



INTRODUCTION

Eleuthero (*Eleutherococcus senticosus* /Rupr. et Maxim./ Maxim.; *Acanthopanax senticosus* /Rupr. et Maxim.), known also as Siberian Ginseng, is a thorny shrub, of the *Araliaceae* family, growing wild in Northeastern Asia. Underground organs of this plant (rhizomes with roots) are used in Traditional Chinese Medicine (TCM) as well as in western medicine as a raw material with adaptogenic activity. Nowadays, commercial *Eleuthero* products, such as drugs and food supplements, are available in many countries. Main active compounds which exhibit their stimulant and tonic effects are eleutherosides. According to European Pharmacopoeia dried raw material is standardized on the content of the sum of eleutheroside B (syringin) and eleutheroside E (liriodendrin).

Taking into consideration growing interest of western medicine in TCM it is important to verify the quality of raw material obtained from *Eleuthero* cultivated in European climate conditions and to develop its extraction procedure.

The aim of undertaken study was to compare the influence of extraction method and extraction medium on the content of eleutherosides B, E and E1 in obtained extracts from *Eleuthero* roots.

MATERIAL AND METHODS

The objects of the investigation were *Eleuthero* roots obtained from plants growing in field collection of Department of Vegetable and Medicinal Plants, WULS-SGGW.

For the investigation fresh and air dried roots of 3-years-old plants were used. Three extraction methods, i.e. Soxhlet continuous extraction (in Büchi Extraction System B-811), heat reflux extraction and ultrasound-assisted extraction (in ultrasonic bath: ITR Intersonic – 102), as well as four extraction mediums, i.e. ethanol – 40, 70, 96% and water, were applied. 1.0 g of powdered plant material was mixed with 50ML of above mentioned media and extracted. The extracts were condensed to 10 ML in vacuum evaporator, filtered through microporous membrane and analyzed using HPLC (Shimadzu chromatograph with SPD-M10A VP DAD detector equipped with 2.6 µm C18 reversed-phase column with core-shell technology), to determine the content of eleutheroside B, E and E1 in obtained isolates.

The results were analysed with one-way ANOVA and Tukey's HSD test at $\alpha=0.95$ using Statgraphics Plus for Windows v. 4.1 software.



Photo 1. *Eleuthero* cultivation at the experimental field WULS-SGGW (full vegetation, 3-years-old plants)



Photo 2. *Eleuthero* plant obtained at the end of vegetation (3-years-old plant)



Photo 3. Underground organs of *Eleuthero* (3-years-old plant)



Photo 4. Extraction in B-811 Extraction System (Büchi apparatus)

CONCLUSIONS

- The most efficient method of eleutherosides extraction was Soxhlet continuous extraction.
- The best extraction medium occurred 70% ethanol.
- The content of eleutherosides in the extracts obtained from fresh and air dried raw materials, calculated on dry matter, was similar.

RESULTS

Table 1. Content of eleutheroside B in *Eleuthero* extracts depending on applied extraction method and extraction medium [mg · 100g s.m.⁻¹]

Raw material	Extraction methods	Extraction medium				mean
		ethanol 40%	ethanol 70%	ethanol 96%	water	
Fresh	Soxhlet continuous extraction	107,10	149,37	58,21	104,99	104,92 c
	Heat reflux extraction	66,76	86,97	73,47	98,97	81,54 b
	Ultrasound-assisted extraction	69,68	79,43	38,84	77,29	66,31 a
	mean	81,18 b	105,26 c	56,84 a	93,75 bc	
Air dry	Soxhlet continuous extraction	129,75	137,47	80,63	117,22	116,27 b
	Heat reflux extraction	90,04	117,17	56,26	86,38	87,46 a
	Ultrasound-assisted extraction	80,87	100,26	31,13	88,97	75,31 a
	mean	100,22 b	118,30 c	56,01 a	97,52 b	

Table 2. Content of eleutheroside E in *Eleuthero* extracts depending on applied extraction method and extraction medium [mg · 100g s.m.⁻¹]

Raw material	Extraction methods	Extraction medium				mean
		ethanol 40%	ethanol 70%	ethanol 96%	water	
Fresh	Soxhlet continuous extraction	74,63	77,64	36,99	53,45	60,68 b
	Heat reflux extraction	39,49	69,36	35,46	61,70	51,50 b
	Ultrasound-assisted extraction	41,01	45,00	22,99	34,62	35,91 a
	mean	51,71 ab	64,00 b	31,81 a	49,92 ab	
Air dry	Soxhlet continuous extraction	78,39	79,32	37,31	63,73	64,69 c
	Heat reflux extraction	51,77	61,47	26,22	40,53	45,00 b
	Ultrasound-assisted extraction	38,60	49,99	13,24	35,00	34,21 a
	mean	56,25 ab	63,59 b	25,59 a	46,42 ab	

Table 3. Content of eleutheroside E1 in *Eleuthero* extracts depending on applied extraction method and extraction medium [mg · 100g s.m.⁻¹]

Raw material	Extraction methods	Extraction medium				mean
		ethanol 40%	ethanol 70%	ethanol 96%	water	
Fresh	Soxhlet continuous extraction	16,42	22,59	18,97	13,86	17,96 b
	Heat reflux extraction	11,26	11,61	11,31	12,56	11,69 a
	Ultrasound-assisted extraction	11,71	11,97	12,24	14,59	12,63 a
	mean	13,13 a	15,39 a	14,17 a	13,67 a	14,09
Air dry	Soxhlet continuous extraction	15,58	16,73	17,23	15,18	16,18 b
	Heat reflux extraction	10,75	11,68	10,81	11,46	11,18 a
	Ultrasound-assisted extraction	11,53	12,60	11,18	16,28	13,00 a
	mean	12,62 a	13,67 a	13,07 a	14,31 a	13,45

Values marked with the same letters do not differ significantly at $\alpha=0.95$, Tukey's HSD test

REFERENCES

1. Li TSC. 2001. Siberian ginseng. Hort. Tech. 11:79-85
2. Court W.C.: 2000. Ginseng: the genus *Panax*. OPA, Amsterdam: 243-246.
3. British Pharmacopoeia online. 2008. Volume I & II. Monographs: Medicinal and Pharmaceutical Substances. *Eleutherococcus* (<http://www.pharmacopoeia.co.uk>)
4. Davydov M., Krikorian AD. 2000. *Eleutherococcus senticosus* (Rupr. & Maxim.) Maxim. (*Araliaceae*) as an adaptogen: a closer look. J. Ethnopharmacol. 72: 345-393
5. Willuhn G. 2004. *Eleutherococci radix*. In: Wichtl M., ed. Herbal Drugs and Phytopharmaceuticals. CRC Press, Boca Rotan: 187-190



poster



author