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## The Study Of *Hosta sieboldiana*, *Hosta ventricosa* And *Hosta lancifolia* Herb Polyphenolic Compounds By High Performance Liquid Chromatography Technique.

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### ABSTRACT

The aim of the study was to determine the qualitative composition and quantitative content of individual compounds by high-performance liquid chromatography (HPLC) in herb of *Hosta sieboldiana*, *Hosta ventricosa* and *Hosta lancifolia*. The qualitative composition and quantitative content of polyphenolic compounds of the herb of the *Hosta sieboldiana*, *Hosta ventricosa* and *Hosta lancifolia* – were investigated by high performance liquid chromatography (HPLC). According to the analysis data, 6 compounds of phenolic structure were identified in *Hosta sieboldiana* and *Hosta ventricosa* herb, 8 – in *Hosta lancifolia* herb. Chlorogenic acid, rutin, quercetin, kaempferol and luteolin were identified in all the studied samples. The highest amount of phenolic compounds accumulated in *Hosta lancifolia* herb and equaled  $1.80 \pm 0.05\%$ . The highest amount of flavonoids ( $1.23 \pm 0.03\%$ ) was determined in *Hosta lancifolia* herb. The highest amount of hydroxycinnamic acids amount was in *Hosta ventricosa* ( $0.60 \pm 0.02\%$ ) and *Hosta sieboldiana* ( $0.57 \pm 0.01\%$ ) herb. Chlorogenic acid and kaempferol was accumulated at a high amount in all types of the studied plant raw material. The highest chlorogenic acid content was in *Hosta ventricosa* herb and equaled  $0.47 \pm 0.01\%$ . The highest kaempferol content was in *Hosta lancifolia* herb and equaled  $0.39 \pm 0.01\%$ . Moreover, the high hyperoside content ( $0.41 \pm 0.01\%$ ) was detected in *Hosta lancifolia* herb. The obtained data can be used in the plant material quality control methods development

**Keywords:** polyphenolic compounds, HPLC technique, *Hosta sieboldiana*, *Hosta ventricosa*, *Hosta lancifolia*.

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## INTRODUCTION

The majority of modern taxonomists put the genus *Hosta* in a monotypic family *Hostaceae* (*Hostaceae* Mathew) on the basis of common classification systems. Although, plants of *Hosta* genus were related to the *Lily* family due to their phenotypic similarity [1, 2, 3].

Natural habitat area of the *Hosta* genus is the South-Eastern Asia. Some *Hosta* species refer to endemic plants in Japan, Korea and China. The climate of these countries is characterized by a significant fluctuation of air temperature during the year and high rainfall. Such qualities as frost resistance and shade tolerance were fixed in *Hosta* genus representatives at the genetic level as a result of adaptation to the conditions of the natural environment. They also tolerate dry periods. Plants of *Hosta* genus had gained huge popularity among gardeners and landscape designers in Europe and USA in less than two centuries due to these characteristics [1, 2].

Therapeutic properties of *Hosta* genus plants are known along with the decorative ones. Representatives of this genus are used in the treatment of inflammatory diseases and as antibacterial means in the Eastern folk medicine [1, 2, 4-6]. Fresh juice from the stalks of some *Hosta* genus species is used against tumors. Decoction of leaves is used for toothache relief, and the sake infusions of the roots use are to treat boils [1, 2]. The leaves and roots of *Hosta ventricosa* is used to treat internal organs pain, injuries, and snake bites [1, 2, 6]. Herbal means of *Hosta longipes* are used in traditional Korean medicine for the treatment of cough, laryngopharyngitis, burns, and edema [5]. Extracts from *Hosta plantaginea* underground organs and leaves are used to treat diuresis, issues, urethritis, endometritis, dysmenorrhea, ulcers, carbuncles and viral diseases [1, 6].

*Hosta sieboldiana*, *Hosta ventricosa* and *Hosta lancifolia* still are not officinal plants and require a more detailed study, despite its wide use in Eastern medicine.

Polyphenolic compounds are a large group of biologically active substances which contain hydroxyl groups in their structure. As known, compounds of phenolic nature, in particular flavonoids and hydroxycinnamic acids exhibit expressed anti-inflammatory, antioxidant, choleric, and diuretic, antimicrobial, antitumor and immunostimulatory properties as well strengthen capillaries [7-9].

It was discovered in previous studies that *Hosta plantaginea* and *Hosta lancifolia* plant material accumulated polyphenolic compounds, including flavonoids and hydroxycinnamic acids in significant amount [10-12]. In view of this, it is advisable to study the qualitative composition and quantitative content of individual compounds of phenolic nature in the herb of *Hosta sieboldiana*, *Hosta ventricosa* and *Hosta lancifolia*.

**The aim of the study** was to determine the qualitative composition and quantitative content of individual compounds by high-performance liquid chromatography (HPLC) in herb of *Hosta sieboldiana*, *Hosta ventricosa* and *Hosta lancifolia*.

## EXPERIMENTAL

### *Plant material*

Dried and chopped herb of *Hosta sieboldiana*, *Hosta ventricosa* and *Hosta lancifolia* were used for the research. The raw material used for the analysis was harvested in 2015-2016 on the territory of Kharkiv and Khmelnytsky regions of Ukraine.

### *Chromatographic conditions*

The determination of qualitative composition and quantitative content of the compounds of phenolic nature in the studied raw material was carried out by HPLC in the samples before and after acid hydrolysis [13, 14, 15].

Chromatographic study of the samples was performed on a liquid chromatograph with diode array

detector Shimadzu HPLC system, ser. 20. Chromatography conditions were the following: column Phenomenex Luna C 18 (2) with size 25 x 4.6 mm, particle size 5 µm, column temperature – 35°C, the wavelength detection – 330 nm, flow rate of the mobile phase 1 ml/min, injected sample volume 5 µl, mobile phase – eluent A (0.1% solution of trifluoroacetic acid in water) and eluent B (0.1% solution of trifluoroacetic acid in acetonitrile) [13, 14, 15].

For the sample 0.5 g (accurate weight) of the grounded material were added to the 100 ml conical flask of capacity, equipped with reflux condenser. 25 ml of 50% ethyl alcohol was added to the flask with following keeping it on a boiling water bath for 45 minutes. The extract obtained was cooled and then filtered through the "red ribbon" filter in a 25 ml volumetric flask. Volume of the extract was adjusted to the mark by 50% ethanol [13, 14, 15].

The obtained extracts were used for carrying out the chromatographic analysis.

The identification of components was carried out according to the retention time and matching the UV spectra of substances-standards.

### RESULTS AND DISCUSSIONS

As the result of the research 6 phenolic compounds were identified in *Hosta sieboldiana* and *Hosta ventricosa* herb. 8 phenolic compounds were identified in *Hosta lancifolia* herb. Chlorogenic acid, rutin, quercetin, luteolin and kaempferol were identified in all the analyzed samples. Neochlorogenic acid was found only in *Hosta lancifolia* herb. Caffeic acid was not found only in *Hosta sieboldiana* herb. Hyperoside was not found only in *Hosta ventricosa* herb.

The highest phenolic compounds content was detected in *Hosta lancifolia* herb according to HPLC analysis results and equaled 1.80±0.05%. Phenolic compounds content in *Hosta sieboldiana* and *Hosta ventricosa* herb was almost similar and equaled 1.43±0.04% and 1.28±0.03 respectively. Moreover, the highest flavonoid content was detected in *Hosta lancifolia* herb and equaled 1.23±0.03% which was 2/3 from the total amount of phenolic compounds in this type of the plant raw material. Hydroxycinnamic acids content was at the same high level in *Hosta ventricosa* and *Hosta lancifolia* herb and equaled 0.60±0.02% and 0.57±0.01% respectively. It was about a half from the total amount of phenolic compounds in *Hosta ventricosa* herb and about 1/3 from the total amount of phenolic compounds in *Hosta lancifolia* herb. Phenolic compounds quantitative content in the analyzed *Hosta* species is presented in table.

**Table: The phenolic compounds quantitative content in *Hosta sieboldiana*, *Hosta ventricosa* and *Hosta lancifolia* herb**

Name of the compound	<i>Hosta sieboldiana</i>		<i>Hosta ventricosa</i>		<i>Hosta lancifolia</i>	
	Retention time, min	Content, %	Retention time, min	Content, %	Retention time, min	Content, %
Chlorogenic acid	20.81	0.36±0.01	22.65	0.47±0.01	20.18	0.33±0.01
Neochlorogenic acid	-	-	-	-	20.77	0.05±0.01
Caffeic acid	-	-	23.18	0.13±0.01	23.54	0.19±0.01
Rutin	31.48	0.11±0.01	32.84	0.10±0.01	32.11	0.12±0.01
Hyperoside	32.00	0.26±0.01	-	-	32.58	0.41±0.01
Quercetin	38.34	0.10±0.01	37.11	0.17±0.01	38.92	0.14±0.01
Luteolin	44.22	0.18±0.01	45.62	0.09±0.01	44.63	0.17±0.01
Kaempferol	53.28	0.35±0.01	53.21	0.32±0.01	53.17	0.39±0.01
Total amount of hydroxycinnamic acids	0.43±0.01		0.60±0.02		0.57±0.01	
Total amount of flavonoids	1.00±0.03		0.68±0.02		1.23±0.03	
Total amount of phenolic compounds	1.43±0.04		1.28±0.03		1.80±0.05	

Chlorogenic acid and kaempferol dominated for the quantitative content in all the studied samples. The highest chlorogenic acid content was in *Hosta ventricosa* herb and equaled  $0.47\pm 0.01\%$ . This compound accumulated 1.4 times less in *Hosta sieboldiana* ( $0.36\pm 0.01\%$ ) and *Hosta lancifolia* ( $0.33\pm 0.01\%$ ) herb than in *Hosta ventricosa* herb.

Kaempferol content differed slightly in the studied samples and equaled  $0.35\pm 0.01\%$  for *Hosta sieboldiana* herb,  $0.32\pm 0.01\%$  for *Hosta ventricosa* herb and  $0.39\pm 0.01\%$  for *Hosta lancifolia* herb. Moreover, hyperoside accumulated at a high amount in *Hosta sieboldiana* and *Hosta lancifolia* herb. Its content in *Hosta sieboldiana* herb was  $0.26\pm 0.01$  which was 1.4 times less in comparison to chlorogenic acid and kaempferol content in this type of plant raw material. This compound content in *Hosta lancifolia* herb was 1.6 times higher and equaled  $0.41\pm 0.01\%$ . Hyperoside was not detected in *Hosta ventricosa* herb. According to the obtained results, caffeic acid accumulated 1.5 times more in *Hosta ventricosa* herb ( $0.13\pm 0.01\%$ ) than in *Hosta lancifolia* herb ( $0.19\pm 0.01\%$ ). Caffeic acid was not identified in *Hosta sieboldiana* herb.

Luteolin quantitative content in *Hosta sieboldiana* ( $0.18\pm 0.01\%$ ) and *Hosta lancifolia* ( $0.17\pm 0.01\%$ ) herb differed slightly. Luteolin content in *Hosta ventricosa* herb was two times less and equaled  $0.09\pm 0.01\%$ . Rutin content was almost equal in all the studied samples. Rutin content was  $0.11\pm 0.01\%$  in *Hosta sieboldiana* herb and  $0.12\pm 0.01\%$  in *Hosta lancifolia* herb. The highest quercetin content was identified in *Hosta ventricosa* and *Hosta lancifolia* herb. It equaled  $0.17\pm 0.01\%$  and  $0.14\pm 0.01\%$  respectively. This compound accumulated 1.7 times less and 1.4 times less than in *Hosta sieboldiana* and *Hosta lancifolia* herb respectively. Neochlorogenic acid was detected only in *Hosta lancifolia* herb at minimum amount and its content equaled  $0.05\pm 0.01\%$ .

## CONCLUSIONS

According to the analysis data, 6 compounds of phenolic structure were identified in *Hosta sieboldiana* and *Hosta ventricosa* herb, 8 – in *Hosta lancifolia* herb. Chlorogenic acid, rutin, quercetin, kaempferol and luteolin were identified in all the studied samples. The highest flavonoid content was detected in *Hosta lancifolia* herb and equaled  $1.23\pm 0.03\%$ . The highest hydroxycinnamic acids content was detected in *Hosta ventricosa* herb ( $0.60\pm 0.02\%$ ) and *Hosta lancifolia* herb ( $0.57\pm 0.01\%$ ). Moreover, the highest total phenolic compounds content ( $1.80\pm 0.01\%$ ) was identified in *Hosta lancifolia* herb. Chlorogenic acid and kaempferol were accumulated at a highest amount in all types of the analyzed plant raw material. Hyperoside was also found at a high level ( $0.41\pm 0.01\%$ ) in *Hosta lancifolia* herb. The highest chlorogenic acid content was detected in *Hosta ventricosa* herb ( $0.47\pm 0.01\%$ ). The highest kaempferol content ( $0.39\pm 0.01\%$ ) was identified in *Hosta lancifolia* herb. The obtained data can be used in the plant material quality control methods development.

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