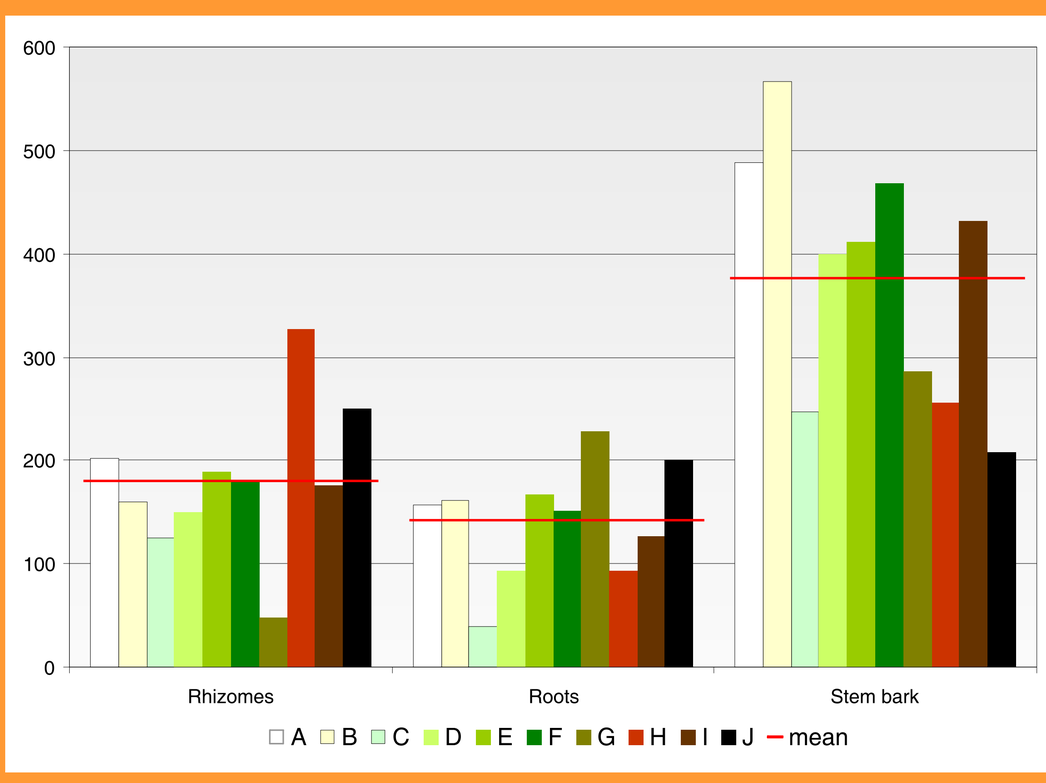

Fig. 3. The content of phenolic acids and rutoside in rhizomes, roots and stem bark of ten eleutherococcus clones (mg × 100g^{-1})

Row materials	Clones	Chlorogenic acid	Rosmarinic acid	Protocatehuic acid	Caffeic acid	Ferulic acid	Rutoside
Rhizomes	A	609.57	103.93	21.75	8.56	2.59	5.93
	B	508.02	43.56	38.82	4.86	1.93	9.09
	C	314.45	42.48	18.76	2.46	1.28	2.06
	D	338.42	47.15	22.48	2.60	1,39	2.08
	E	740.41	80.06	30.59	2.84	2.18	7.30
	F	774.67	159.28	22.92	2.36	3.87	3.62
	G	407.43	71.68	13.07	2.63	2.35	2.67
	H	897.70	134.20	61.06	2.71	3.43	12.44
	I	610.18	65.28	32.01	3.98	2.01	2.32
	J	576.26	75.01	50.11	5.28	1.98	20.36
	Means	**577.71**	**82,26**	**31.16**	**3.83**	**2.30**	**6,79**
Roots	A	590.22	167,46	28.22	13.53	2.75	12.60
	B	672.29	121.67	21.32	9.13	0.58	13.09
	C	187.96	29.87	6.18	2.78	0.23	0.60
	D	496.22	87.46	10.72	7.81	0.78	9.71
	E	688.89	84.41	28.34	13.39	2.52	7.87
	F	1009,19	219,65	35.19	20.22	2.44	2.43
	G	760.47	226.36	29.71	19.53	3.81	2.98
	H	899.70	214.83	17.93	1.87	1.72	5.74
	I	781.44	246.73	24.14	15.02	1.85	6.00
	J	1018.32	147.06	33.31	13.57	3.39	14.42
	Means	**710.47**	**154.55**	**23.51**	**11.69**	**2.01**	**7.54**
Stem bark	A	694.30	66.64	30.93	4.92	4.47	3.12
	B	951.54	44.29	93.16	5.30	4.64	17.76
	C	923.81	56.58	35.28	5.58	1.55	3.80
	D	860.29	35.66	38.55	3.47	1.61	11.39
	E	657.25	13.83	31.56	3.72	2.70	9.60
	F	1007.21	32.95	28.96	4.47	3.76	9.22
	G	834.74	85.03	41.10	7.65	2.53	3.50
	H	897.86	87.38	47.89	6.25	1.83	10.26
	I	1095.13	47.03	27.36	3.93	3.11	8.07
	J	595.46	63.26	23.56	4.13	2.67	3.51
	Means	**851.76**	**53.27**	**39.84**	**4.94**	**2.89**	**8.02**

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